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The Biological Viability of a Xenomorph By Jackson Dollar

Introduction

Humanity has long wondered about the possible appearances of beings other than themselves. The advent of motion pictures allowed a wide scope of possibilities about this to flourish, but soon audiences wanted plausibility and realism in these visions. Due to the financial risks of audiences rejecting unbelievable premises, employment opportunities developed for researchers in highly specialized fields dependent on the situation and genre involved. These fields include anything from a professional armorer providing era-specific weaponry, to cultural experts verifying depictions in the film haven't misconstrued cultures. One of the most interesting applications of this method of fact-checking is in the genre of science fiction. Throughout science fiction's history, many types of professionals have been hired to try and get everything they can right about realism in a field, at least when it comes to theoretical examples. One great example of this is the movie *2001: Space Odyssey*, whose form of spacecraft was one of the first to genuinely design and transform theory into image when it came to the creation of a craft with artificial gravity. Despite the involvement of professionals in these films though and some films having put theory into image in a manner that has inspired researchers globally, the field overall is rather under-researched. The amount of research in the field of astrobiology about aliens' representation in media is particularly lacking. It is hoped by looking into the biological capability of these creatures in media, similar to the way *2001: Space Odyssey* depicted space travel, researchers may allow for new perspectives in the involved fields. This greater focus allows for more publicity towards the research of realism and capability in media associated with possible alien life forms.

Literature Review

In terms of widely researched portions of the conversation of aliens as a whole, there are three main aspects. These tend to be; why we haven't found aliens or why they don't exist, theories on how aliens could be including things like habitability, and also how aliens are represented in various forms of media.

In terms of aliens existing and how we plan to find them, there is only theory. This includes ideas like the Fermi paradox or the theory that every civilization has a "great filter"

tipping point, at which they destroy themselves. Along with this is the fact that exoplanets, planets other than Earth orbiting other stars, have only been recognized as scientific facts for around a decade (Michael Gillion 2019). Gillion says even more about this topic than just the recognition of fact and theory. The astrobiologist speculates that if aliens exist, we may be able to find them in the next few decades. This is, as he states, because future facilities may be able to use high technological inventions to test atmospheric, terrestrial, and biological compositions past the clouds on some possibly “Habitable” exoplanets.

Other researchers, though, have focused more on the theory of what planets could be habitable, along with why our current assumptions of habitability are false. This includes papers like that of E. Camprubi and Co. (2019) who study the emergence of life both on our planet and life outside of our planet that may take different forms and compositions. Similarly, Louis Irwin and Drik Shulze-Makuch (2020) take a similar approach, only instead of the emergence of life they focus on the constraints needed for life. In their collective paper, they analyze the constraints of life as we know it, and properties that could increase, decrease or stagnate life. This paper helps to widen the horizons and help focus on specific areas, such as the work of James Stevenson, Jonathan Lunine, and Paulette Clancy (2015) that took a targeted approach to the previously wide approach of the previous paper. They focus on life in a specific kind of world: those with seas of liquid methane. This may currently sound impossible based on our knowledge of carbon-based life forms, but this paper makes a good argument for another type of life that has a nitrogenous base and could live in these extreme conditions. If this were to be proved with absolute certainty, it could help us find life we may not have found otherwise on places such as Saturn’s moon, Titan. While hypothetical and not experimental, the study does a very good job of providing a proof of concept for this new type of cell.

Some papers like Jr. Istvan Csicsery-Ronay’s (2007) choose to cover instead the discussion of alien and anthropomorphic creatures in media such as Science fiction films, books, cartoons, and more. His paper discusses how humans have represented aliens in various mediums, along with comparing different representations in a myriad of ways. Istvan similarly wrote another paper on a very similar topic (2002) where he discusses the topic more specifically with the question: what makes aliens in horror effective? They conclude in this paper that, for the most part, it is because of how grotesque and unfamiliar creatures of this kind can be when represented and designed. Additionally, Douglas Fowler (1981) writes on the same topic of what

makes these creatures so horrifying, focusing mainly on the xenomorph from the 1979 film *Alien* and the alien creature from the 1951 film *The thing*. In this paper, Douglas writes about the “principle of terror,” although instead of determining that the grotesque nature of the creatures is the true reason for such horror in these critically acclaimed films, he uses the concept to speak on how the horror of the creature is derived from the amount of time they are on screen and the suspense created.

Using these sources to form somewhat of an idea of the scholarly conversation around the topic of aliens in media, there is an apparent knowledge gap in the prior research; while most prior research has addressed the elements of aliens in media or what aliens might look or be like in real life, few have combined the two areas to address the biological capability of aliens in popular media (Michael Gillion 2019, Istvan Csicsery-Ronay 2007)

Method

Using this gap as a guide to the research at hand, it was determined that content analysis should be done on a famous science fiction film involving extraterrestrials. More specifically, this analysis should be done on a film or film series that predominantly focuses on the extraterrestrial aspect. One of these series was the film *Alien*, which along with being a famous series that largely centered around the alien, is also an extremely infamous movie that influenced much of the science fiction genre after it. Deciding upon *Alien* as the movie in question the following research question was created; “What biological capabilities do Xenomorphs, from the 1979 movie *Alien* and its predecessors, have, and does that make them feasible to exist within the real world?” It was then hypothesized after the research question was locked in place that the research would point towards the xenomorph having a “low biological capability, and subsequently a low level of realism and real-world biology.”

This research question sparked the development of the remainder of the total method, which was formed together by utilizing other sources of content analyses that did so in rather unique ways, such as the work of Emmons Mocarski (2014), Guadelupe Degrete (2021) and G Escamilla (2000). Each of these papers takes a chart-based approach to the genre of research known as content analysis, and where the inspiration for this paper's method of analysis came from. Using these papers, a six-step process for analyzing each film was then created. Along

with this, a table of NASA characteristics of life was created (shown below), based on an educational NASA page (“What are the characteristics of life?”, n.d.).

Table 1 *Coding Categories and Theoretical backings*

7 Main Biological Needs	Subsections of these needs	Theoretical backing
Structure	Signs of microscopic structure, Signs of Larger scale structure	All living things have some sort of structure, may that be on the microscopic level or larger. This means that for this creature to be considered as "Living" or realistic, it must have some sort of structure to it.
		All living things must be able to reproduce in one way or another, otherwise they are not considered to be a living organism. This is because one of the fundamental aspects of life is the both the passing down of genetic information/the preservall of the organisms own genetic information, and the concept of survival of the fittest, and should you be the fittest you get to pass down your genetic information (though it is important to note that intelligent species may find ways to bypass this concept, wich may be able to null the point of reproduction to a certain point)
Reproduction	Signs of Sexual reproduction, Signs of Asexual reproduction	Living things must be somewhat complex, and therefore normally have stages of growth no matter how minimal or short they are. Without stages of growth and signs of development throughout the creatures life, an organism may not be able to fully be considered a living organism.
Growth and development	Signs of different stages of life, Signs of general growth	Organisms need some sort of energy along with materials for growth, development and reproduction, including a realistic organism. This means that the organism in question must have some way to secure energy for the useage of growth, movement, senses, reproduction and other aspects of everyday life.
Nutrition	Signs of dietary needs, Signs of Photosynthetic needs, Signs of other methods of nutrition	All realistic organisms need to be able to regulate themselves to achive their own custom homeostasis. If the organism in question cannot achive homeostasis it effectively isnt a realistic organism and its biological viability goes down darastically.
Homeostasis	Signs of internal homeostasis	To ensure survival, any organism must be able to immedietly react to its enviroment in various methods, sense dangers around it, find nutrients and many other things. Senses in general tend to be the cornerstone of any organism to the smallest bacteria to the largest elephant.
Reactions to enviroment	Signs of reactionary mesures, Signs of general senses, Signs of other senses	Adaptation is incredibly important to any organism, and is a main aspect of life in general. Adaptation can be done by; past generations such as the development of countermeasures for other organisms, natural disasters, or enviromental conditions; Current living organisms in the form of behavioral adaptations, invention, and other methods of adaptation during the organisms life; and done in the future by future generations at a varying rate. All three of these formws of adaptation are important to most organisms, Past because it shows the ability to adapt, current because it shows behavioral intelligence and the ability to adapt to various environments, and future because the organism may be able to live much longer without undergoing extinction thanks to its ability to adapt to an ever-changing enviroment, world, or in this case universe.
Adaptation to enviroment	Signs of past adaptations (Evolutionary practices), Signs of current adaptations (Currently evolving), Signs of future adaptations (Future evolutionary routes)	

1. Analysis of media around the movie

This step was the simple reading of common synopsis and reviews of the movie as a whole. This was mainly done to separate plot elements and go into each movie knowing exactly what will happen, what parts to be looking for, and overall try to eliminate as much bias as possible for the movie itself. This was done because knowing everything that happens allows the reviewer to filter out portions of the movie that do not pertain to the research at hand. This also involved finding and reviewing other scene-by-scene analyses of the movie, which helped to provide other perspectives and ideas on each scene, allowing for a broader overall lens.

2. The primary analysis of film

This was arguably the most important step in the process, as this was where most of the note-taking and general data was gathered. This was where the reviewer watched the film, all the way through only pausing for a time to make notes. The reviewer did this in similar or identical conditions for every movie, following the same seven main types of data with the 16 types of sub-classifications. For every piece of data, the reviewer then wrote a brief description or summary of the evidence for or against the main type and subtype, before continuing in the film.

3. Primary Identification and evaluation of data

This step involved specifying the data, before researching each point to identify its authenticity and truthfulness, to prevent a null point from being included in the final data. After researching each point individually and determining its effectiveness, each category was then evaluated similarly before each of the seven main categories in the movie was rated. A Likert scale was used that ranged from the category of “Strongly points towards high biological capability” to “Strongly points towards low biological capability” with three points in-between of “Somewhat points towards higher biological capability,” “Points in neither direction of biological capability” and “Somewhat points towards lower biological capability”. Along with this, the following data chart was the basis for the overall review, along with providing the theoretical explanation for the inclusion of each topic and subtopic.

4. Secondary analysis of film

After completing steps one, two, and three, came the secondary analysis. This involved watching the film scene by scene, keeping the data gathered from the primary analysis in mind. This was done to accurately and directly identify and gather extra data that may not have been involved in the original analysis of the film, trying to gather more extensive information on whatever the original analysis caught along with more closely scanning through the movie to gather enough data as possible for the research. This was done in a similar or identical environment to the primary analysis, only instead of only pausing for note-taking time, each time something new was found or something from the primary analysis was being reviewed, the film was rewound and the scene evaluated multiple times.

5. Secondary identification and evaluation of the data

In a similar manner to the primary evaluation, this step involved the simple evaluation of pre-existing data, to make sure all data currently presented effectively represented what the reviewer was trying to research in addition to ensuring everything was accurate and supported

overall to provide the least amount of bias or nulled data as possible. At the end of this step, as in the primary analysis, the already rated pieces of data were then re-rated to include any new information that was found, before any new pieces of data, upon an extended review of the footage, were evaluated on the same Likert scale as before.

6. Final evaluation of each topic for the film

After all of this data was collected and evaluated once again a final review of the data itself was done. This data was then used to effectively break down each of the seven topics and then rank them on a Likert scale so they each had a numerical value.

Following these steps, they were then reset and repeated for every film watched on an individual basis, creating a new sheet so as not to muddle any previous results on other films

After every movie that was going to be evaluated had gone through each of these steps, a final evaluation became necessary. To do this final evaluation, the reviewer looked at each set of data individually, before combining the Likert scales into one separate sheet organized by each of the topics. Using this, each category was then averaged out by assigning a numerical value of 1-5 and averaging them. This was then repeated vertically to average every category into one total Likert scale result.

Gathered Data

As described in the methods section of this paper, the deductive coding method used based on NASA's defined astrobiological characteristics for life has 7 main parts to it: Structure, Reproduction, Growth and Development, Nutrition, Homeostasis, Reactions to Environments, and Adaptations to Environments. By then breaking down these aspects into more core biological elements, such as Nutrition being broken down into "dietary needs," "photosynthetic needs," and "other needs," it allows for a more specific approach closely defined in the previous methodology section. By using these codes, the data can be gathered in an easily digestible and definite manner. In total, the coding process concluded with 42 data points across all categories.

First to address, Structure, which was broken down into the two categories of "Larger scale structure" and "Microscopic structure" which had nine main data points across both movies. One of these was a sign of "Microscopic Structure" shown in *Alien*, and the other eight points of data were under the "Larger scale structure" category, five of which were in *Alien* with three in *Aliens*. This category took into account both the realism of structures as compared to

their counterparts, or the most similar counterpart, that exists on Earth and the mere existence of said structures, as the existence of complex structures at the very least points them towards a higher classification of living and complexity. Within the “larger scale structure” data, three points indicated a low biological capability because of unrealistic or unjustifiable structures shown in the movies, such as that of a detachable “womb” like organ attached to the Queen in *Aliens* and an extendable inner mouth exhibited in all of the adult level Xenomorphs in both films. Despite this, five other points, show a likelihood of high biological capability thanks to existing structural aspects being seemingly accurate to that of terrestrial biology. These traits included clearly shown muscles, lungs, ribcage, bones, and even a heart and spinal cord within the early stages of the organism's life commonly referred to as a face hugger. Along the same lines, the point of Microscopic structure also points toward a high biological capability because it shows that the organism is what is called a carbon-based life form, which we know to exist. After all, that is how all life on Earth is classified. In numerical terms, however, the section of structure was rated at a 3.33 for *Alien* and a 3.66 for *Aliens*, averaging to 3.485 for the total category.

Second to address, reproduction, which was broken down into the two categories of “Asexual Reproduction” and “Sexual Reproduction” and in total only had two points. One of these took place in the movie *Alien* under the sub-category of “asexual reproduction,” with the other being an added point near the end to balance data, as there were no data points found in *Aliens* for either sub-category. This category took into account the viability and addressing of reproductive cycles and organs within these movies' canon, and any relations to known terrestrial aspects of reproduction. The main point found based on the little amount of data found, was that this species must reproduce asexually at the very least within the second stage of its life cycle, known as a face hugger, and that its method of reproduction and growth to the next stage of life could be counted as pointing towards a high biological capability. Overall, the specifics of reproduction in this species are mostly based on speculation, and as such only slightly point towards a high biological capability. This is reflected in the data with *Alien* having a rating of 5 in the reproduction category, and *Aliens* having a rating of 3 for an average overall of 4.

Third to address, Growth and Development, which was broken down into the two categories of “Signs of Different Stages of Life” and “Signs of General Growth” and in total had seven points of data. .5 of these points were under the “General Growth” sub-category and found in the film *Alien*, and the other 5.5 points were classified in the sub-category of “Different Stages

of Life," 4.5 being found in *Alien* and one being found in *Aliens*. To explain the missing data point, as only six have been listed, an additional point was added outside of the films to address unrealistic growth rates within both films. Overall, this category was to effectively evaluate the realism of this species' shown life cycle, along with its growth rates. Within the "Different Stages of Life" category 1.5 points were in neither direction of capability as there either wasn't enough data in the points addressed to make a full decision, or contradicting data canceled out and did not allow for an educated decision to be viable. The other 5.5 points in this subcategory pointed towards a high biological capability, most of these being due to the life cycles of this species being very clearly defined and shown, along with the same life cycles being strongly related to terrestrial life. However, despite this, as previously addressed, another point was added outside of the films, to address the unrealistic growth patterns of the species. Overall, though, *Alien* gained a rating of 3.5 in this category, and *Aliens* gained a rating of 3, for a total rating of 3.25.

Fourth to address, Nutrition, which was broken up into three subcategories of "Signs of Dietary Needs," "Signs of Photosynthetic Needs" and "Signs of Other Methods of Nutrition" and in total had four points. One of these points was in the "Other Methods of Nutrition" subcategory and found in the film *Alien*, while another was under the "Dietary needs" subcategory and found in the film *Aliens*. Once again, two points were added outside of the films to account for external factors not originally in the review or specifically shown in portions of the film. This category as a whole was to evaluate anything relating to the nutritional value and processing of the species in various aspects of its life as well as, comparing these methods of nutrition to those found in terrestrial organisms. Within the "Other Methods of Nutrition," the one point involved pointed toward a high biological capability thanks to its similarities to a terrestrial metabolism though in a unique manner. Under the "Dietary Needs" subcategory, one point pointed towards a high biological capability, thanks to a clear address of how the species deals with days without nutrition at least within the secondary adult form known as a Xenomorph. The subcategory of "Photosynthetic Needs" was never addressed in any way, and as such was not included in the data. On the opposite end, was the inclusion of two extra data points pointing toward a low biological capability, both of which were added due to the unaddressed subject of actual nutritional methods of the adult form, along with where it would have gotten such nutrients within the colony and ship that these films take place on. In all, *Alien* earned a 3 on the scale in this category, with *Aliens* earning a 3.5 for a total average of 3.25.

Fifth to be addressed, Homeostasis, a small category that only included one subcategory of “Internal Homeostasis” having a mere three points involved. This category as a whole was to evaluate how this species may involve and maintain internal homeostasis, which is defined as a form of internal equilibrium between elements. Within this data set, one of the points was found in *Alien*, and the other two in *Aliens*. Two out of these three points pointed towards a slightly higher chance of biological capability, one of which was because of an outside heat source causing a reaction to a Xenomorph, and the other being the inclusion of a heart within the Face Hugger stage of life. However though, there is one point in this data set that points towards a low biological capability, that being of a scene where a Xenomorph in the Queen stage of life hangs onto and travels with a spacecraft on its way to orbit, obviously showing a rather unrealistic nature considering the sheer amount of un-viable things both space and atmospheric exit can cause to a creatures homeostatic levels. Overall, *Alien* gained a rank of 4 in this category, and *Aliens* gained a rank of 2.5 for a total ranking of 3.25.

Sixth to be addressed, Reactions to the Environment, which was one of the three largest sets of data, with three different subcategories of “Signs of Reactionary Measures,” “Signs of General Senses” and “Signs of Other Senses” and had a total of nine data points. These, unlike other categories, were very evenly spread out, with three “Reactionary Measures” data points, two coming from *Alien* and one from *Aliens*, along with four “General Senses” data points, one from *Alien* and three from *Aliens*, and finally, two within the “Other Senses” subcategory that was only found in *Aliens*. This category’s subtypes were much more important than most, as they rather closely and strictly cordoned off what they were and were not. First, the subcategory of “Reactionary Measures” was to identify the instinctual and built-in signs of movement, senses, etc. such as pain. Overall, in this subcategory, all three data points pointed towards a high biological capability, thanks to the species in question showing rather clear and objective forms of reactionary measures, according to the previously defined criteria. Second, the subcategory of “Signs of General Senses” served to evaluate the effective senses in accordance with senses we know of in terrestrial life such as sight, touch, smell, etc., and how the reactions of the species compared to that of terrestrial creatures. In this subcategory, two of the data points seemed to show a slightly high biological capability. An additional high capability data point was reduced to not showing either way, thanks to further research into less known senses certain terrestrial species have such as electroreception and inferred sight, and finally determining that the species

in question does not seem to possess the organs possible for these senses. The final subcategory of this was “Other Senses”. This specific subcategory is meant to be sort of a catch-all for other more outlandish or at the very least non-terrestrial senses that may or may not be scientifically accurate. One of the points in this category was originally a pointer toward high biological capability, however, had to be reduced after closer inspection indicated that the species did not possess the organs needed for these senses to be similar to terrestrial ones, and subsequently unprovable. The other point in this subcategory was similar although pointed more harshly in favor of a lower biological capability, mainly because of its more outlandish nature but also paired with again the absence of any sort of organ that may indicate any sort of terrestrial connection to it. Overall though, *Alien* scored at a 4.33 while *Aliens* took a score of 3, making the total score for this category 3.665.

Seventh and finally to be addressed, was the category of Adaptation to the Environment, which was broken down into three subcategories of “Signs of past Adaptations,” “Signs of Current Adaptations” and “Signs of Future Adaptations”. In these subcategories were a total of eight data points making it the third largest section. This included four “Past Adaptations” points, two being found in each film, three “Current Adaptations” points, one of which was found in *Alien* and two found in *Aliens*, and finally one “Future Adaptations” point found in the film *Aliens*. This category as a whole though was to effectively analyze how the creature has evolved, as signs of evolution show a clear level of change needed for something to be considered life, along with current adaptations showing how the creature adapts within its life through things like behavioral changes, and then future evolutionary pathways that could arise, as having changes in the future points towards a realistic conception of the species. Within the subcategory of “Past Adaptations,” two points pointed in neither direction of capability, thanks to one of them being part of preliminary research and the other not having enough real evidence to point either way. Another point in this category pointed towards a high biological capability because of its similarities to evolution in some terrestrial life forms showing how it could have existed and evolved in the past, although another point does point towards low biological capability because of the unrealistic nature of one of its adaptations, specifically the concept of acid blood. In the subcategory of “Current Changes” results were just as neutral though less divided, with two points pointing in neither direction, both because of the odd nature they present and the level of intelligence needed in the species to have such behavioral adaptations only being slightly proven,

along with another point showing originally a neutral biological capability because of the interpretation of a quote within the film. However on closer investigation the scientific principles shown do exist, which points the biological capability higher up than previously thought. Finally, in the “Future Adaptations” data point, it was just as neutral, pointing in neither direction because of its feasibility but never being specified enough to take any educated non-bias data from. Overall, in this category *Alien* earned a 3.33, and *Aliens* earned a 3.2 for a total average of 3.265

Table 4 Overall numerical data based on movie analysis

	<i>Alien</i> Data points	<i>Aliens</i> Data points	Averaged data points
Structure	3.33	3.66	3.485
Reproduction	5	3	4
Growth and development	3.5	3	3.25
Nutrition	3	3.5	3.25
Homeostasis	4	2.5	3.25
Reactions to environment	4.33	3	3.665
Adaptation to environment	3.33	3.2	3.265
Total Average:			3.45214286

After the final evaluation of each point of data along with the averaging out of every film, the above chart was created to represent the raw numerical data.

Discussion

Contrary to the hypothesis previously stated in this paper, the data gathered here seems to show that the species known as “Xenomorphs” may have a high biological capability. In all seven categories across both movies analyzed, the species gained a three or higher rating, the only exception being that of the “Homeostasis” category in *Aliens* with a rating of 2.5. While this methodology and study as a whole does have its flaws, listed in detail later in the limitations section of the paper, six out of seven NASA-listed categories for life do in the end, point, even to a small extent, towards the hypothesis that the species in the question of specifically the first and second movie in the *Aliens* franchise may be biologically viable and capable. This is even more so when averaged fully as the whole set of data has a total average of 3.45 (Rounded) which falls almost directly in the middle of two points in the crafted Likert scale. Specifically, these points

are three, or “points in neither direction of biological capability”, and four, or “points slightly towards a high biological capability”. Overall, this study cannot say definitively that this species is realistic or that it could one-hundred percent exist within the real world, however, the data gathered does point slightly toward that it may be a realistic and biologically capable species.

Implications in this Field

Thanks to the large research gap between practical evidence, research, theory, and discovery of alien species that could exist in real life and the study of cryptids, monsters, alien species, and other horrors along the same lines in fiction, this paper hopes to be a starting point of bridging that gap. Admittedly the practical application of much of the information in this paper is mainly useful for those who want to speculate on behalf of what could be out there, in addition to being able to help in aspects of study involving how realism in media may affect other topics like the schema (the concept of how humans have a subconscious thought and identification to most things, similar to a stereotype except broader and having to do with objects, people, theories, ideas, etc.) of various portions of the public. Much of the main reasoning and usefulness comes from how in a way, this paper is a proof of concept. Many people tend to believe that things they see in media, especially in science fiction, horror, and suspense genres, are completely unrealistic or have no effect on the world as a whole, and subsequently, most of the analysis and research into the realism of many of these aspects of these movies is left to people (mainly online communities) who are rather interested in these movies to do their unprofessional research and concoct their own theories of how they might work. While not necessarily a bad thing, this paper aims to demonstrate to some degree that the analysis of these concepts and creatures can be done professionally and in a manner that promotes real scientific processes instead of unprofessional research and speculation. Throughout the research for this paper, numerous threads on a multitude of social media platforms could be found addressing various aspects of how this species could exist, what parts are realistic, and what isn't realistic about them. This paper strives to show that the scientific field as a whole may want to sink its teeth into some of these pieces of media, not only for things that we have seen before like schema, psychological aspects of the films, comparisons to other films, and much more, but also into the in-depth research into how physics, biology, chemistry, and any other field of science portrayed in these films can be done realistically (or unrealistically) along with what we may be

able to gain from such outlandish ways of thinking that allow for different interpretations of seemingly insignificant scientific principles to be considered.

Limitations

The main limitation of this study was its methodology. As a whole, it is a good concept that effectively achieves its goal, however, had to be cobbled together based on other forms of analyses due to a lack of framework for the specific style of analyses being unavailable. This caused not only issues in the creation of this study and its idea as a whole, but also largely created some partial results that only slightly pointed towards a conclusion. Additionally, a safety was not added until halfway through the study, when it was realized that to account for things that had not been seen in the films or had not overall been addressed, more data points had to be artificially added to account for them. This minor variance from the original methodology paired with the methodology's new nature means that the results gathered may be slightly off or skewed. Despite considerable efforts devoted to preventing personal bias and an attempt to approach this study from a completely indifferent standpoint, it is undeniable that some amounts of researcher bias may have slipped through the cracks and seeped into the results. Another main and obvious limitation of this study is the fact that it was originally designed to address all six movies in the franchise, however, it was determined that five and six being prequels did not necessarily allow for an accurate study of the species evolution and would add a confusing layer of timeline involvement and that three and four dealt with topics that were much more fiction than science and subsequently may skew the data of the first two movies to a point that did not allow accurate study.

Forward Statement

Obviously with such large and rather glaring limitations, this study cannot completely cover all of this field or even the two films studied in depth. With some fine-tuning to account for some limitations now seen after the fact and also to account for other films and pieces of media, this paper hopes to in some way be a jumping-off point for other studies involving topics like crypto-zoology (the study of fictional creatures like cryptids and aliens). Hopefully, it will allow for more research to be conducted and a higher awareness or interest in this field that may

help answer many of the lingering questions both of this study specifically and having to do with other pieces of important media.

The Effects of Student Activism on Civic Leadership Skills: A Quantitative Study

By Henry Rhoades

Abstract

Student activism has been a powerful force in shaping change throughout history. In recent years, many researchers suggest students have become more politically active because of the rise of social media and online activism. Student activism is a powerful tool for students to push for change, and this study attempts to determine whether civic activist actions by high school students influence their leadership abilities. This study intended to determine whether student civic activism could influence their current leadership abilities. The results determined students who frequently engaged in activism showed an average of 8.67 percentage points higher leadership scores than students who never did. This could suggest that student civic activism leads to improved leadership skills. However, a potential converse hypothesis could support this instead: natural leadership talents influence students to engage in civic activism. Overall, this study provides valuable insights into the potential relationship between civic engagement and student leadership skills. While further research is needed to confirm these findings, the results suggest that promoting civic activism and education could have long-term benefits for both individuals and society as a whole.

Introduction

Student activism has been a powerful force in shaping change throughout history. From protesting against an authoritarian government to fighting for workers' rights, students have always been at the forefront of change. In recent years, there has been a resurgence of student activism, as young people increasingly use their voices to demand change on various issues. This, in turn, has led to a more politically interested student population.

Theoretically, this implies a more politically inclined student body, more similar to that of the Vietnam War era, than what has been observed in previous decades. The increasing usage of social media could be strengthening this trend, as it enables students to organize more effectively and connect with one another more easily, leading to a broader and potentially more accepting viewpoint on social issues. Activism through this medium has become an increasingly important method of youth-propelled movements by amplifying messages to a global audience and thus raising awareness. The accessibility of these elements and other new technologies also grants the

benefit of increased exposure, allowing students to develop viewpoints and opinions on a wider range of issues. Though this also offers opportunities for fringe and sometimes dangerous beliefs to form, it could also lead to higher levels of acceptance as students educate themselves on new topics. As a consequence, student activism is once again rising as an important part of change and a method of dissent, providing a means for many students to address what they perceive as injustices.

Literature Review

Student activism has been present in the United States since the early colonial era. Frequent student revolts erupted at the first college campuses due to the many restrictions placed on their social lives and food restrictions. These activists became enflamed with the revolutionary spirit after the American Revolution, and frequent protests and revolts occurred at many of the nation's premier universities. The resistance by students to institutions remained culturally significant, up to the modern era. Today, student activism in the United States is still present, although it has taken on different goals. Students are now more likely to protest issues such as tuition hikes, racial discrimination, and sexual assault on college campuses. They may also participate in environmental protests or protests against gun violence. Though they have declined in recent years, historically, and in other parts of the globe, student unions have been significant contributors to this activism.

As student activism evolves, the tactics change, but the overall goal remains the same. Students engaged in campus activism in the 21st century are frequently building upon the ideas of previous generations. In many ways, they are even building upon colonial student activism. When disenfranchised students face a hostile environment, they unite to promote change. Students protesting sweatshops bring to mind the socialist-inspired protests of the early 20th century. Protests in the US about the Israeli occupation of Gaza and the West Bank are remarkably similar to those protesting Apartheid in the late 20th century (Broadhurst). Broadhurst, an associate professor of educational development at the University of New Orleans, argues that student activism has been effective in promoting change throughout history. He cites examples of how current protests echo those of previous generations, indicating that the overall goal of student activism has remained the same: to unite and fight for a cause. This historical parity continues to elaborate on the heightened power of student activists throughout history.

Aside from civic engagement by students being a powerful force, another question should be asked: What effects does it actually have on society? In a study regarding the Swedish Student Union (SU), it was found that membership in the SU and being elected to the council increased the probability of becoming a candidate in public elections by 34% (Lundin et al.), which suggests that there are beneficial effects of politically active student organizations. In addition, it has been theorized that in Scandinavian countries where student union groups have a strong history, often with automatic or mandatory enrollment, students are significantly more likely to hold beliefs about the importance of political participation when compared to countries like Poland, where student unions have a rocky history or are being newly established (Brooks et al.). The more established a student union is in a nation, the more involved the youth tend to become in politics. This is likely because student union groups give young people the opportunity to learn about the political process and develop the skills necessary to run for office. Additionally, Aaron Fountain, a freelance writer for Indiana University, found the creation of non-school-sponsored activist groups allows students to “express dismay with school policies, provide alternative ideas for their education, and comment on local and school-related issues.” This method of expressing views could lead to more politically active students, as they feel more comfortable expressing their beliefs, without the fear of retaliation by school officials or significant backlash.

Student activism has been a powerful force in shaping change throughout history. Whether it's been protesting against an authoritarian government, fighting for workers' rights, or pushing for democratic reform, students have always spearheaded change. Frequently, student activism has been one of the most potent catalysts of political change. Student protests have led to the decline and rise of nations around the globe. University student activism in South Korea, for one, contributed to the fall of the authoritarian First Korean Republic (1949-1960). Later, they were heavily involved in championing workers' rights during the military governments until 1987. They were also vital in passing the “6.92 Declaration,” a critical turning point from the authoritarian government of the past to a democratic one (Shin et al.). The height of student activism in the United States during the 1960s reflected growing post-WWII dissatisfaction in the United States. Campus enrollment doubled during this period, and increased funding due to cold war fears led to heightened protests. This led to national organizations that unified students attempting to fight against perceived hostile environments (Broadhurst). Student activism has

been an incredibly powerful force for change throughout history. When students are united in a cause, they have the power to bring about real and lasting change.

Student activism is not a new phenomenon. Young people have always been at the leading edge of social change, from the civil rights movement to worker's rights protests. This has declined as time went on. In recent years, however, there has been a resurgence of student activism, as young people are increasingly using their voices to demand change on various issues. Representation and activism by secondary students can have a significant impact on their political future. In a democracy, all voices must be heard, and young people have a right to be involved in the decisions that will affect their lives. When secondary students are active and engaged in the political process, they are becoming more likely to become as informed and engaged in politics as adults and become leaders. Past studies on student activism have mostly focused on higher education or cases that are significantly dated. However, the new "renaissance" of student activism is also occurring at the secondary level, as adolescents are using their voices to demand change on a variety of issues. It is important to understand how representation and activism by secondary students contribute to their political future, as they are the future leaders of our country.

Methods

Thus far, studies conducted that have analyzed civic awareness and leadership skills have primarily focused on students in higher education. Other studies that examine activism by high school students, such as that by Broadhurst, serve only to analyze the skills of these students several years after graduation. During that time, various events could have influenced their abilities, potentially unrelated to activism. This study intends to investigate whether student activism affects students' abilities while students are in high school. Ideally, this will allow for more accurate data, as it will concurrently determine their activism and civic engagement without the potential influences that come after secondary school.

To begin, student political activism will be defined as volunteering to address a civic issue. This could be via political movements, community service that involves civic engagement, or other factors that the participant may consider "political engagement". As previous studies have investigated, the effects of civic activism will be analyzed through the following measures: social agency, civic awareness, and outspoken leadership abilities (Biddix). Social agency refers

to students' value of political involvement, civic awareness refers to changes in students' understanding of civic issues, and outspoken leadership refers to students' self-confidence, public speaking abilities, and risk-taking. These abilities and traits will be scored on a scale of 1.0 to 10.0, with one being an absolute lack of ability and ten being the highest possible attainment of the ability. The study will attempt to find a correlation between these skills and activism in high school students. Several questions will be asked to attain the scores, modeled on a study by Biddix. The student will answer questions such as, "How often do you keep up with current political events by using reputable news sources?" (Every day, every few days, once a week, once a month, rarely, never) to determine social agency. To determine outspoken leadership skills, students will rank themselves concerning their peers as either far below average, below average, average, above average, or far above average on their leadership ability, public speaking ability, risk-taking, and self-confidence. Finally, to rate civic awareness, students will rate their understanding of several current events with scores similar to those used to rank outspoken leadership values. This data will then be compiled and averaged to determine the ability scores of each student. Students will also be asked to provide how often they participate in activist activities, defined earlier in this section, as well as what types of activism they engage in if any at all. The data will then be arranged to determine if a relationship exists.

Subjects surveyed will be limited to those aged 14-18. The data obtained will be divided into several sections, and analyzed by age, as someone aged fourteen will theoretically have had significantly less opportunity to become politically engaged than someone who is eighteen. The study will also be limited to the Katy/Fulshear area of coastal Texas, which has a population that is more ethnically diverse than the majority of the United States. This presents other problems as well, as economic diversity is also very low. These will be addressed by obtaining demographics during the survey to determine factors such as ethnicity and financial status beforehand. For safety and ethical reasons, this will require the data collected to be anonymous, and participants will be aware of this beforehand.

Subjects will be provided with a Google Form containing the survey questions upon signing up and will be left to answer the questions provided at their leisure. The window for students to take the survey and provide answers will be approximately one month, ideally with a minimum of 40 subjects for a more varied data collection and demographic sample.

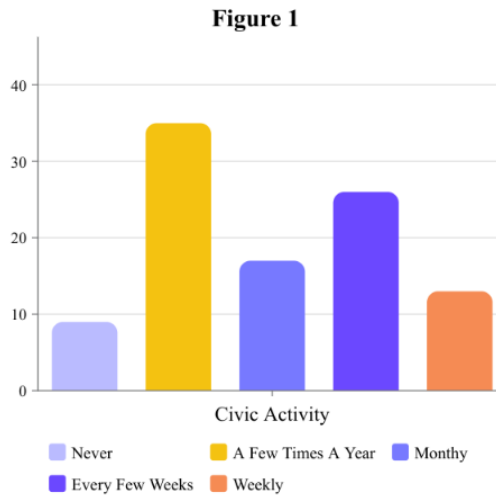
Upon collecting data from students, the data will be analyzed. Answers will correspond to a value depending upon the answer. For example, when ranking public speaking for outspoken leadership, the scores will receive values of 1, 2, 3, 4, and 5, with 1 being far below average and 5 being far above average. The value will then be divided by the number of potential scores in that category and multiplied by ten to determine how the value ranks on a score of 1.0 to 10.0. All values for that ability category will then be added together and averaged to determine a student's score in that category. Students and scores will then be divided into several groups, depending on their political activism responses. The averages of all scores in that group will be calculated to determine that group's average in each ability. These scores will then be compared with those of other groups in their respective skills to determine if one group has scored statistically higher than another group. Upon finding this data, it will be determined whether a correlation exists by several percentage points difference in one category between groups.

Results

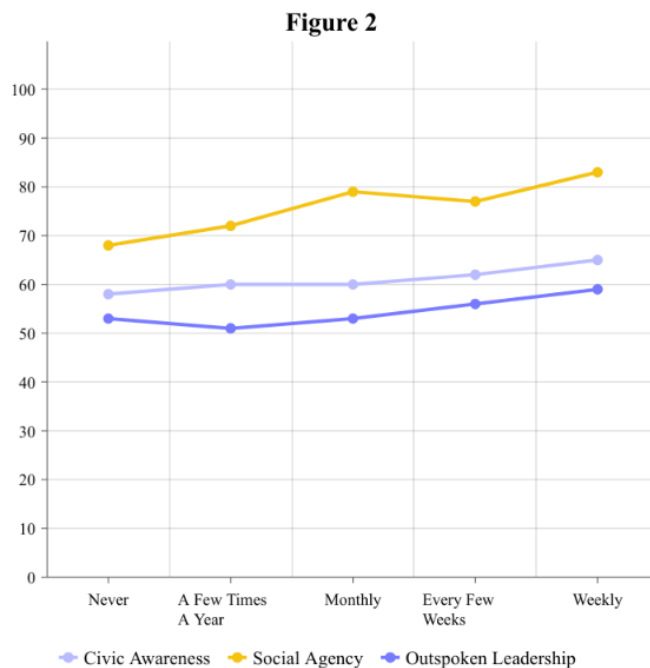
A total of 46 subjects signed up to participate in the research study. Demographic samples showed that 43% of participants were female and 57% male. In addition, 52% of participants identified as white, followed by Asian (26%), Hispanic (9%), Black/African American (9%), and Pacific Islander (4%). No participants identified themselves as other, two or more races, or Native American, despite these being options. On age, about 17% of participants were 14, 9% were 15, 22% were 16, 26% were 17, and 26% were 18. The highest percentage of participants had unweighted GPAs in the 3.5 - 4.0 range (65%), followed by 3.0 - 3.5 (26%). No participants recorded their GPAs lower than this; however, a small percentage (9%) did opt to skip this question. Concerning political alignment, left-leaning was the most popular category (22%), followed by moderate (17%), right-leaning (17%), left-wing (13%), far-left(13%), right-wing(9%), and far-right(4%). Categorizing political alignment can also be done with three categories: center(left-leaning, right-leaning, moderate), left(left-wing, far-left), and right(right-wing, far-right), with 56%, 26%, and 13%, respectively.

Student respondents primarily indicated that they participated in civic activism every few weeks (26%) or a few times a year (35%). Few participants said that they engaged in civic activism every week (13%), and even fewer responded that they never did (9%). These can be observed in Figure 1. Additionally, several participants indicated they engaged once a month

(17%). Overall, the most frequent form of activism students took part in was debating civic and political issues with their peers (65%), followed by community service (57%), other forms of engagement (22%), and demonstrations -- political marches, protests, and rallies -- with a mere 9%. Students could select multiple responses for the type of activism.



The mean civic awareness score for all students was 61, with a range of 39 to 78, on a scale from 0 to 100, determined by adding the amounts scored out of twenty points per question. Interestingly, students rated understanding issues facing the world as twenty to thirty percent more important than understanding problems facing their nation or community, on average. The social agency was determined by asking six questions, each of which had participants rate the importance of certain factors (ex. Keeping up to date with political affairs, Becoming a community leader). The rating on each of these questions was multiplied by 2. Afterward, all the scores were added together and multiplied by 0.83 to give a value out of 100. The mean score for this section was 78, with a range of 52 to 94. Individual self-evaluation was used to determine outspoken leadership. Subjects ranked themselves out of five compared to their peers on several traits (ex. Self-confidence, willingness to take risks). A total of four questions were asked in this section. To determine the mean score for this category, each question's ranking was multiplied by five, and all of the scores were then added together. This resulted in a mean score of 55 (20 to 85) for this category.



Respondents' answers were then grouped into five categories, depending on their civic activity frequency. The mean scores for each leadership skill were then determined for that category using the same methods previously stated. The mean results for the categories were as follows: Never (CA: 58, SA: 68, OL: 53), a few times a year (CA: 60, SA: 72, OL: 51), once a month (CA: 60, SA: 79, OL: 53), every few weeks (CA: 62, SA: 77, OL: 56), and every week (CA: 65, SA: 83, OL: 59). These results can be observed in Figure 2. Scores have been rounded for clarity.

A positive correlation can be observed between the rate of civic engagement and overall leadership scores. Students who frequently engaged in activism showed an average of 8.67 percentage points higher leadership scores than students who never did. No significant correlations were found between any demographic variables and overall leadership scores or frequency of participation.

Discussion

Following the study, the correlation between the leadership skills and civic activity portions of the paper could show a potential relationship between the two. Student activism could be an integral part of building the leadership skills of a student. This supports the findings

of a similar study conducted by Biddix, in which it was found that students obtained statistically higher leadership skills the more frequently they engaged in demonstrations.

Based on this, it could be theorized that promoting civic engagement and education could potentially lead to increased leadership abilities in students. Encouraging civic activism in education could yield long-term benefits for not only students but for society as a whole as well. Additionally, it could also lead to more confidence in students' abilities and thus increase their willingness to volunteer for leadership roles and further develop those skills. A self-reinforcing skill cycle could result from this system, which could yield benefits in future political situations that require a high degree of skill. In addition, it is important to consider the potential barriers to civic activism that students may face, such as a lack of resources or support from their schools or communities. Attempting to overcome these barriers and give students opportunities to engage in their communities on their own in public schools, such as offering volunteer opportunities that engage with the community or engaging student government and leadership organizations, participation could be increased in civic engagement that promotes activism and stronger civic leadership skills could be developed.

By gaining a better understanding of the relationship between student civic activism and leadership skills, educators and students alike will potentially be able to develop more effective strategies for promoting political activism and civic leadership development in institutional settings. The current body of literature on this topic as stated prior contains little information on the effects that being politically engaged has on students in high school, and ideally the correlation and potential relationship found in this study will be able to direct future research down a new path focusing on these students. Studies thus far widely seem to agree that there are numerous positive effects when students engage with their communities. Engaging in activism and building leadership skills is simply an extension of this. Increasing the number of opportunities students receive to engage in civic activism could lead to better opportunities for students to build leadership skills and become more engaged citizens in the future.

Moreover, this study found that students felt understanding global issues was more important to most subjects than focusing on local or national ones. This finding provides some grounds for supporting the theory that students in a more digital age have access to a wider scope and more pressing issues take priority for them. Having students engage in activism focused on large-scale issues may prove to be more effective than problems facing their immediate

communities in fostering an interest in students. Similarly, community service initiatives and debating civic issues with peers also scored higher than alternatives. This finding may suggest that students are more comfortable with forms of activism that do not involve confrontation and conflict and may be more interested in working to address social issues through collaboration and consensus-building, which may prove more effective tools for engagement. Alternatively, it could imply that students are not afforded as many opportunities to engage in direct action forms of activism, and future studies could attempt to explore this.

Unfortunately, this study did contain several limitations. The research question and subsequent study were created with only a small geographic area in mind, so whether the results apply to the broader community has yet to be determined. In addition, due to time constraints within the research and due to the limited nature of the subject count, the data collected may not accurately reflect the student population of the Katy-Fulshear area. It does appear to be somewhat representative, however, based solely on demographic statistics. Future studies could potentially address this and determine whether the correlation persists. Should it continue to be observed in different areas with larger group sizes, the hypothesis could be applied to a larger scope. The methods used in this study could also be used in further research, ideally to address these limitations and to inform decisions when attempting to determine scoring and other relationships.

It is important to also note that this study only measured the correlation between civic activism and leadership skills. It is possible that other factors, such as natural charisma or a student's upbringing, could also influence one's leadership abilities. A potential converse hypothesis could support this: natural leadership talents influence students to engage in civic activism. Students who are naturally more inclined to lead or have received an education that builds interpersonal and management skills may be more inclined to be more involved in their community and aware of civic issues that affect them. This relationship could even be mutualistic and create a self-reinforcing cycle. Students with leadership abilities engage in civic activism, in which they further develop and refine their leadership skills. It would be important for future studies to explore these factors in more detail to gain a better understanding of the relationship between civic engagement and leadership.

Overall, this study provides valuable insights into the potential relationship between civic engagement and student leadership skills. While further research is needed to confirm these

findings, the results suggest that promoting civic activism and education could have long-term benefits for both individuals and society as a whole. By encouraging students to engage in civic activities, society may be able to foster the development of stronger leaders and ultimately create a better future for all. Additionally, this study has important implications for the broader field of sociopolitical research in general, with governmental systems and public perception of them becoming more complex and the need for effective leadership becoming increasingly important.

Conclusions

Civic activism's effects on the leadership skills of students could be vital to understanding the potential value that encouraging civic engagement in learning could provide. While limitations of this study somewhat restrict its true potential in understanding the overall causes of this relationship, further research may be able to better qualify the results and determine a cause.

In addition, the convergent potential explanations for correlation warrant further research on this issue. The outcome of further research may also be a step toward determining whether natural leadership ability exists or if it is merely a skill that develops over time. Perhaps it is even a mixture of both. It may be relevant to determine whether this applies to groups outside of the Katy-Fulshear area and with a large sample population to confirm the results.

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The Impact of the 20th Century AIDS Epidemic on Queer Art By Vivian Wang

“It is empty because I have left it,” said poet Andrew Durbin at an open closet nook built into the blank wall of a museum.¹ While this piece, *Untitled Closet* (1989) by Robert Gober, is seemingly simplistic and rudimentary, it holds the anguish and defiance of a century of oppression and discrimination. In 1952, the American Psychiatric Association deemed that homosexuality was a sociopathic personality disorder, articulating previous decades of homophobia and paving the way for decades more.² The rising prejudice against LGBTQ+ individuals in the early 1900s created a period of heavily censored and “coded” queer art. True freedom of queer expression in art remained elusive even after the Stonewall Riots in 1969 and the beginning of the gay liberation movement, until the AIDS crisis. Artist Thomas Lanigan Schmidt expressed, “The more desperate the situation, if a person has the talent and the ability to articulate that desperation into a moment, bang, there's art. That's it”.³ The HIV/AIDS crisis was the “more desperate” situation described by Schmidt that fostered an era of momentous queer representation and visibility as it gave the LGBTQ+ community a space to express their fear, grief, and anger. The urgency of the epidemic, coupled with the sentiments of the gay rights movement, resulted in politicized and personalized art that helped unite the queer community and strengthen their fight against discrimination and disease.

In the early 20th century, American society began to cultivate a culture that was increasingly homophobic. Faced with discrimination and censorship, LGBTQ+ artists were unable and unwilling to put their sexuality at the forefront of their art. As a result, they developed a “coded” language to covertly communicate queer ideas and themes.⁴ For example, gay artist Paul Cadmus was widely recognized for his controversial tempera painting *The Fleet's In!* (1934), which depicts a playful scene of sailors and women. The illustration, which was part of a Works Progress Administration (WPA) exhibit, gained its controversy over the promiscuous nature of the women, who many interpreted to be prostitutes, and this led members of the US

¹ Jonathan Weinberg, *Art after Stonewall, 1969-1989* (National Geographic Books, 2019), 56.

² American Experience, PBS, “Milestones in the American Gay Rights Movement,” June 13, 2018, <https://www.pbs.org/wgbh/americanexperience/features/stonewall-milestones-american-gay-rights-movement/>.

³ Weinberg, *Art after Stonewall, 1969-1989*, 77.

⁴ Christopher Reed, *Art and Homosexuality: A History of Ideas* (Oxford University Press, 2011), 158.

Navy to protest against what they viewed as a defaming portrayal of sailors.⁵ With this heteronormative interaction at the forefront of the painting, Cadmus distracted his audience and masked the subtle flirtatious exchange between one of the sailors and a businessman towards the left of the illustration. Amidst the numerous vibrant dresses, only certain viewers noticed and recognized the significance of the red tie worn by the cleanly dressed businessman. At a time when non-conforming gender and sexual orientations were widely hidden or suppressed, wearing a red necktie was indicative of one's homosexuality within the gay community, and "closeted" businessmen commonly wore red ties to "invite remarks from newsboys and others".⁶ Cadmus's use of red herring tactics and gay symbolism to covertly incorporate queer existence into his work represents the repression of open expression in queer art in the early 20th century.

The 1969 Stonewall Uprising was a pivotal moment in LGBTQ+ history; despite starting the gay rights movement, the event had little immediate effect on queer art.⁷ Since homosexuality was illegal in the 1960s, police frequently raided gay establishments, as was the case for a popular gay bar in New York named the Stonewall Inn. The initial resistance to the targeted attack escalated into a series of protests for the legalization of same-sex relationships and against police brutality that lasted for several days. The event received significant media attention, and it was credited for being the catalyst for the gay liberation movement.⁸ Originally, lesbian artist Louise Nevelson had agreed to create a public installation to commemorate the riots. However, upon further consideration, the artist withdrew, believing that this commission would permanently associate her with lesbianism and detrimentally affect her and her partner's reputations and careers. No other gay-identifying artist approached after was willing to take on the commission for similar reasons, so the commission was given to George Segal.⁹

George Segal's life-sized sculptures titled *Gay Liberation* (1980) encapsulate the continued lack of queer presence in art even after the beginning of the gay rights movement. The artist himself identified as heterosexual, and his white sculptures, simply consisting of two male and two female figures having a light conversation, hardly reference the protests.¹⁰ What little

⁵ Paul Cadmus, *The Fleets In!*, 1934, Tempera on canvas, 37 × 67 in., Naval History and Heritage Command, District of Columbia, <https://www.history.navy.mil/our-collections/art/travelling-exhibits/paul-cadmus/>.

⁶ Henrik Olesen, "Some Faggy Gestures," *Art Journal* 72, no. 2 (2013): 96, <http://www.jstor.org/stable/43188603>.

⁷ Reed, *Art and Homosexuality: A History of Ideas*, 180.

⁸ American Experience, PBS, "Milestones in the American Gay Rights Movement," June 13, 2018.

⁹ Reed, *Art and Homosexuality: A History of Ideas*, 181.

¹⁰ George Segal, *Gay Liberation Monument*, 1980, Bronze (white lacquer), 51-53 Christopher Street, New York, <https://www.nycgovparks.org/parks/christopher-park/monuments/575>.

queer representation found in *Gay Liberation* was scrutinized by the public, who complained that “youngsters...will be lured into homosexuality”, while the lack of distinct queer representation in the sculptures created frustration among gay activists, who thought Segal’s work had “reduced the gay experience...to a pickup on a park bench”.¹¹ The reluctance of many queer artists to approach the project and the negative response generated towards a piece of art meant to commemorate Stonewall and celebrate the LGBTQ+ community reflects a continued disconnect between LGBTQ+ politics and art as well as a persisting hesitancy towards unreservedly queer art during the beginning of the gay liberation movement.

On July 3, 1981, the *New York Times* released an article titled “Rare Cancer Seen in 41 Homosexuals,” marking the beginning of a new age of marginalization, prejudice, and fear for the LGBTQ+ community.¹² The prominence of sick individuals who identified as gay led many to believe this disease was only transmissible within homosexuals, which is reflected in its initial name, “GRID” (gay related immune disorder).¹³ By the time the Centers for Disease Control and Prevention had more accurately named the disease HIV (human immunodeficiency virus) and AIDS (acquired immune deficiency syndrome) in 1982, the correlation between the disease and the LGBTQ+ community was irreversible; being gay had become synonymous to being sick, mentally and now physically. In an interview for a news article, one doctor openly stated, “We used to hate f***** on an emotional basis. Now we have a good reason”.¹⁴ Rising infection rates of HIV/AIDS in gay individuals opened the doors to using hard science to justify bigotry. One artist solemnly wrote, “The closet is turning into a coffin,” referencing how homophobia exacerbated the already detrimental effects of the HIV/AIDS epidemic, for the stigma against non-conforming sexualities resulted in a mass media riddled with misinformation, a government lacking in involvement, and a healthcare institution uninterested in researching and curing this fatal and rapidly spreading disease.¹⁵

The further ostracization of the queer community due to the AIDS crisis had an unionizing effect; solitary artists formed into bands of activists, united against one central issue,

¹¹ Reed, *Art and Homosexuality: A History of Ideas*, 182.

¹² Lawrence K. Altman, “Rare Cancer Seen in 41 Homosexuals,” *New York Times*, June 3, 1981, <https://timesmachine.nytimes.com/timesmachine/1981/07/03/180485.html?pageNumber=20>.

¹³ Lawrence K. Altman, “Outlook on AIDS Is Termed Bleak,” *New York Times*, June 13, 1988, <https://timesmachine.nytimes.com/timesmachine/1988/06/13/221388.html?pageNumber=13>.

¹⁴ Reed, *Art and Homosexuality: A History of Ideas*, 219.

¹⁵ Jack Lowery, *It Was Vulgar and It Was Beautiful: How AIDS Activists Used Art to Fight a Pandemic* (Bold Type Books, 2022), 27.

resulting in the politicization of queer art. “Fear and grief faded away when I discovered action,” said one artist, expressing how LGBTQ+ individuals used art to channel their emotions for “action” and social change.¹⁶ In 1987, a group of gay and lesbian individuals in New York united and formed an organization ACT UP (AIDS Coalition To Unleash Power).¹⁷ Within ACT UP, artists formed separate collectives with different styles and methods of activism. The most well-known collective was Gran Fury, who described themselves as “a band of individuals united in anger and dedicated to exploiting the power of art to end the AIDS crisis”.¹⁸ Driven by the desperation of the crisis, these activists led the frontier for a new age of politically influenced art.

ACT UP and Gran Fury, inspired by rising art movements and the gravity of the AIDS crisis, blurred the line dividing modern art and politics with their posters. For example, ACT UP’s *AIDSGATE* (1987) poster uses a stencil of President Reagan with neon pink eyes on lime green paper and the words “AIDSGATE” printed on top.¹⁹ This poster was similar to pop artist Andy Warhol’s screen prints of public figures like Chairman Mao Zedong and Marilyn Monroe, both using bright colors and graphic linework to immortalize their subjects.²⁰ However, unlike Warhol’s work and other examples of pop art, ACT UP’s *AIDSGATE* is more serious and has a more profound political context. “Aidsgate” is a play on former president Nixon’s infamous Watergate scandal, and so it called for Reagan’s administration to be investigated similarly for their silence regarding the HIV/AIDS epidemic.²¹ The combination of the two fluorescent colors, rather than read as humorous in the way that pop art does, are lurid. The lime green color of Reagan’s skin creates a nauseating impression, ironically portraying the president as sick. Furthermore, the nature of Reagan’s violently pink eyes is jarring and uncomfortable to look at. However, because it is paired with its complementary color, it is also compelling, forcing the viewer to face the poster. The bright colors of the *AIDSGATE* poster drew the public’s attention to the poster in the same manner in which they called for Reagan and his administration to draw their attention and resources toward the AIDS crisis. ACT UP’s innovative combination of pop

¹⁶ Lowery, *It was Vulgar and It was Beautiful: How AIDS Activists Used Art to Fight a Pandemic*, 52.

¹⁷ Nicolas Lampert, *A People’s Art History of the United States: 250 Years of Activist Art and Artists Working in Social Justice Movements*, (The New Press, 2015), 254.

¹⁸ Lowery, *It was Vulgar and It was Beautiful: How AIDS Activists Used Art to Fight a Pandemic*, 131.

¹⁹ Silence = Death Project, *AIDSGATE*, 1987, Offset lithograph, 33 3/4 × 22 1/8 in, The Metropolitan Museum of Art, New York, <https://www.metmuseum.org/art/collection/search/497874>.

²⁰ Susie Hodge, *The Short Story of Modern Art: A Pocket Guide to Key Movements, Works, Themes, and Techniques* (Laurence King Publishing, 2019), 34.

²¹ Lowery, *It was Vulgar and It was Beautiful: How AIDS Activists Used Art to Fight a Pandemic*, 74.

art and activism effectively captured people's attention and raised awareness about the government's intentional silence.

ACT UP also incorporated powerful iconography in the manner of advertising, which became a critical factor in spreading awareness and campaigning against marginalization. The most recognizable work from HIV/AIDS activism is the *Silence = Death* (1986) poster.²² The blunt slogan is accompanied by a dark piece of LGBTQ+ history: a pink triangle. It originates from Nazi concentration camps, where a downward-facing pink triangle identified homosexual prisoners to be sent to death. In order to reclaim the symbol, ACT UP chose to face the triangle upwards, instilling a sense of pride and power in its use while reminding society of its shameful past. The simplicity of the design allowed Gran Fury and ACT UP to plaster the design on all sorts of mediums, such as T-shirts, buttons, mugs, billboards, and more.²³ Other queer artists, such as Keith Haring, would also go on to incorporate the *Silence = Death* triangle into their art. Haring stated in an interview, “I don’t think art is propaganda; it should be something that liberates the soul, provokes the imagination, and encourages people to go further”.²⁴ The mass production and distribution of the symbol made the pink triangle and “liber[ation]” it stood for an unavoidable and constant reminder to the public to confront rather than ignore the epidemic, transforming a symbol of oppression into one of visibility, power, and unity.

ACT UP’s “Seize Control of the FDA” demonstration showed that beyond spreading awareness, their bold and graphic art was able to enact change and alleviate the AIDS crisis. At the time, AZT was the only Food and Drug Administration (FDA) approved HIV/AIDS medication, and besides being highly toxic and only offering short-term benefits, it was largely inaccessible due to its expense. Additionally, most pharmaceutical companies and the FDA were uninterested in researching cures for what they believed was a “niche disease”.²⁵ On October 11, 1988, in one of ACT UP’s largest demonstrations, hundreds of activists rallied outside the FDA headquarters to protest against the FDA’s slow approval process for new HIV/AIDS-related medication and call for increased resources and research into more effective medication. They brought together different affinity groups under their iconography, plastering the FDA’s windows

²² Lampert, *A People’s Art History of the United States: 250 Years of Activist Art and Artists Working in Social Justice Movements*, 253.

²³ Ibid.

²⁴ Keith Haring, “The Ten Commandments, an Interview,” Interview by Sylvie Couderc, Bordeaux, December 16, 1985, https://www.haring.com/!/selected_writing/ten-commandments-an-interview.

²⁵ Lampert, *A People’s Art History of the United States: 250 Years of Activist Art and Artists Working in Social Justice Movements*, 254.

with a mixture of previous posters such as *Silence = Death* and *AIDSGATE*.²⁶ This show of unity under these prominent symbols and graphics resulted in viral media attention, and “what had begun as a project for one now had an audience of millions”.²⁷ A week later, the FDA released a statement promising more extensive research into a cure for HIV/AIDS, and pharmaceutical companies followed suit. Soon after, they lowered the cost of AZT and approved two new medications, ganciclovir and an aerosolized version of pentamidine, both of which worked to improve the lives of those living with HIV/AIDS.²⁸ The large-scale demonstration led and united by the easily recognizable and bold iconography produced by queers artists changed the perception of AIDS as a “niche” and small-scale disease, demonstrating that simple graphics and symbols were an effective cultural agitation and agency for socio-political change.

Fortified by ACT UP and the politicization of art, LGBTQ+ artists cast aside their fears of censorship and shame around sexuality; this newfound pride in being queer resulted in a rise of openly queer representation in art. Artist Ross Bleckner said in an interview, “AIDS...It made me identify myself more as a gay man,” exemplifying how while HIV/AIDS forced many individuals to “come out,” it also empowered many to embrace their sexuality.²⁹ Robert Gober’s *Untitled Closet* (1989), an unmistakable reference to the metaphorical term “in the closet,” which refers to someone who hides their sexuality, juxtaposes greatly with the suppressed, silenced, and coded artwork from the early 20th century.³⁰ The built-in closet faces directly at the audience without embellishment or distraction so that it cannot be ignored. The piece’s simplicity gives the viewer space to investigate deeper into the specific choices Gober made, such as size, color, and model. Poet Andrew Durbin wrote:

What is here? An architectural incision, a recessed hole scaled to the size of a person, a place to put ourselves, to hand out metaphors for life in denial... I was a “closet case” once too, and it is precisely this obviousness that reminds us of denial’s inevitable failure to keep the door closed. Here there is no door... there is no place to hide. Nothing in it

²⁶ Lowery, *It was Vulgar and It was Beautiful: How AIDS Activists Used Art to Fight a Pandemic*, 186.

²⁷ *Ibid.*

²⁸ *Ibid.*, 189.

²⁹ Reed, *Art and Homosexuality: A History of Ideas*, 209.

³⁰ Robert Gober, *Untitled (Closet)*, 1989, Wood, plaster, enamel paint, 92 ½ × 52 × 33 ½ in, Glenstone Museum, Maryland, <https://www.glenstone.org/artist/robert-gober/>.

too – no collared shirts, no ties, no pressed trousers draped on hangers. It is empty because I have left it.³¹

As Durbin suggests, the conscious decision not to include a door to the closet is symbolic of a departure from secrecy and suppression. Goyer's *Untitled Closet* not only expresses his own liberation but also works to liberate other LGBTQ+ individuals like Durbin. His art shows that queerness had outgrown the dingy, muted closet of shame.

The blatant misinformation and homophobia in the media regarding HIV/AIDS also caused queer artists such as David Wojnarowicz to begin to use their art to address their oppression beyond the scope of the epidemic, critiquing the fundamentals of society that discriminated against non-conforming ideas and individuals. To encapsulate the deep discrimination and marginalization he experienced as a gay man, Wojnarowicz created *Untitled (One Day This Kid...)* (1990).³² Wojnarowicz understood that the extent of their oppression could not be adequately captured in a single symbol or slogan like the posters from ACT UP. However, he needed an effective way to relay his message. Thus *Untitled (One Day This Kid...)* features a black and white print of the younger Wojnarowicz and his toothy smile with lines of print in the background that mimics the print style of newspapers. He wrote:

One day this kid will get larger...One day this kid will do something that causes men...to call for his death...When he begins to talk, men will attempt to silence him with strangling, fists, prison, suffocation, rape, intimidation, drugging, ropes, guns, laws, menace, roving gangs, bottles, knives, religion, decapitation and immolation by fire. Doctors will pronounce this kid curable as if his brain were a virus...All this will begin to happen in one or two years when he discovers he desires to place his naked body on the naked body of another boy.³³

The elegy that makes up the background of *Untitled (One Day This Kid Will)* uses literary devices like anaphora, so it reads like poetry, adding depth and emotion to his work. It starts innocently and becomes increasingly grotesque, violent, and angry. Furthermore, contrasting the

³¹ Weinberg, *Art after Stonewall, 1969-1989*, 56.

³² David Wojnarowicz, "Untitled (One Day This Kid...)," Print, 1990, Whitney Museum of American Art, New York. <https://whitney.org/collection/works/16431>.

³³ Ibid.

horrors of existing as a gay man in their current society with the image of a little boy “addresses the way in which...from our first moments after birth, society inculcates these shameful feelings and brutally enforces the conditions of acceptable behavior”.³⁴ Wojnarowicz’s presentation of his experience as a gay man became notable for its effectiveness at opening the eyes of the public to fundamental flaws of society, which, as one critic wrote, can be “easily related to all kinds of prejudice and oppression today”.³⁵ The marginalization that followed the AIDS crisis prompted artists like Wojnarowicz to become more cognizant of the extent of their oppression, and the emergence of artistic activism through ACT UP instilled indignant and accusatory themes in queer art.

The HIV/AIDS epidemic also encouraged experimentation regarding ways to represent LGBTQ+ life in art. In contrast to the stifled work from early 20th century queer artists, artists during the HIV/AIDS crisis began unashamedly addressing LGBTQ+ socio-political and personal issues in their art. For example, gay Cuban-American artist Felix González-Torres employed his minimalist aesthetic and conceptual philosophy to address his grief and represent AIDS profoundly and innovatively.³⁶ His *Untitled (Portrait of Ross in L.A.)* (1991) is a tribute to his partner Ross Laycock, whom he watched die of AIDS.³⁷ The installation, consisting of shiny pieces of colorfully wrapped candy, was designed to be the exact weight of his partner. It initially appears innocent and playful, inviting the viewer to take from it. González-Torres explained, “I’m giving you this sugary thing; you put it in your mouth, and you suck on someone else’s body. And this way, my work becomes part of so many other people’s bodies. It’s very hot”.³⁸ By participating in this installation, the viewer also experiences part of González-Torres and his partner’s relationship. However, as viewers continue to take pieces of candy away, the installation shrinks, losing its presence and size, a metaphor for his partner’s shrinking weight as he slowly died from AIDS. The use of candy specifically was another way González-Torres highlighted AIDS as a subject in this piece, as it mirrors the small indulgences people take despite knowing the health risks. González-Torres further explained, “pieces just disperse

³⁴ Weinberg, *Art after Stonewall, 1969-1989*, 31.

³⁵ Ibid.

³⁶ Hodge, *The Short Story of Modern Art: A Pocket Guide to Key Movements, Works, Themes, and Techniques*, 43.

³⁷ Felix González-Torres, “Untitled (Portrait of Ross in L.A.),” Candies in variously wrapped colors, Dimensions vary, ideal weight 175 lbs. The Art Institute of Chicago, Illinois, <https://www.artic.edu/artworks/152961/untitled-portrait-of-ross-in-l-a>.

³⁸ Reed, *Art and Homosexuality: A History of Ideas*, 214.

themselves like a virus that goes many places”.³⁹ Thus he asks the participating audience to reevaluate their biases and judgment against those who contracted HIV/AIDS. The multitude of ways *Untitled (Portrait of Ross in L.A.)* can be interpreted to evoke the queer experience and ignite cultural conversation around sexuality, illness, and identity embodies the growing confidence of LGBTQ+ artists in expressing their personal life and their desire to bring about change.

The themes of candor and activism that emerged from queer art also spread to other communities. For example, Masami Teraoka, a straight Japanese-American artist, produced *AIDS Series: Geisha in Bath* (1988), a series of traditional Japanese woodblock prints depicting a geisha fervently opening packs of condoms in a bath.⁴⁰ The background contains Japanese script with explicit and profane language that attempts to promote safe sex to prevent the spread of HIV/AIDS. Although geishas are female entertainers for men, they are highly respected and viewed as part of the upper class in Japanese culture.⁴¹ Teraoka’s vulgar depiction of these respected figures opening condoms in *AIDS Series: Geisha in Bath* drew criticism and controversy, which he utilized to promote his message written out in the background. This bold use of art draws attention to overlooked aspects of the epidemic. This echoed queer art like *AIDSGATE*, as both incorporated HIV/AIDS as a subject of the preexisting styles of art. Teraoka was never diagnosed with HIV or AIDS.⁴² Nonetheless, he still dedicated the theme of his art to spreading awareness and alleviating the AIDS epidemic, indicating that the socio-political queer art movement expanded to a national level, uniting LGBTQ+ art activists with their allies.

The NAMES Project AIDS Memorial Quilt (1987), conceptualized by Cleve Jones, is considered one of the most influential and significant pieces of art born from the HIV/AIDS crisis, as it is a culmination of all the values and themes that defined queer art in the late 20th century.⁴³ “It was clear that if we didn’t find ways to not only make and present our work, but to document it, to preserve the work and rewrite the histories, we too would be erased,” said one

³⁹ Ibid.

⁴⁰ Masami Teraoka, *AIDS series: Geisha in Bath*, 1988, Wood block print, 19 ½ x 13 ½ in, Catherine Clark Gallery, San Francisco, <https://cclarkgallery.com/exhibitions/teraoka-a-selection-of-works-from-masami-teraoka-1979-2013>.

⁴¹ Jessica Bocinski, “Masami Teraoka - Contemporary Issues Through a Ukiyo-e Lens,” Escalette Permanent Collection of Art at Chapman University, March 16, 2017, <https://blogs.chapman.edu/collections/2017/03/16/masami-teraoka-2/>.

⁴² Ibid.

⁴³ The Names Project Foundation, *AIDS Memorial Quilt*, 1987, Mixed media, Golden Gate Park's Robin Williams Meadow, California, <https://www.aidsmemorial.org/quilt-history>.

artist, “and I refuse to let that happen”.⁴⁴ Such was the sentiment behind the AIDS quilt. Due to the stigmatization of HIV/AIDS, many of those who died of the disease were not buried or mourned appropriately. To “preserve” the lives of those lost to AIDS, the quilt, originally made out of 40 handmade panels, was embroidered with the names of those lost. A few months later, when it was displayed in Washington DC for the National March for Gay and Lesbian Rights, the quilt had grown to around 2,000 panels, reiterating the unity and strength of the LGBTQ+ community.⁴⁵ The quilt combines the traditional masculinity of the anger that drove protests and activism with the traditional femininity of sewing and embroidering, “incorporat[ing] common ideas of homosexuality as a blurring of gender boundaries”.⁴⁶ In addition to memorializing those who passed, the quilt also worked to “document” and celebrate the lives and achievements of those lost. Each patch is uniquely decorated to match the qualities and personalities of each person it remembers, and it is handmade with the love of their family and friends, creating a powerful message that those who lost their fight and those still fighting against HIV/AIDS are loved, rather than quarantined or isolated. One participant stated that the quilt was “something that comforts and covers rather than remains covered itself,” describing the pride signified by this collaborative art.⁴⁷ Significantly, not all people featured in the quilt were homosexual, many were heterosexual, and many of the contributors to the quilt were heterosexual; thus, the quilt stands as a collaboration between the queer community and its allies.⁴⁸ The NAMES Project AIDS Memorial Quilt, a center of community, healing, and pride, was most recently counted at over 82,000 panels and continues to be expanded.

By the end of the 80s, there had been over 100,000 reported AIDS cases in the US, and there was still no promising cure.⁴⁹ Tired and discouraged by the relentless homophobia, lack of medical advancement, and perhaps most significantly, the rising deaths of participating activists and artists, the movement lost momentum, and AIDS-related art subsided. In 1995 ACT UP and its collectives disbanded.⁵⁰ As HIV/AIDS activist Thomas Sokowoski put it, “people just can’t scream all the time.”⁵¹ Nonetheless, the queer art movement that blossomed from the HIV/AIDS

⁴⁴ Weinberg, *Art after Stonewall, 1969-1989*, 109.

⁴⁵ Reed, *Art and Homosexuality: A History of Ideas*, 215.

⁴⁶ *Ibid.*, 216.

⁴⁷ Weinberg, *Art after Stonewall, 1969-1989*, 242.

⁴⁸ Reed, *Art and Homosexuality: A History of Ideas*, 216.

⁴⁹ Weinberg, *Art after Stonewall, 1969-1989*, 301.

⁵⁰ Reed, *Art and Homosexuality: A History of Ideas*, 229.

⁵¹ *Ibid.*

crisis had a historical political and cultural impact. It brought together LGBTQ+ artists, helped them cope with their sorrow, and channeled their indignation into meaningful action to address the crisis and reshape its trajectory. Their art, much of which currently resides in prominent museums and galleries, continues to move and inspire the masses, while the symbols and motifs, such as the pink triangle from *Silence = Death*, still holding their original weight, continue to be used in HIV/AIDS protests and LGBTQ+ parades in the modern day. HIV is now a manageable disease with access to the correct medicine and healthcare, homosexuality has been legalized, and there has been a decrease in the stigmatization of LGBTQ+ individuals since the AIDS crisis.⁵² However, these issues have not been completely eradicated, and artists, guided by the queer art of the late 20th century, still use their work to celebrate their pride in their sexuality and fight against discrimination.

⁵² American Experience, PBS, "Milestones in the American Gay Rights Movement," June 13, 2018.

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Development and Application of Intercultural Enzyme (IE) Principles in Relation to Empathy Enrichment Treatment By Briana Biswas

Abstract

This study investigated the extent to which the application of Intercultural Enzyme (IE), a set of proposed sociocognitive intervention principles, modified the capacities associated with intercultural empathy. Utilizing a matched pairs design, an experiment was performed to determine the impact of an empathy enrichment workshop designed with IE principles. Data were collected from 30 adolescent, cisgendered male participants attending a public high school located in Southern California. The capacities associated with intercultural empathy, self-concept and ethnocultural empathy, were measured through the Self-Concept Questionnaire (SCQ) (Robson, 1989) and Scale of Ethnocultural Empathy (SEE) (Wang et al. (2003). The experimental group that participated in the IE centered workshop displayed statistically significant, increased levels of intercultural empathy capacities in comparison to the control group. Theoretical and practical implications are discussed.

Keywords: intercultural empathy, self-concept, ethnocultural empathy, cognitive scheme

Introduction

The contemporary, global phenomenon of the empathy deficit reveals a cognitive bias in which individuals undervalue the impact of visceral drives on their attitudes, biases, and behaviors. The advent of modern media and changing social dynamics has impeded the development of empathy and fueled global conflict. Thus, the proposed principles of IE aim to surmount the psychological barriers that obstruct the cultivation of interculturally empathic concern within an era of rapid globalization and technology. Intercultural empathy generally denotes the ability to comprehend, acknowledge, and vicariously experience the sentiments and thoughts of individuals from diverse cultural backgrounds and effectively communicate this empathic understanding (Eichbaum et al., 2022).

The Gravity of Intercultural Empathy Application

The ongoing evolution of contemporary society, driven by the advent of revolutionary technology, embrace of sexual diversity, racial bias mitigation, and the reassessment of

traditional social roles (Kavanagh et al., 2021), hinders the development of self-concept due to the requisite of evaluating complex social factors prior to establishing cognitive and affective decisions about the self. The ineptitude to process social factors evidently manifests as the inability to empathize with identities incongruent with the self, reinforcing an allegiance to in-group biases as a means of maintaining sense of self, fulfilling the social identity theory proposed by Hogg et al. (1995). Consequently, the cultural phenomenon of failing to understand and resonate with the emotions and marginalization of groups incongruent to the self continues to result in global conflicts. Therefore, achieving cultural heterogeneity dynamics through acceptance of the other's identity elements such as gender, religion, race, income, urbanity, and political orientation holds the potential to increase social cohesion and capital absent in contemporary society (Desmet & Wacziarg, 2020). Notably, the Coronavirus disease (COVID-19) built a unique impact on 21st century gaps in social cohesion as it fueled extreme political and social polarization in Western society (Desmet & Wacziarg, 2020). Further elucidating the significance of maximizing culturally empathic capacities to foster effective cultural communication and avoiding deficits in empathy that propel passive or active participation in oppressive organizations. According to Zhu (2011), culturally empathic capacities or intercultural empathy, involves an individual to create conscious and willing shifts from one's own cultural perspective to project oneself into another culture, while still maintaining the native perspective. The application of intercultural empathy promotes reciprocal respect for dignity in the presence of cultural differences, weakening exclusionary cognitive schemas emerging from naivete to environmental influences preserving stereotypes or prejudice.

Empathic Ability & Self Concept

Neuroimaging studies have corroborated the notion that observation of another's emotional state activates paralleling neural regions to those involved in the experience of that emotional state, such as pain and disgust (Bernhardt & Singer, 2012). Lending credence to the notion that empathizing with others activates the brain network that underpins the empathizer's internal emotional state. This automatic mimicry and consequent emotional contagion are thought to provide the basic foundation for affective empathy, a key driver of prosocial behavior and empathetic concern. Networks of emotions: joy, love, fear, anger, terror, loss, shame, and grief allow humans to understand who and what is significant to them via their experiences of emotions (Mikulincer et al., 2015). These emotions serve as the currency of human interaction,

creating opportunities for humans to conceptualize and attach purpose to their existence and the existence of others (Mikulincer et al., 2015). Therefore, through understanding emotions as interactive currency and pro-social ability as the key to preservation, it remains evident that the architect of social dynamics is human empathy; fostering prosocial actions, hostility inhibition, and community collaboration; engineering motives for morality and justice (Decety & Cowell, 2015). Despite its vitality to human existence and adaptive functions, not all humans are predisposed to boundless empathetic capacities; people frequently fail to empathize with others, particularly members of different social or cultural groups (Cikara et al., 2014).

The concept of empathy is multifaceted and requires a precise interplay of neural networks, enabling individuals to discern and resonate with others' emotions and perspectives, while also distinguishing between their own emotional experiences and those of others (Riess, 2017). However, there has been a lack of attention in empathy research directed towards understanding the vital role of recognizing the distinction between self and other. Despite a number of researchers emphasizing the importance of this self-other differentiation in empathy (e.g., Bird & Viding, 2014; de Vignemont & Singer, 2006; Decety & Jackson, 2004; Lamm et al., 2016), there remains a gap in knowledge regarding the psychological factors that facilitate this ability to distinguish between the self and others. To date, empathic responding has been extensively considered to rely on other-oriented processes, and the vast majority of interventions designed to enhance empathy have been predominantly centered around augmenting emotional comprehension and exchange (Weisz et al., 2021). In contrast, contemporary research suggests that these interventions may prove futile in individuals lacking a cohesive sense of self, thereby elucidating that bolstering one's self-concept may hold the key to unleashing the empathic, prosocial behavior that is pivotal in human social interactions (Krol & Bartz, 2022). The significance of possessing a coherent and consistent self-concept in activating empathetic concern is heightened by the respect that is accorded to it (Campbell, 1990; Campbell et al., 1996). While empathy necessitates the adoption of the target's emotional and mental state, theory and research underscore that this sharing must be accompanied by a robust self-other distinction in the perceiver. The affective response to the other's feelings may trigger emotional distress, engendering a self-centered negative reaction that is more likely to manifest as withdrawal than an emphatically motivated response. Lacking a coherent perception of self heightens the susceptibility to confusing one's own distress with that of the other, resulting in less adaptive

emotional responses to the other's distress and, ultimately, undermining the prosocial behavior that is indispensable for fostering human connection (Krol & Bartz, 2021).

Neural & Social Basis of Identity Development in Adolescent Males

The demographic notoriously characterized by a poorly cultivated sense of self is male adolescents. Erik Erikson, a Danish-German psychologist most known for his theory of psychosocial development, describes the developmental period of pubertal adolescence as an “identity crisis” in itself as males explore sexual preferences and self-perceptions of masculinity (Erikson, 1970). According to Erikson, those secure in identity perception and worldview tend to exhibit healthier prosocial development, and a recent study examining the male adolescent identity through the Development Scale and The Extended Objective Measure of Ego Identity Status (EOM-EIS) provides findings consistent with Erikson’s life span theory of psychosocial development (Jones et al., 2012).

Stephen Russell, Ph.D. (2016) in Sociology from Duke University highlights the urgency of utilizing science’s potential to expand understanding of the adolescent mind in order to be conscious of how science may contribute to inequalities and normativity that limit opportunities for adolescents to achieve their full potential. By highlighting scholarly reliance on tropes of developmental immaturity when regarding the adolescent mind, Russell encourages regressing from pathologizing adolescence and concentrating on the impact of social, cultural, racial, socio-economic class, gender, sexuality, and other categories of inequality (2016).

Media’s Impact on Neural Maturation

The neural architecture of humans innately includes a neural circuitry responsible for the expression of core affect, characterized by hedonic valence and arousal (Gaspar & Esteves, 2022). This neural system facilitates the binding of somatovisceral and sensory information to construct meaningful representation, enabling humans to navigate their environment safely (Gaspar & Esteves, 2022). The decoding of complicated emotions, the interpretation of contextual regulators of affect, and the comprehension of 'unexpressed' affect, which refers to the intensity of emotional reactions to the affect of others, increase gradually with age (Gaspar & Esteves, 2022). Nevertheless, the capacity for these abilities may plateau at a relatively early age due to the significant biological contribution of reciprocal connections between the ventromedial prefrontal cortex (vmPFC), anterior cingulate cortex (ACC), and amygdala (Decety &

Michalska, 2010). With age and increased neural maturation, in conjunction with input from interpersonal experiences that are strongly modulated by contextual and social factors such as ingroup versus outgroup processes or relationships, children and adolescents become sensitive to social norms regulating prosocial behavior; in accordance, they may become more selective in their response to others (Decety & Michalska, 2010). Within an era of increased exposure and accessibility to media, individuals remain vulnerable to internalizing negative content that reinforces stereotypical images of out-groups, which may inflate esteem derived from in-groups and create desensitization to the adversity of out-groups (Hogg et al., 1995; McKinley et al., 2014). Within individuals possessing jeopardized levels of esteem in self, it remains evident that empathy becomes subconsciously reserved for groups or individuals that contribute to a sense of security and esteem in one's identity (Golec de Zavala et al., 2020).

As the increasing prevalence of social media and communication technology perpetuates toxic principles of hegemonic masculinity, such as aggression and avoidance of femininity, unequal power relations and hindrance of empathic expression is reinforced in adolescent males. Such gender socialization creates restrictive environments that impede the installation of prosocial behavior in intercultural contexts. Notably, the development of emotional empathy does not exhibit a linear trajectory from adolescence to adulthood, as it is already significantly developed during the transition from pre-adolescence to adolescence. This respect underscores the critical importance for parents and educators to implement empathy nurturing programs early in the developmental process, particularly those that facilitate the elicitation of vicarious empathic responses.

Intercultural Enzyme (IE) Model & Addressing Gaps In Empathic Understanding

The cognitive capacity for mental flexibility, enabling individuals to consciously adopt the subjective perspective of another person, can be intentionally cultivated (Janssen, 2014). A classic experiment conducted by social psychologist Erza Stotland in 1969 revealed that imagining someone's pain in a video, as opposed to merely observing it, resulted in greater physiological stress (Decety & Jackson, 2004, p. 84). Additionally, students who were instructed to adopt the perspective of a person featured in a video conversation demonstrated greater empathy than those who did not adopt such a perspective (Regan & Totten, 1975). Empirical evidence has consistently demonstrated that individuals hold the capacity to assume the point of view of another individual is a deliberate and controlled process, implying that empathy is an

intentional ability susceptible to socio-cognitive interventions such as training or enhancement programs (Decety & Jackson, 2004; Lam, 2010). According to a study by Rebecca Gotlieb, Ph.D., a researcher in human developmental psychology and educational neuroscience at the University of California Los Angeles (UCLA), it is crucial to foster socio-affective development using neuroscience supported cultural learning (Immordino-Yang & Gotlieb, 2017). In an interview with Gotlieb, she highlighted the prevalence of group dynamics theory, which may hinder the goal of empathy development and instead foster hostility. In accordance with theory, facilitation of an IE-centered workshop would require careful regulation of group behavior and promotion of group functionality for enhancement of empathy achievement.

Drawing on contemporary conceptions of empathy, and addressing gaps in knowledge regarding psychological principles that distinguish self from others in terms of empathic response, the proposed Intercultural Enzyme (IE) model presents a comprehensive framework of sociocognitive principles to enrich empathy workshops and treatments. In contrast to prior empathy interventions, IE-centered workshops aim to promote self-concept security necessary to attune individuals intellectually and emotionally, enabling them to comprehend adverse situations even in the absence of empirical knowledge.

Table 1

Principles of Intercultural Enzyme (IE)

Interactive	Interactive Forum Structure
Exposure	Exposure to Diverse, Logic Based Counterarguments to Cognitive Schemas
Encouragement	Encouraging the Identification of Common Ground with Out-groups and Expression of Native Perspectives
Navigation	Navigation of Complex Social Ideals

Note. This table demonstrates the foundational principles of IE to apply onto empathy interventions and workshops.

The IE model employs a forum structure to encourage collaborative exchange of ideas among intervention participants, who engage in didactic, mindfulness, and experiential training activities to enhance their intercultural empathy capacities. Through a multifaceted understanding of empathy from both neurobiological and self-distinction perspectives, it is plausible that providing a controlled environment that promotes consumption of diverse perspectives, exposure to logically-based counterarguments to cognitive schemas, exploration of present curiosities, identification of common ground with out-groups, and navigation of complex modern social ideals without pressure to conform to socially desirable ideals, may serve as a catalyst for intercultural empathy. The workshop facilitator acts as a mediator and enforces rules that ensure participants approach the ideas of others with a degree of interest and maintain composure throughout the session.

Method-Participants

The population sample of cis-gender adolescent males is derived from a public highschool in Southern California. Using a non-probability sampling method, fifty cis-gender adolescent males attending Summit High School were recruited. A purposive, maximum variation sampling technique is utilized in order to secure racial, intellectual, political, cultural, and sexual diversity to allow multiple demographics of the adolescent male population to be represented within the sample. To note, volunteer service hours were provided as an incentive to eligible participants. Therefore, participation in the study was not appealing to a majority of eligible individuals, particularly those who did not require volunteer hours toward college applications. Additionally, the predominant racial demographic of the high school chosen are individuals who identify as Hispanic, Latinx, or of Spanish origins; therefore, racial and ethnic diversity is limited. The experiment follows a posttest only control group, matched pairs experimental design. Twenty-five pairs are made, a subject from each pair is randomly assigned into the treatment group, while the other subject from the pair will be assigned to a control group. To test the hypothesis that the application of Intercultural Enzyme (IE) principles to intercultural empathy interventions create statistically significant differences in capacities associated with intercultural empathy, an independent sample *t*-test was performed for each examination administered. Capacities were operationalized by variables of self-concept and

ethnocultural empathy, indicated through Self-Concept Questionnaire (SCQ) (Robson, 1989) and Scale of Ethnocultural Empathy (SEE) (Wang et al. (2003).

Measures and Materials

Intercultural Enzyme (IE) Centered Workshop Framework

The workshop consists of activities and video stimuli. The USC Suzanne Dworak-Peck School of Social Work Diversity Toolkit: A Guide to Discussing Identity, Power and Privilege (2020) workshop consists of group activities to assist participants to learn about their own identity as well as the “implications of socially constructed labels and stereotypes of an individual’s experience”. Various activities of the diversity toolkit were adapted into the workshop as follows in Table 2. The newfound knowledge acquired through the workshop is projected to serve as a catalyst for empathy development. As per USC Suzanne Dworak-Peck School of Social Work’s instructions, the workshop will be altered in order to best suit the participants (eg. removing activities specific to women and transgender participants).

Each workshop session will be conducted in a designated classroom, where participants will be randomly assigned to equally sized groups. A visual presentation will function as a guide, displaying reflective questions and activity instructions throughout the duration of the workshop. Legal requirements necessitated the presence of a teacher to supervise the workshop and examination sessions. As shown in Table 2, each activity is tailored to address one or more of the Intercultural Enzyme (IE) framework's principles. Activities A through D were administered during Part I of the workshop, held in the morning for a duration of three hours. Part II, which included the remaining workshop activities, was conducted during the afternoon of the following week for a duration of two hours.

Table 2

IE Workshop Activities & Stimuli

<i>Title</i>	<i>Activity Description</i>
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Activity A Facilitator Sensitivity Activity (“Diversity Toolkit: A Guide to Discussing Identity, Power and Privilege,” 2020)

Facilitator verbally ensures participants of their rights as well as reinforces the fact that they are in a safe environment to discuss sensitive issues.

Activity B Icebreaker Activity (“Diversity Toolkit: A Guide to Discussing Identity, Power and Privilege,” 2020)

The participants will engage in a discussion aimed at examining the manners in which they demonstrate respect within their respective groups. Following this, each group will share their responses with the wider workshop cohort. The purpose of this activity is to encourage a critical reflection on underlying assumptions and socialization processes that inform expressions of respect. The primary objective is to learn from each other's differences rather than to reach a consensus. Through this exercise, participants establish a foundation of mutual respect that enables them to initiate and sustain constructive conversations surrounding issues of social justice and equity.

Activity C Introduction to Identity “My Fullest Name” (“Diversity Toolkit: A Guide to Discussing Identity, Power and Privilege,” 2020)

In this exercise, participants are requested to inscribe their full names on the front of a paper, while on the back they list the three identities that they most closely align with. The facilitator guides the participants in a circle, inviting each individual to share the cultural and personal significance, historical and ancestral roots, and the top three identities they cherish the most. This sharing process ensures that every participant has an opportunity to voice their identity to the group. The primary objective of this exercise is to reinforce the recognition and appreciation of the diverse identities represented by the participants, with the ultimate goal of promoting communal bonding.

Activity D Asian Americans Debate Model Minority & Asian Hate | VICE Debates (VICE, 2022)

A panel of politically diverse Asian American present unique perspectives regarding the topic of race relations. This activity is meant to stimulate interest in the topic, expose participants to opposing views. After viewing the debate, participants engaged in debate and reflection with all participants.

Activity E Systematic Racism Explained (act.tv, 2019)

The video explains systematic racism in simple terms that are meant to assist the participants in navigating the issue without becoming overwhelmed with complicated terminology.

Activity F Evaluating Environment
("Diversity Toolkit: A
Guide to Discussing
Identity, Power and
Privilege," 2020)

Participants are asked to fill out a chart in which they are asked to record the aspects of individuals in their environment. The objective of this activity is to help participants take stock of the multicultural diversity in their lives. It should help participants get a clear image of how diverse or homogenous their surroundings are and identify ways to improve their exposure to multiculturalism on a daily basis.

Activity G Political Management of
Race Relations
(HuffPost, 2020)

Emory University Professors Carol Anderson and Andra Gillespie, and HuffPost's own Rowaida Abdelaziz reflect on the Trump Administration's management of race relations. This activity is meant to evaluate the United State's previous administration and status of racial equality in Western society. Following the video stimulus, participants were asked to engage in discussion about the management of racial relations in the United States.

Activity H	Standing Together (“Diversity Toolkit: A Guide to Discussing Identity, Power and Privilege,” 2020)	During the exercise, the facilitator presented a series of statements regarding sensitive social issues, requesting that participants stand if they resonated or supported each statement. This activity necessitates that participants venture outside of their comfort zones, thereby promoting vulnerability and openness. Through this process, participants may gain deeper insights into the identities that they do not share and learn from those who hold different perspectives. This exercise has the potential to foster mutual understanding and promote the identification of common ground with out-groups.
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The SEE was developed by Wang et al. (2003) to measure ethnocultural empathy levels of various ethnic groups and is composed of 31 items. The SEE uses a 6-point Likert-type scale (1 = strongly disagree that it describes me to 6 = strongly agree that it describes me). The examination was administered during the morning in the format of a Microsoft Form.

Self-Concept Questionnaire (SCQ)

The SCQ is a self-report scale measuring self-esteem (Robson, 1989). It consists of 30 items (e.g., “I have control over my life,” “I feel emotionally mature,” “I can like myself even if others don’t”). The questionnaire indicates the attitudes and beliefs an individual holds towards themselves. Scoring is performed on an eight-point scale, ranging from completely disagree to completely agree. The examination was administered during the morning in the format of a Microsoft Form.

Results

Qualitative Observations Regarding Workshop Participation

The students initially approached the activities with a visible degree of discomfort, however, as the workshop progressed, students displayed increasing levels of engagement. The stimulus of the Vice debate served as a catalyst for heated argument amongst the participants.

The majority of the participants resonated with the conservative ideals expressed in the video. Through participant debate, many rejected or questioned the validity of diversity implementation and adversity towards marginalized groups. The main concern expressed was towards the proposed “liberal” technique of galvanizing voter support through false promises of diversity centered movement. Through the debate, the cognitive schemas of the participants became apparent. A majority of students that expressed political biases identified with conservative beliefs or expressed political neutrality. Due to the discomfort that arose from the debate, certain participants expressed a refusal to return to Part II on the basis of their sensitivity to their sociocultural and political beliefs becoming challenged. However, during Part II, participants began to express verbal affirmations of respect and acceptance of multicultural differences. Notably, during Part II, the mandated supervisor communicated to the workshop participants that the video stimulus in Activity G, Political Management of Race Relations (HuffPost, 2020), is not reliable information due to its “heavy bias.” The supervisor was not sanctioned or encouraged to convey such comments by the research team. The action of undermining the credibility of the diverse identities present in the video may have altered the perceptions of participants.

Statistical Analysis

Of the 25 participants in the experimental group who attended Part I, 10 individuals failed to complete Part II and/or examinations, and were consequently excluded from the dataset. In the control group, 5 participants failed to complete the examinations, and as a result, 15 individuals were randomly selected for inclusion in the final dataset. Therefore, the final total number of participants included in the study was 30.

Table 3

Independent Sample T-Test for SEE

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Scale of Ethnocultural Empathy (SEE) Total Score	Equal variances assumed	.120	.732	3.320	28	.001	.003	23.267	7.009	8.910	37.623
	Equal variances not assumed			3.320	27.981	.001	.003	23.267	7.009	8.910	37.624

Note. (N = 30) One Sample Independent T-Test Calculated via SPSS statistical software

The experimental group ($N = 15$) was associated with ethnocultural empathy capacity $M = 93.40$ ($SD = 19.441$). By comparison, the control group ($N = 15$) was associated with a numerically smaller ethnocultural empathy capacity $M = 70.13$ ($SD = 18.943$). The experimental and control group distributions were sufficiently normal for the purposes of conducting a t -test (i.e., skew $< |1.0|$ and kurtosis $< |2.0|$; Kim, 2013). Additionally, the assumption of homogeneity for variances was tested and satisfied via Levene's F test, $F(28) = .120$, $p = .723$. The independent samples t -test was associated with a statistically significant effect, $t(28) = 3.320$, $p = .003$. Thus, the experimental group was associated with statistically significantly larger mean ethnocultural empathy capacity than the control group. Cohen's d was estimated at 1.21, which is considered a large effect based on Cohen's (1992) guidelines. A graphical representation of the means and the 95% confidence intervals is displayed in Table 3.

Table 4

Independent Sample T-Test for SCQ

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Score						One-Sided p	Two-Sided p			Lower	Upper
	Equal variances assumed	.978	.331	3.241	28	.002	.003	16.200	4.999	5.960	26.440
	Equal variances not assumed			3.241	27.998	.002	.003	16.200	4.999	5.960	26.440

Note. ($N = 30$) One Sample Independent T -Test Calculated via SPSS statistical software

Consistent with the primary hypothesis, the intervention improved intercultural empathy levels through increasing self-concept, $t(28) = 3.241$, $p = .003$. Experimental participants demonstrated higher self-concept levels ($M = 119.40$, $SD = 13.752$) than the control group participants ($M = 103.2$, $SD = 13.629$). The intervention had a large effect on self-concept levels as per Cohen's d of 1.183.

Discussion, Limitations, Implications, and Future Avenues

The study's findings indicate that the utilization of Intercultural Enzyme (IE) principles in empathy enrichment treatment produces statistically significant advancements in the intercultural empathic capabilities of participants. However, several limitations must be acknowledged when interpreting the study's results, such as the limited sample size, short duration, and the constraints of existing knowledge regarding the neural processes involved in empathy. Advisor, Marco

Iacoboni, M.D., Ph.D., professor in the department of psychiatry and biobehavioral sciences at University of California Los Angeles (UCLA) notes that the methodological decision of lack of pretesting, chosen due to limited timeline, exposes the data to disregard individuals differences of participants capacities prior to treatment. Additionally, the Hawthorne Effect (*Vol. 26, No. 4, August 2000 of Scandinavian Journal of Work, Environment & Health on JSTOR*, n.d.) may have influenced the results, as participants may have altered their behavior in response to the presence of authority figures during the workshop and examinations.

The results provide a modern insight into the relationship between empathy development and self-concept as the data collected illustrates that sociocultural learning contributes to a refined perspective on society, facilitates cognitive processes regarding self-identity, and ultimately fosters the capacity for empathy. These results reinforce the findings of prior research suggesting the vitality of the self-other differentiation in empathy growth (Krol & Bartz, 2022). While supporting the concept that empathic abilities tend to plateau at relatively young ages (Decety & Michalska, 2010), the gathered data indicates that adolescents exhibit adequate levels of cognitive adaptability to enhance their existing empathic skills and intercultural competence. Further research is necessary to expand the IE model into a more comprehensive framework capable of accommodating diverse student populations and effectively implementing IE workshops within academic institutions. Extended avenues for future research may include investigating the applicability of IE-centered empathy enrichment treatments to diverse psychiatric demographics, which may present variations in mirror neuron system functioning compared to neurotypical individuals.

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Cannabinoids as a Therapeutic Treatment of Alzheimer's Disease By Rohan Melwani

Abstract

Millions of people worldwide suffer from dementia and various forms of neurodegenerative diseases. The most common neurodegenerative disease, as well as the most common cause of dementia, is Alzheimer's Disease (AD). AD in the brain is physiologically characterized by amyloid beta ($A\beta$) plaques, hyperphosphorylation and aggregation of Tau, neuroinflammation, and synaptic loss. These processes all result in progressive cognitive decline in neurological functions such as memory, attention, and judgment. As there is no cure nor many viable treatment options in which the benefits outweigh potential side effects, the search for possible treatment options continues. One category of promising treatments is cannabinoids, the most notable of which are cannabidiol (CBD) and delta-9-tetrahydrocannabinol (THC). In this review, I will discuss in vivo and in vitro studies showing positive behavioral, neuroprotective, and neuroregenerative impacts as a result of cannabinoid treatment. These properties of cannabinoids exhibited in the treatment of AD show a lot of promise and thus deserve further research and consideration as a potentially effective therapy.

Introduction

1.1 Genetic and Environmental Factors

Alzheimer's Disease (AD) is a neurodegenerative disease and a common form of dementia (Villain and Dubois). AD does not have a specific genetic or environmental cause but is a result of various factors. The most notable of these factors is the *ApoE-ε4* allele of the *APOE* gene (Corder et al.). APOE is the primary ligand for low-density lipoprotein, and its prominent role is the transportation of lipids, such as cholesterol, through the cerebrospinal fluid and plasma. Some other biological and environmental factors that can put one at risk of developing AD include the *APP*, *PSEN1*, and *PSEN2* genes and aluminum exposure, cardiovascular disease, and Diabetes, respectively (A Armstrong).

The human lifespan has increased with advancements in medicine, and because AD in its most common form is a late-onset illness, the number of patients suffering from this illness is rapidly increasing. It is projected that by 2050, the number of patients suffering from AD will

increase to 115 million (Wisniewski and Goñi). A large part of this is due to the lack of proper treatment or cure.

1.2 Molecular Mechanisms in the Development of AD

AD starts when an increased amount of Beta-Amyloid ($A\beta$), a byproduct of the β -secretase pathway, aggregates and forms plaques. These $A\beta$ s are a byproduct of one of the two pathways in which amyloid precursor protein (APP) is cleaved. In the first pathway, the α -secretase pathway, APP is cleaved by α -secretase at one location on the protein, leaving two pieces of APP without any byproducts. In a second way, the β -secretase pathway, APP is cleaved by both β -secretase and γ -secretase in different locations, leaving a portion of APP, in the form of $A\beta$, as a byproduct. For healthy individuals, these pathways constantly occur, and the $A\beta$ byproducts are cleared by macrophage-like cells of the central nervous system (CNS), called microglia. However, in an individual with AD, many factors can disrupt this delicate balance, including the up-regulation of β -secretase and γ -secretase, down-regulation of α -secretase, or inhibition of microglial functions. No matter the cause, the effect is the same: $A\beta$ aggregation and plaque formation, both of which contribute to physical and cognitive effects experienced by patients with AD.

Due to their synaptotoxic properties, these $A\beta$ plaques can disrupt neurons by damaging their initial axon segments, where the site of action potential firing occurs, leading to lower neuron excitability. Another part of this disruption includes the hyperphosphorylation of tau, a microtubule-associated protein, via the overactivation of glycogen synthase kinase-3 beta (GSK-3 β). The length of a neuron necessitates the transportation of certain nutrients along microtubules from the soma, across the axon, to the terminal buttons. Furthermore, neuronal microtubules are numerous and long, so they must be stabilized to prevent tangling. The proteins that support the microtubules and keep them in line are tau. When these proteins become hyperphosphorylated, they can no longer do their job, eventually leading to the death of the neuron. The hyperphosphorylated Tau is then released, where it aggregates with other Tau, forming plaques. These plaques, similar to the $A\beta$ plaques, can disrupt neurons and, in turn, cause more hyperphosphorylation of Tau, creating a positive feedback loop. The result is a continuous loss of neurons, meaning fewer synapses and, therefore, a reduction in plasticity. With all this loss of neural networks, the intracranial volume (ICV) significantly decreases, also known as brain atrophy, during the progression of AD (Mori et al.).

1.3 Current Primary Treatments for AD

The most common treatment for AD is acetylcholinesterase inhibitors (AChEIs), such as donepezil, galantamine, and rivastigmine. Acetylcholine (ACh) is an excitatory neurotransmitter whose primary functions are muscle movement and memory formation. ACh is different from other neurotransmitters as there is no reuptake of ACh to control the strength of the resulting electrical signal. Instead, there are AChEs that break down ACh to prevent too high of ACh from remaining in the synaptic cleft, the space between the pre and post-synapse of communicating neurons. This class of drugs inhibits this enzyme from breaking down ACh, leaving an excess of this neurotransmitter in the synaptic cleft. This excess volume of ACh produces stronger signals of surviving neurons to compensate for the dysfunctional neurons. ACh is significant to AD because cholinergic neurons, neurons that fire action potentials in response to ACh, are highly present in the hippocampus, the chief region affected by AD. As such, these cholinergic neurons play a very important role in the formation of memory and are the main neurons destroyed by the A β and Tau plaques. Therefore, the damage and destruction of cholinergic neurons are the reason for AD patients' outward symptoms at later stages, such as the inability to form new memories. While AChEIs cannot address the root causes of AD, they can help manage some symptoms for some patients. However, AChEIs also have various adverse side effects, such as anorexia, vomiting, and muscle cramps. They also can lead to more severe side effects, such as long-term liver damage.

Another standard treatment for those with AD is a class of drugs called glutamate regulators, such as memantine. This class of drugs aims to normalize the activity of overactive glutaminergic neurons, which is a proposed cause of neurotoxicity. Like the AChEIs, memantine and other glutamate regulators improve cognitive function and behavioral disturbances, but they have their limits as a treatment (Guo et al.). Side effects of this drug include weight gain, localized pain in the body, and aggression. The most commonly recommended treatment plan for a patient with AD includes donepezil in combination with memantine due to its compatibility (Chen et al.). As a result, there is a need for better therapies that do not give these side effects to improve the overall health of AD patients.

1.4 Current Supplementary Treatments for AD

While AChEIs and glutamate regulators are the chief current treatments, other drugs are used to supplement them to target specific symptoms. One example is atypical antipsychotic

drugs, which are used to limit symptoms of aggression, agitation, and psychosis. However, studies have shown that antipsychotic drugs aren't fully effective for patients with AD (Schneider, Lon S. et al.). Worse, the adverse effects of this drug outweigh any potential benefits for treating these specific symptoms in patients with AD, as they can have side effects of parkinsonism and cerebrovascular events (Wooltorton).

Another class of supplemental treatment for AD is selective serotonin reuptake inhibitors (SSRIs) (Porsteinsson et al.). SSRIs are used as a treatment for AD because of serotonin's mood-regulating properties as a neurotransmitter. SSRIs work by blocking the reuptake of serotonin from the synaptic cleft, which results in more serotonin absorbed by the postsynaptic neuron. The increase in serotonin will calm the patient down, reducing aggression, agitation, and even the loss of appetite commonly present in AD patients. Not surprisingly, however, these drugs have many cognitive and cardiovascular side effects, which may limit their potential as a therapy for AD (Porsteinsson et al.).

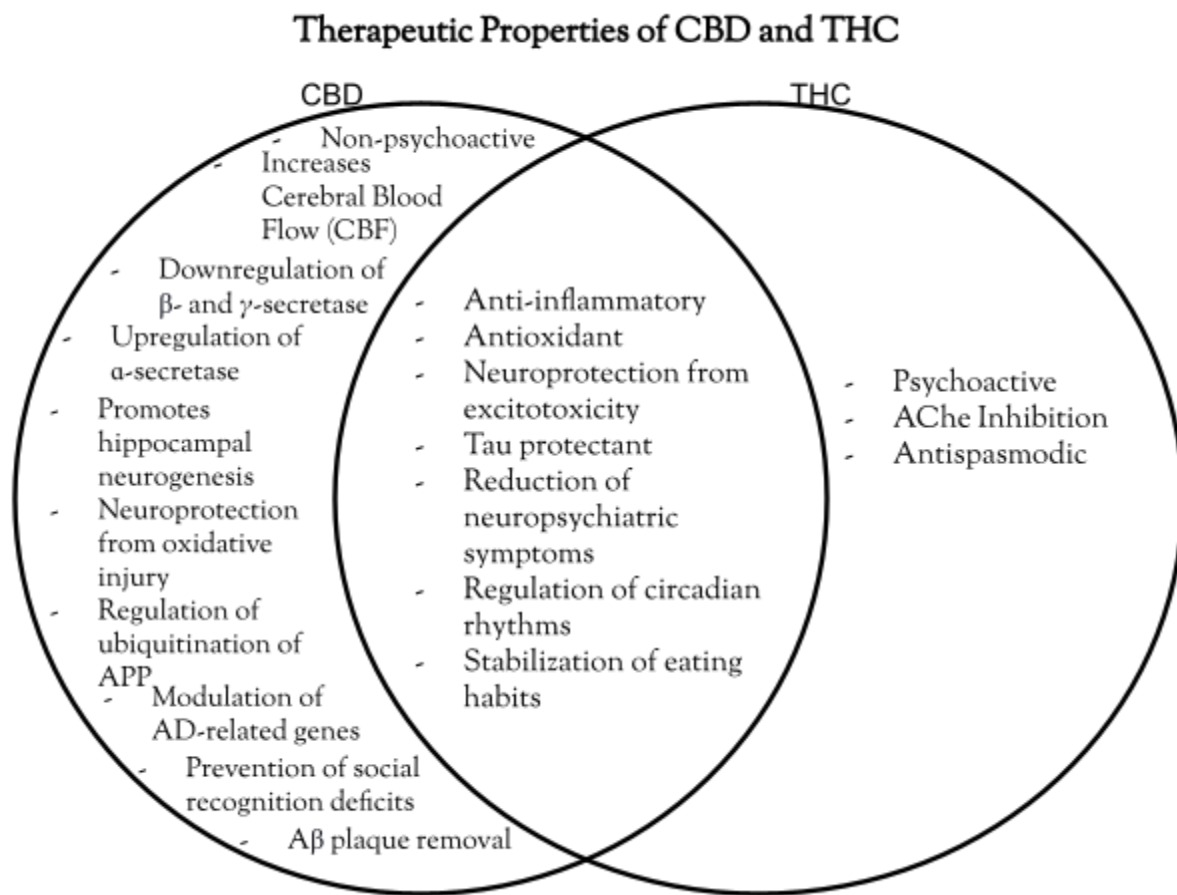
1.5 New Drugs

Finally, another supplemental treatment for AD patients to regulate common symptoms of agitation, sleep, and appetite is orexin (also known as Hypocretin) receptor antagonists. orexin is a neuropeptide directly involved with the bodily systems that control arousal, appetite, and sleep. While it has not been proven that there are statistically significant varying levels of orexin between AD patients and healthy individuals, orexin receptor antagonists have shown some promise in treating a specific subset of AD symptoms (Raïch et al.). However, this being a relatively new treatment, more research is needed to further confirm these findings.

All the drugs listed above have one primary attribute: none address the root cause of AD. These drugs aim to minimize the symptoms, and most of them are largely ineffective at this goal. A drug called Aducanumab, a monoclonal antibody that selectively binds A β plaques, was created to address the underlying cause of AD. This binding marks the A β for removal by one's body's immune system. However, while some clinical trials did show some success, others failed to exemplify effectiveness; thus, this "revolutionary" new drug is surrounded by controversy (Knopman et al.). The drug's approval was expedited by the FDA under uncertain terms in June of 2021, meaning that it was not tested to the extent of previous drugs on the market. Furthermore, the drug has many side effects, such as vision changes, hallucinations, and seizures. Besides strong side effects, the use of this drug is also significantly limited by its exorbitant cost.

While it initially cost more, Biogen has reduced the price to \$56,000 yearly for treatment. This means that in addition to Aducanumab's controversial efficacy and side effects, it is also not accessible to a large portion of the population, especially those without insurance. Considering all this, it is evident that Aducanumab is not yet a viable treatment method for those suffering from AD.

Still, the need for a non-disruptive treatment for AD that can address the A β and Tau plaques effectively remains. In this review, I propose that Cannabinoids such as CBD and THC are ideal candidates to treat AD as they offer several behavioral, neuroprotective, and neuro-regenerative effects that mimic or exceed those of current treatments (Figure 1).



CBD and THC Effects

While there are multiple species of plants in the *Cannabis* family, they all share one thing in common: they all contain over 100 chemicals known as cannabinoids, specifically phytocannabinoids. These phytocannabinoids work by interacting with the endocannabinoid

system (ECS) in our body by binding to endocannabinoid receptors, effectively mimicking endocannabinoids are the neurotransmitters of the ECS. The ECS, while its own distinct system, is interconnected with many other systems in the body. There are two main types of ECS receptors, cannabinoid receptor type 1s (CB1Rs) and cannabinoid receptor type 2s (CB2Rs). CB1 receptors are primarily found on the neurons of the central and peripheral nervous systems, and their primary job is to inhibit neurotransmitter release. The purpose of this is to calm down an individual and reduce stress. Increased anxiety and depressive symptoms are a result of reduced CB1R signaling, indicating that the endocannabinoid system plays an important role in the limbic system, which includes the hippocampus, CB2 receptors, on the other hand, are located mainly on cells of the immune system and in the brain(Steffens et al.). As such, CB2R signaling plays a large role in the immune system, specifically regarding inflammation. It has been shown that the activation of the CB2 receptors not only significantly reduced inflammation but also slowed the progression of diseases associated with chronic inflammation (Steffens et al.). In fact, both CB1 and CB2 receptors are present on microglia, suggesting the potential to reduce A β and Tau plaques in the brains of AD patients (Duffy et al.).

While there are dozens of cannabinoids, this review will mainly focus on the two most prevalent cannabinoids in *Cannabis*: Cannabidiol (CBD) and delta-9-tetrahydrocannabinol (THC). CBD is a non-psychoactive compound with a wide range of pharmacological benefits, including antioxidant and anti-inflammatory properties. Due to the pervasiveness of the ECS in the body, it also has both antianxiety and antidepressant effects and antipsychotic and neuroprotective properties (Fabre and McLendon) (Leweke et al.). THC, on the other hand, is psychoactive yet still has many of the important properties that CBD and other phytocannabinoids have, including anti-inflammatory, antioxidant, and neuroprotective effects (Carroll et al.).

2.1 Behavioral Effects

To start, both cannabinoids have diverse behavioral effects relating to mood, sleep, and eating habits without the negative side effects (Figure 1). This challenges current clinical treatments, which have many negative side effects. Both CBD and THC have been shown in studies to reduce the neuropsychiatric symptoms associated with AD, such as agitation and aggression, as well as other disturbed behaviors (Woodward et al.)(DeFrancesco et al.)(Volicer et

al.). This is most likely because of the ECS's strong association with mood and the limbic system. Cannabinoids can also improve sleep quality by regulating circadian rhythms and stabilizing eating habits through the management of appetite (Antonsdottir et al.). This helps to improve the quality of life for those suffering from AD and their caretakers, a valuable characteristic that gives these cannabinoids potential to compete with current treatments for AD.

2.2 Anti-inflammatory and Neuroprotective Effects

In addition to their distinct impact on behavior, CBD and THC have many anti-inflammatory and neuroprotective effects (Figure 1). These anti-inflammatory properties result from the presence of CB2 receptors in parts of the immune system. CBD and THC, among other cannabinoids, can also reduce neuroinflammation by activating the glial pathway. Furthermore, studies have shown that CBD reduces A β -induced neuroinflammation *in vivo* in mice by inhibiting the production of proinflammatory molecules in the hippocampus (Esposito et al.). This means that CBD may be able to decelerate the progression of AD.

CB1 receptor activation protects neurons in the hippocampus from excitotoxicity, the toxic excitation of neurons, preventing or, at minimum, delaying neuronal death (Abood et al.). Another way that CBD exerts neuroprotective effects is by protecting neurons from oxidative injury (Marsicano et al.) (Hampson et al.). Antioxidant effects also lead to the prevention of reactive oxygen species (ROS)-induced cell death, one of the causes of neuronal death due to A β plaques.

For instance, CBD and THC have both been proven to prevent the hyperphosphorylation of Tau through the receptor-mediated signal transduction Wnt/beta-catenin pathway (Esposito et al.). This ability prevents neuronal death short-term by preventing the Tau from being hyperphosphorylated but also prevents a significant amount of neuronal death long-term by slowing down the development of Tau plaques. Thus far, studies have been conducted in transgenic mice models and *in vitro*; further studies in humans are needed to determine whether CBD and THC may be used to specifically slow AD progression.

CBD also can upregulate the pathways that ubiquitinate APP, resulting in targeting of APP for degradation and, therefore, lower amounts of A β s (Scuderi et al.). CBD further reduces the production of A β s through the upregulation of α -secretase expression, promoting the non-amyloidogenic cleavage of APP. It has also been shown to inhibit both β -secretase and

γ -secretase, reducing the production of A β s (Libro et al.). This shows a multidimensional approach to reducing the amount of A β s in the brains of AD patients, thus slowing the progression of AD.

In addition to these methods of decreasing Tau hyperphosphorylation and A β production, CBD has been shown to be able to modulate the expression of certain AD-linked genes. These include those of *GSK-3 β* , the kinase that is overactivated as a result of A β plaques and is responsible for the hyperphosphorylation of Tau, and β -secretase and γ -secretase, responsible for the production of A β (Libro et al.). These properties further reduce the impact of Tau neurofibrillary tangles on the progression of AD and slow down the detrimental A β s from becoming so pervasive in the brain as AD progresses. In fact, a study has shown that long-term CBD treatment can prevent social recognition deficits from developing *in vivo* (Cheng et al.).

Furthermore, studies have also suggested that THC competitively inhibits AChE, making it, in a sense, a viable AChEI (Eubanks et al.) (Figure 1). This, as mentioned with AChEIs, suggests that THC can slow down the progression of decline in memory formation abilities in AD patients. Moreover, THC specifically has the ability to bind to AChE, inhibiting amyloidogenesis (Eubanks et al.). THC has been shown to inhibit AChE more effectively than other commonly used AChEIs, such as propidium. This more effective inhibition of AChE results in anti-aggregation effects on A β (Eubanks et al.) (Belluti et al.). Such anti-aggregation properties result in slower formation of tangles and senile plaques, which consequently slows down the progression of the disease. These effects are exemplified in a recent study done on APP/PS1 mice suggesting low-dose THC treatment can reduce the aggregation of A β and reduce hyper-phosphorylation of Tau, along with improving spatial memory (Wang et al.).

Taken together, all the positive effects of CBD and THC on AD have been shown to prevent cognitive deficits from occurring. Thus, more studies need to be conducted on CBD and THC to confirm these effects.

2.3 Hippocampal Neurogenesis

CBD has the ability to promote neural regeneration via cell proliferation and increased cerebral blood flow (CBF) while also reducing neuronal death (Schiavon et al.). There is great synaptic loss due to the senile plaques and neurofibrillary tangles that result in cognitive

deterioration. Consequently, this property of CBD is paramount because it can slow down the cognitive deficits from becoming present and slow progression if already present.

First, CBD, in small doses, activates pathways that promote hippocampal neurogenesis, allowing the brain to bounce back against the progression of AD (Schiavon et al.). The other pathway of neural regeneration is CBD-induced increased CBF, specifically in the hippocampus (Schiavon et al.). In a normal AD patient, CBF is reduced by up to nearly 10-28%, which not only can speed up the progression of the disease but is correlated with the cognitive decline experienced by AD patients (Bloomfield et al.). While the cause of CBF in AD patients is still disputed and can possibly vary, when CBF is increased, disease progression can be slowed, and cognitive function can improve. This is backed up by both mouse models and human subjects experiencing cognitive improvements, especially in reaction time and memory (Bloomfield et al.) (Bracko et al.).

CBD can also reduce neuronal death occurring while promoting neural regeneration via binding Peroxisome Proliferator-Activated Receptor- γ (PPAR γ), which is involved in the inflammatory response, which ultimately promotes neurogenesis in the hippocampus. This is achieved via the selective activation of PPAR γ , which decreases the A β -induced depletion of neurons and stimulates the neurogenesis pathways (Janani and Ranjitha Kumari)(Esposito et al.) (Campos et al.). This ability to allow the brain to bounce back against the damage done by A β and tau plaques is invaluable to the treatment of AD. Unfortunately, the current popularly prescribed treatments for AD do not provide this, leaving an opportunity for CBD. Due to their similarities in chemical structure and interaction with CB1 and CB2 receptors, it is possible that THC also possesses some of these abilities, but this has yet to be determined and deserves further study.

2.4 Side Effects

Like the majority of treatments, cannabinoids can occasionally have unwanted side effects. THC is a psychoactive compound; therefore, consuming THC alone may result in an intoxicated and euphoric state. Dependence on THC is a likely result of mid to long-term consumption. For CBD, however, side effects are rare and mild in most cases, and it is not psychoactive (Figure 1). Clinical studies in humans have suggested that the most common side effects are drowsiness, gastrointestinal problems, and weight gain, but diarrhea, irritability, and

fever can be caused by drug-drug interactions (Tzadok et al.). Fortunately, Clozapine, an antipsychotic drug, is the only common AD treatment where drug-drug interactions have been reported with cannabinoids (Zullino et al.).

This study also concluded that high doses of CBD in animal subjects could result in a range of side effects. At a low instance, male reproductive damage, specifically impacts on spermatogenesis, was observed in these high-dose treatments (Rosenkrantz et al.). While this may seem alarming, 95% of all AD cases are late-onset, impacting those over the age of 65, meaning that these individuals would already be far past the average age of reproduction. Even at a low prevalence, this reproductive damage may be a barrier to the treatment of similar diseases where the average patient is much younger in reproductive age; hence further investigation is needed to confirm this negative side effect.

CBD has also been shown to have toxic effects on the liver in patients with autoimmune hepatitis (Rosenkrantz et al.). On the other hand, CBD is not psychoactive and, therefore, will not produce the same intoxication and euphoria. Better, studies have shown that long-term treatment using CBD doesn't result in tolerance to the substance (Hayakawa et al.).

Another concern regarding the safety of cannabinoids relates to their neurotoxicity and respiratory and cardiovascular system impacts (Resstel et al.). Both CBD and THC have been shown to positively impact neurotoxicity in higher doses. But these effects were often avoided in lower to moderate dosing of CBD and THC (Wang et al.).

2.5 THC and CBD Compatibility

Most of the studies cited in this review examine CBD or THC alone for both the potential benefits and possible dangers they possess. However, these cannabinoids have evolved to function together, both augmenting each other's beneficial effects and counteracting each other's negative effects. In fact, one study has shown that CBD and THC activate different parts of the brain alone as opposed to when administered together (Bhattacharyya et al.). While many of the properties of CBD and THC are similar as they are both cannabinoids, they individually present some unique abilities that the other doesn't have (Figure 1). For example, as seen earlier in this section, THC possesses anti-aggregation properties that CBD does not have, while CBD has the ability to increase CBF, an ability that THC does not have. Thus, when THC and CBD's respective abilities are combined, more effective treatment for neurodegenerative diseases such

as AD may be achieved. An example of this is how CBD and THC, when paired together in treatment, reduce microgliosis, inflammation, and learning impairments to a greater degree than the cannabinoids alone (Aso et al.). In addition, CBD and THC together changed the composition of the senile plaques, possibly suggesting further ability to reverse the effects of AD on the brain. This shows how it can be highly beneficial in slowing AD progression to pair the two together in treatment.

When it comes to the main concern of drug dependence and abuse of THC, the risk of this is actually lessened when paired together. THC and CBD have opposite effects on the body, and as a result, CBD has been shown to reduce many side effects of THC, including intoxication and psychotic symptoms, as long as the THC:CBD ratio is appropriate (Dalton et al.)(Englund et al.).

Discussion

3.1 Current Cannabinoid Use and Potential in Tauopathies

The wide range of abilities that these cannabinoids possess make them capable of being treatments for other dementias, neurodegenerative diseases, and even beyond that. One possible application of CBD and THC is in tauopathies, a large group of diseases characterized by the hyperphosphorylation of Tau and their aggregation into plaques and tangles, which result in neuronal death (Ali et al.). The most common forms of tauopathies are categorized as frontotemporal dementias such as Pick's disease, progressive supranuclear palsy, corticobasal degeneration, and argyrophilic grain disease (Kovacs et al.). Similarly to AD, tauopathies do not have many viable treatment options. Since CBD and THC exhibit certain neuroprotective effects, namely the ability to prevent Tau hyperphosphorylation, they could provide to be helpful treatments in patients with tauopathies (Esposito et al.)(Figure 1). Furthermore, CBD can promote neurogenesis and reduce inflammation, which can both be advantageous in treating tauopathies.

As of now, the use of CBD and THC are approved for the treatment of Multiple Sclerosis (MS), a neurodegenerative disorder, and epilepsy. Nabiximols, an oral spray composed mainly of CBD and THC, have been FDA-approved for the treatment of MS. This is because THC has been shown to have the ability to decrease the frequency of spasms and spasticity in patients (Novotna et al.). Due to CBD also having potent antiepileptic effects, oral CBD has been

approved for treating seizures in patients with Dravet syndrome, Lennox-Gastaut syndrome, and Tuberous Sclerosis (Lattanzi et al.).

3.2 Further Neurological Application

A randomized controlled trial has shown promise for CBD when paired with standardized treatments in treating Schizophrenia (McGuire et al.). Specifically, this trial aimed to assess the efficacy of the antipsychotic properties when it came to managing symptoms of Schizophrenia. While the results showed that the amount of positive psychotic symptoms decreased, as did the patients' severity of symptoms, statistically significant results weren't achieved. However, it should be noted that the rate of adverse events was similar between the placebo and experimental groups, suggesting that short-term treatment with CBD may be safe for Schizophrenia patients and deserves further study.

Another possible application of these two cannabinoids is with sleep disorders such as insomnia, sleep apnea, and sleep-related movement disorders. In the form of Nabiximols and Vaporization, CBD and THC have both been shown to positively impact sleep (Figure 1). THC has been shown to increase the amount of NREM when taken in a ratio with little CBD (Mondino et al.). On the other hand, CBD has shown promise in treating REM Sleep Behavior Disorder and excessive daytime sleepiness (Babson et al.). However, the long-term side effects, specifically on sleep disorders, are still unknown. More research is needed to confirm the efficacy of treating these sleep disorders and to explore the possible application of CBD and THC in other sleep disorders.

3.3 Beyond Neurological Conditions

A specific wider application of cannabinoids is with the treatment of Anorexia Nervosa. Studies have shown that THC specifically is helpful when it comes to increasing the appetite of patients suffering from anorexia. Dronabinol, a synthetic version of THC, successfully increased the appetite and slowed down or stopped the weight loss experienced in patients with AIDS (Beal et al.). More research is needed to assess the application of THC beyond Anorexia Nervosa and the eating disorders associated with AIDS.

Even if CBD and THC do not address the root cause of these diseases, these cannabinoids' anxiolytic properties, antiemetic properties, and ability to reduce chronic pain can

be used to improve the quality of life of patients and relieve side effects of their respective conditions (Schiavon et al.)(Rock et al.)(Boehnke et al.). In fact, medical cannabis is used in patients undergoing chemotherapy due to its ability to reduce chronic pain and reduce nausea (Rock et al.) (Boehnke et al.). This means that there can possibly be a wider application beyond these specific conditions listed, even if the minimum CBD and THC increase patients' comfort.

3.4 Future Areas of Research for CBD and THC

While CBD and THC may have many possible applications, it is important to consider certain factors that may prevent it in treating certain conditions. One such barrier is the possibility of negative drug-drug interaction with the current treatments for other conditions. As CBD is an inhibitor of some cytochrome P450 (CYP) enzymes used in various drugs this can cause enhancement or inhibition of the drug (Nasrin et al.). There are also differing degrees of impact of CBD's inhibition of these enzymes in different drugs, meaning various levels of risk and impact. There is a mild possibility of a negative interaction between Clozapine and CBD in a specific case report in which an individual consuming both CBD and nicotine had a significant increase in Clozapine in the bloodstream, which resulted in hallucinations (Zullino et al.). A probability of severe interaction is with Warfarin, an anticoagulant used in patients with heart disease. In a few case studies, individuals who were consuming both Warfarin and cannabis had internal bleeding, suggesting that CBD and THC are not safe to consume with this drug (Yamreudeewong et al.). A less severe yet still concerning interaction is with Buprenorphine, an opioid analgesic. In this pharmacokinetic interaction, the amount of Buprenorphine dropped in the bloodstream of males only, indicating that these drugs should not be paired together in treatment (Vierke et al.). While the strongest evidence of a negative interaction is with Warfarin, the possibility of other interactions must be investigated with further research. If there is a confirmed reaction between cannabinoids and Clozapine, this may reduce the application of CBD and THC within neurodegenerative diseases such as Schizophrenia. This may be a small but potential obstacle in AD, too, because Clozapine can be prescribed to patients, but there are alternative antipsychotic drugs that do not have this pharmacokinetic interaction.

Another barrier that CBD and THC may face is certain side effects. While most aren't significant, male reproductive damage is concerning. This isn't a problem when it comes to most neurodegenerative diseases, as many of them are late-onset, but for MS, whose primary form is

not late-onset, this can be an issue. However, similarly to AD, women make up the majority of patients with MS, meaning that CBD and THC can still be used, but primarily in female patients. Apart from neurodegenerative diseases, conditions such as Schizophrenia with an earlier onset and a more balanced or male-skewed percentage of patients, may not be viable to treat with cannabinoids due to their side effects. However, further research is necessary to determine the prevalence of this specific possible side effect and to determine these restrictions on the use of CBD and THC in these various conditions.

3.5 Limitations

An important consideration is the relevancy of this research about the properties of Cannabinoids. While cannabinoids have become an increasingly popular and controversial topic in the media recently, the research cited in this review originated from as early as the 1970s. This demonstrates how the use of CBD and THC as medical treatments is something that has been investigated in a scientific setting for decades. However, due to cannabinoids' recent popularity, it has become a topic of controversy. Thus, preconceived notions and personal stances on CBD and THC have proven to be an obstacle to having an objective view of Cannabinoids in the media. Consequently, there are still many social barriers that may hold CBD and THC back from approval.

Conclusion

CBD and THC have shown promise as a multidimensional treatment for AD with behavioral impacts, neuroprotective effects, and the ability to promote hippocampal neurogenesis in various ways. In other words, CBD and THC can be viable treatments but are in no way a “cure-all,” as they do still have a few side effects. It is very important to note that further research must be conducted to fully confirm the efficacy and side effects of this drug and explore previously undiscovered abilities or side effects. They do, however, show promise of having wider applications in the field of medicine in treating a variety of conditions, especially AD.

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Art Museum Trends During the Digital Age By Claire Peden

In recent years, the COVID 19 pandemic has had a large impact on business operations in both the major and minor industries, leaving 41.3% of businesses temporarily closed (Bartik et al.). Due to the lockdowns required because of the prevalent health risks of the pandemic, non-essential businesses have suffered as people lose access to in store options. While incomes dropped and jobs were lost because of the economic downturn from businesses no longer being able to function to their full potential, people's ability to spend money on non-essential items decreased as necessities such as groceries were prioritized. This prioritization in conjunction with the aforementioned lockdowns of many stores caused the pandemic to impact non-essential businesses the most.

One such non essential area of interest is art. While art is generally considered a normal good, meaning its demand is directly correlated to consumers' income, the demand for art decreased greatly during the midst of the pandemic when the total income across the country dipped more suddenly than it has in the past 30 years (Bartik et al.). Conversely, due to the loss of jobs and peoples' inability to leave the house frequently, art enthusiasts experienced a great increase in free time in 2020. In response to both of these trends, major art museums such as the Dallas Museum of Art (DMA), the Los Angeles County Museum of Art (LACMA), and the New York Museum of Modern Art (MoMA) began to offer online options for viewing art, allowing consumers to continue to enjoy art even with the geological and health related restrictions previously preventing them from doing so. However, with this shift towards technology that was encouraged by the COVID 19 pandemic, people have continued to use these online options despite art museums reopening because of the easy access of clicking on a website rather than driving to a museum. This could simulate a continued COVID as the issues financially harming museums, lack of attendance, continue even after forced closures are lifted.

While government grants were offered to art museums and many other struggling businesses due to the economic impact of the pandemic, many programs intended to support businesses affected by the pandemic ceased to provide support shortly after 2020. With a continued dip in attendance and a discontinuation of grants needed in order to offset the financial issues related to attendance changes, art museums could continue to suffer in the coming years, marking 2020 as a turning point in the art world. This issue could have a huge impact on the arts

industry and other, similar non essential industries in future years and it is therefore incredibly important to determine the true impact of this technological shift brought about by COVID 19, leading me to question “To what extent did the increase of attendance at virtual tours since 2019 due to the COVID 19 lockdown cause the decline in success of prominent art museums in the US?” Any conclusion drawn from this research could predict the fate of art museums, determining whether they have a chance of survival in this technology based society of the future.

Literature Review

In the past 30 years, professionals have begun to heavily rely on technological information (Vogel, 4). Because of this shift, art enthusiasts are using digital platforms to observe and interact with art at an increasing rate due to technology’s ability to provide “efficiency and accessibility of information to users while helping them overcome the impediments of physical galleries” (Lee, 4). Suzanna Simor notices these trends, highlighting how technology allows for bypasses to obstacles such as time, access, and geography. Furthermore, with the start of the COVID 19 pandemic, accessing museums in person became much more difficult, if not impossible, due to country wide shutdowns. In response to this, popular museums have started to offer virtual tours on their websites, allowing users to enjoy art without geographical or health restrictions that deter people from visiting exhibits (DMA). However, with the increase in the number of free virtual tour options, in person museum attendance could be affected, potentially causing an impact in museum profit in the long term, as many popular museums gain a large portion of their revenue through ticket sales (MoMA).

The trends in art gallery attendance and success in relation to the start of the COVID 19 pandemic can be clearly outlined over the years by looking at Dallas Museum of Art’s annual reports of attendance and participation from the past decade. In 2008, the annual attendance reached nearly 650,000 people and grew to an impressive 800,000 in 2019. Similarly, Carl Loeffler reports a great increase in the use of technology to communicate about art over the past decade through online art platforms. In the context of an increase in attendance at art museums, these trends imply a correlation between use of technology in relation to the art community and general interest in museums. Nevertheless, the DMA reports a great decrease in attendance for the 2020 to 2021 fiscal year, the numbers dropping to just over 80,000 in person and virtual

visitors. Similarly, the New York Museum of Modern Art's attendance dropped from over 3 million to just over 700,000 visitors in 2021 and the Art Institute of Chicago's attendance dropped from 1.76 million to 365,000 from 2016 to 2020. These numbers are understood in the context of the restrictions put in place due to COVID 19 in 2020 prohibiting people from attending large events. Many museums' solution to this inability to attend exhibits in person has been offering online resources for observing art, such as virtual tour options that each aforementioned museum offers. This represents a much more significant shift in the way art is interacted with, these previously established technological shifts solidifying the trend towards virtual tours that museums are experiencing. However, a more permanent shift to online art resources could present a financial issue for museums and galleries.

Although museums lost a large amount of revenue during the first year of the COVID 19 shutdown, they were receiving government subsidized grants to make up for much of their lost revenue. Even still, while the DMA received a sizable government grant in 2021 of \$637,000 due to the pandemic related lockdown, causing their net assets to increase by \$57,000, this is a one year anomaly that will not support them financially in the long run. Museums and galleries across the country have been awarded similar grants that will likely not make up for the financial loss in the coming years due to the shift away from in person attendance at art museums. This could have a huge impact on the success of art museums if the current technological trends perpetuate, discouraging attendance at museums as the benefits of virtual options continue to outweigh the drawbacks for the consumer.

Evidence Gap

When attempting to analyze the success of art galleries in relation to the increasingly prevalent reliance on technology due to COVID 19, an evidence gap is realized. Price sets up the idea that online art options are becoming more popular and will continue to grow in popularity, allowing greater access to art resources and encouraging greater involvement in the online art community. This is put into the context of art museums by Shaw's assertion that, as art gathers a larger audience, attendance at large scale gallery events increases, implying greater success of art museums with the rise of technological awareness. Museum websites such as the Dallas Museum of Art corroborate this assertion by providing financial statements that highlight success congruent to what is predicted. However, this financial success is due to government grants

awarded to the museum after the COVID 19 pandemic due to their forced closure and does not accurately portray their success when taking into consideration the revenue from museum visitors they have lost. In fact, attendance numbers and the subsequent ticket revenue have greatly decreased, making it difficult to determine the true financial impact of this closure on museums as the decrease in attendance is a long term issue while the government grants are a short term solution. Overall, the issue regarding COVID 19's impact on art museum success must be explored further in order to fill this identified evidence gap.

Methodology

In order to answer the research question “To what extent did the increase of attendance at virtual tours since 2019 due to the COVID 19 lockdown cause the decline in success of prominent art museums in the US?”, a correlational research method was used to collect and analyze the data. The main part of said method was to collect data for the Dallas Museum of Art, the Museum of Modern Art in New York, and the Los Angeles County Museum of Art since 2018. These museums were chosen because they represent various locations around the United States, allowing for more generalizable data. They are also all large scale, popular museums so the effect of COVID 19 on each of them should be similar. Methods similar to this have been used previously in existing literature in this field. Sarah Skinner, in “Art Museum Attendance, Public Funding, and the Business Cycle,” used a correlational research method analyzing how museum attendance compared to their funding throughout a fiscal year in an attempt to discover a relationship between the two variables. Similarly, this research focuses on the relationship between funding and attendance, but instead analyzes how revenue is impacted by attendance before, during, and after the COVID 19 lockdown.

Steps Taken

The expectation in the research is that the increase of attendance at virtual tours offered by popular museums since 2020 led to a decrease in income due to ticket sales and financial success of these museums. In order to come to this conclusion, numerous steps were taken during research. The first step in this method was to collect financial data for each museum. By accessing the yearly audited financial statements that each museum is required to provide the public, data was collected for total net income for each year since 2018 and total government

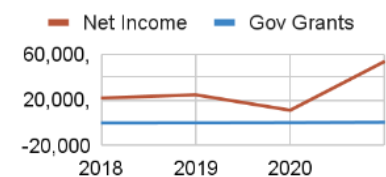
grants offered to each respective museum each year. By subtracting the government grant income from the total income, it was possible to determine the true effect of COVID 19 when government grants are not offered, as many large museums relied on government grants to stay afloat during the pandemic. This data was added to a spreadsheet with a column for money gained due to government grants and total income. Finally, a graph was created from this information, graphing total revenue as well as income due to government grants versus year with time on the x axis, each museum's data on a separate graph.

The next step was to collect attendance data for each museum by accessing the various 'year in review' links that each museum has available on their website. More specifically, a number for fiscal total attendance and fiscal virtual attendance was collected for each museum. These numbers were placed in a spreadsheet with a column for virtual attendance and a column for total attendance. All numbers were organized by year. A graph was also created from this information, recording attendance versus year for each museum with time on the x axis and a separate graph for each museum's data. The graphs of total fiscal revenue and government grants versus year and the graphs of total attendance and virtual attendance versus year were then compared in order to determine a correlation or similarity in the trend noticed in each graph. Any similarities noticed could hint at a correlation between attendance at virtual tours over the years and financial success, answering the research question initially proposed.

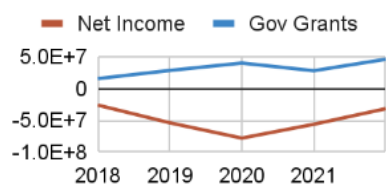
Results--Finances

In order to determine the true impact of COVID 19 on art museums in the United States, a correlational study was conducted. Firstly, financial data from the past five years was collected in order to determine the impact of the pandemic on museums' financial success. By gathering the net income over five years for each museum, it was possible to determine how each museum was affected differently. While the Dallas Museum of Art maintained an increase in income each year with the income dropping to half what was typical in 2020, the Museum of Modern Art has exhibited a negative change in income every year since 2018, with an even worse decrease in income in 2020. However, the pandemic had the

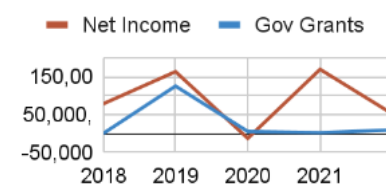
DMA



MoMA



LACMA

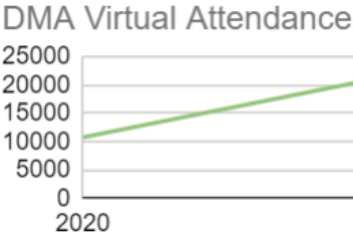


most abnormal impact on the Los Angeles County Museum of Art. While in 2018 to 19 they experienced an exponential increase in net income, reaching \$163,982,954, this number dropped to -\$12,456,911 in 2020, then jumping back up to \$170,030,567 in 2021. This proves that, while the pandemic impacted each museum’s financial success, the LACMA was able to recover financially the quickest.

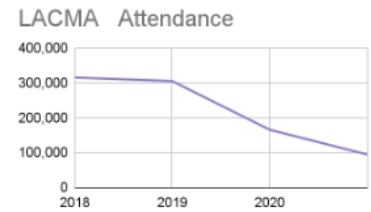
In order to determine why these museums are experiencing these trends or recovering so quickly, it was imperative to look at the government grants awarded to each museum over the past five years. The Dallas Museum of Art experienced the largest increase in government grants in 2020 to 2021, funds jumping from an average of \$48,000 to \$274,861 in 2020 and \$637,000 in 2021. This is reflected in the sharp increase in net income in 2021, as their income becomes twice the typical pre-pandemic income, allowing the DMA to thrive due to the grants, being the only analyzed museum to not lose money despite suffering through a pandemic. But, the government grants offered to the MoMA do not vary greatly due to the pandemic, resulting in a normal dip and gain in income, reaching its lowest point in 2020 and slowly increasing again as the pandemic begins to have less of an impact on the museum. This data provides a control for the other museums, as it is possible to compare the success of museums who are receiving pandemic specific funding to a museum who is not, allowing it to be possible to determine the importance of government grants for museum success. Similarly, the LACMA did not receive pandemic specific grants; however, they received a large grant in 2019 that likely allowed them to recover from the pandemic quicker than other museums. Overall, government grants have proved to have a large impact on art museum success, as those who received large grants were least impacted by the pandemic.

Attendance

It is important to analyze attendance for each museum over the past five years in order to determine how lasting the effect of the pandemic will be on these museums. With each museum beginning to offer virtual tours because of the pandemic related closures, people began to choose these opportunities over visiting museums in person, even after COVID 19 restrictions were lifted. The DMA experienced an increase in attendance at virtual tours from 2020 to 2021,



demonstrating how people began to prefer virtual tours more and more as the museums develop these experiences even further. Furthermore, the Los Angeles County Museum of Art experienced a dip in attendance in 2020 and 2021, having a lower attendance number in 2021 than 2020 and both years' attendance being lower than every other year recorded. However, the Dallas Museum of Art did not report total attendance for 2020 to 2022, the Los Angeles County of Museum Art did not report any virtual attendance, and Museum of Modern Art did not report any attendance, so limited graphs were able to be made.



Discussion

COVID 19 had a lasting effect on art museums even after restrictions were lifted and museums reopened. With art museums pushing their virtual tours, they may still experience something similar to the pandemic, as people use virtual options rather than visiting in person, potentially causing another drop in income after grants are no longer available, supporting my hypothesis that the increase of attendance at virtual tours offered by popular museums since 2020 leads to the decrease in income due to ticket sales and financial success of these museums. As each of these museums recovered greatly from the pandemic after receiving government grants, their reliance on this type of funding in situations in which they lose attendance is demonstrated through these graphs. Furthermore, attendance at virtual tours has increased since 2020 in response to the pandemic. Since virtual options have become normalized for museums, these art museums may continue to see a lack of attendance even after the pandemic, potentially causing art museums to suffer financially once again but this time without the COVID 19 related government grants.

With the continued technological shift of the past decade, this shift towards virtual tours could prove more permanent than initially expected by the museums (Vogel, 4). Furthermore, Jin Woo Lee has previously highlighted how art enthusiasts have prioritized virtual options for viewing art through the growth of digital art platforms, detailing how virtual museums allow for easier access to art. In the context of the recent pandemic, easy access to goods and services has become a huge priority for Americans as they have searched for easy ways to find a sense of normalcy via technology as the pandemic related restrictions prevented many from leaving their

homes. This represents a much more significant shift in the way art is interacted with, these previously established technological shifts solidifying the trend towards virtual tours that museums are experiencing. However, this more permanent shift to online art resources will likely present a financial issue for museums and galleries as the success of virtual tours discourages attendance at museums and the benefits of virtual options continue to outweigh the drawbacks for the consumer. Furthermore, with the shift towards virtual tours, in person attendance is not likely to increase greatly. With the dip in attendance being the main cause of the decline in financial success of art museums, museums may struggle even more, as they deal with the same issue again but this time without the assistance of government grants.

Limitations

It is difficult to definitively determine the impact of virtual tours on all museums. While the data from the DMA, MoMA, and LACMA should be generalizable for other museums that operate similarly, the impact that the pandemic had on each museum financially varied greatly, even though a similar conclusion was able to be made from each data set. While the DMA demonstrated a quick recovery from the pandemic after government grants increased, the government grants that they received were still such a small percentage of their net fiscal income that it may be difficult to attribute their quick recovery solely to the increase in grants. Furthermore, the LACMA did not receive any significant grants due to the pandemic. However, they did receive a significant grant of \$125 million the year before which could have allowed them to recover so quickly from the pandemic. Even still, without knowing what they used the grant money for, it would be difficult to attribute this to their recovery as well. Because the research relied so much on this data, this limitation puts the reliability of the findings into question. However, other research methods would have the same issue as the source of the limitation is the data which is difficult to interpret and it is still possible to come to the conclusion that a second dip in attendance similar to that during the pandemic could cause another dip in income similar to that during the pandemic without relying on specific government grant data as this conclusion relies more heavily on total attendance and net income. Furthermore, with the limited data available on attendance for any of the analyzed museums, drawing conclusions from the data that was collected was slightly more difficult. Even still,

attendance data is more easily generalizable for other museums or businesses as all museums were impacted by the same pandemic related closures that caused the dip in attendance.

Implications

This research could have a huge impact on the art community, specifically those interested in the success of art museums. As art museums are currently still developing their virtual tour options, making them an even more feasible option for potential museum visitors, these museums are likely not considering the possible long term effects of an increase in virtual tour attendance and the possibility of a future financial crisis similar to that experienced during the pandemic is even more likely. With an understanding of how virtual tours might affect museums in the long run, it would be possible for museums to adjust their actions accordingly in order to account for the possibility of a drastic drop in net income due to virtual tour use.

It is difficult to definitely predict what may occur in the future based on this data due to its limitations. Even still, with the shift towards technological resources, it can safely be said that virtual tours will continue to be used often by consumers and many people will still prefer virtual tours over visiting art museums in person. The data concerning the increase in virtual tour use also acts as a forecast for future changes in technology use, especially for those using online platforms to view art at an increasing rate. As a great increase in technology use was noticed in the art community during and after the pandemic, 2020 is affirmed as a turning point in technological use, solidifying the detrimental lasting impact that COVID 19 will have in the future if a change is not made by art museums.

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Flower Power: A Correlational Analysis of How Plants Affect Academic Performance By Kavya Shah

Abstract

Plants and natural landscapes have long been observed to have positive effects on both mental and physical health, yet the topic of how plants affect academic performance, while just as crucial, is much less explored. This study aims to further investigate this population gap and understand how high school students can be affected by plants and green spaces in their academic environment. This paper elucidates on how high school students may respond to plants differently than other age groups and explains how specific aspects of greenery, such as distance to windows, may affect scores more than others. The goal of this study is to provide a broader understanding of how plants and green spaces affect academic performance and it could be a helpful starting point for future research involving high school students' academic performance in relation to greenery.

Plants and their various benefits are a well explored topic. The mental health benefits of interacting with plants (Lee et al, 21), the physical benefits of taking a daily stroll in a park (Dadvand et al, 1329), and even the productivity benefit of plants in workplaces (An et al) are all slowly making their way into the limelight. However, the benefits of plants and greenery range far past simple health and efficiency benefits, even encroaching into the territory of academics, namely academic performance. Many studies have shown that plants, as well as windows outlooking nature, cause improved concentration and attention span (Oh et al, 796), to such an extent that they positively impact academic performance and even test scores (Browning & Rigolon, 429). Yet, despite these various benefits, most of the current research in the field focuses on elementary school or college students, with little attention given to high school students.

Moreover, most of the studies on academic performance look into greenery seen through windows, not plants within the classroom (Browning & Rigolon, 429). As implementing windows into the classroom is difficult when schools are already built, if plants could provide the same benefits as windows, that would create an easy method to improve students' academic performance as well as improvements in mental and physical health (James et al., 131). To discover more about the possible benefits of plants in the classroom, this paper focuses on the

question, “To what extent can the presence of plants in high school classrooms replace the benefits of increased academic performance that viewing green spaces provides?” In doing so, the paper delves into the different aspects of academic performance and test scores that both greenery and plants affect and the differences and similarities in those changes.

Literature Review

The EPA (Environmental Protection Agency) defines Green Space as “land that is partly or completely covered with grass, trees, shrubs, or other vegetation.” This definition encompasses parks, community gardens and cemeteries. Green space is often positively associated with physical activity, feelings of safety, and stress reduction, and has many associated benefits in all aspects of human life (Hartig et al., 208). The definition for green spaces is very broad, meaning that greenery often looks different. Green spaces can be well-maintained like lawns or fields, or they can be completely natural such as large expanses of trees and shrubs. As a result, green spaces can often have different effects depending on what type of greenness is present, especially in terms of academic performance (Matsuoka, 273).

Overall Benefits of Green Spaces

It has been a widely accepted fact that plants and interactions with greenspaces do impact human health (James et al, 131), however the different specific aspects of health that are impacted most have been debated with varying amounts of information.

From health benefits to workplace satisfaction, green spaces affect a wide range of factors which impact all aspects of human life. One such aspect of health that green spaces can affect is stress as Coleman and Mattson (137) and Thompson et al. (221) both found through different methods of investigation that green spaces could reduce stress levels and thus advocate for increased interaction with green spaces in our daily lives. Furthering on different aspects of health that green spaces affect, Davand et al. (1329) explain with their research that parks have a greater impact on asthma, while surrounding greenness instead has a greater impact on obesity and excessive screen time. James et al. (134) similarly found that greenness impacts many aspects of health, helping prevent adverse mental health outcomes, cardiovascular disease, and mortality because greenness, physical activity, and mental health all have a strong positive correlation. Nutsford et al (1006)’s study corroborates with James as they also found that increased access to green spaces in urban areas has a positive impact on mental health, helping

reduce and prevent anxiety and mood disorders. Kuo and Taylor (1580) built on these multitudes of benefits by studying the impact of interaction with the outdoors on ADHD on children and found that green outdoor settings seem to reduce ADHD symptoms across a broad group of children.

Plants can also have positive impacts not just on health but only on productivity. An et al. found that natural elements such as plants and sunlight related positivity to job satisfaction and organizational commitment, and negatively to depressed mood and anxiety. Fjeld (46) similarly found that the presence of foliage plants improves the indoor environment as they help increase productivity, work satisfaction, and even reduce sick-leave absence from workplaces.

Academic Performance

A less commonly researched aspect of our lives that interaction with nature affects is academic performance, specifically the academic performance of high school students (Markevych et al, 71). Overall, most studies conducted on this topic, concluded that greenspaces do have a positive correlation with academic performance, however the extent of this relationship and how different types of greenery, landscaped or natural, affect it differently are still being debated (Browning and Rigolon, 149).

Li and Sullivan (149) studied the association between tree cover density in school surroundings and school-level academic performance of public high schools in Illinois, US and found that students with a green window view not only scored significantly higher on tests of attention but also recovered significantly faster from a stressful experience than their classmates in rooms without views to green spaces. Matsuoka (273) similarly concluded that views with greater quantities of trees are positively associated with standardized test scores, graduation rates, number of students planning to attend a four-year college, and fewer occurrences of criminal behavior. However, Matsuoka takes this a step further and narrows down the types of greenspaces that actually benefit high school students, arguing that natural features such as areas with trees benefit students, however landscaped areas, despite being “green”, such as turfs and fields actually harm academic performance. This observation was backed up by Kweon et al. (35) whose study found that schools with more trees had higher academic performance, however “large expanses of featureless landscapes” such as lawns and athletic fields harm performance. Taken in conjunction their findings imply that while windows with views should be implemented, it is important to consider what the view is of as that can also impact performance

in many ways. Hodson and Sander (16) expand on this idea even further as they found that while trees continue to benefit students' academic performance, other natural features such as vegetated land covers and water bodies didn't impact scores. However, unlike the featureless areas in Kweon et al. and Matsuoka's research, these other vegetated landscapes didn't harm academic performance. Comparatively Markevych et al. (71) advocate for increased research as they didn't find any beneficial associations in their studies in Munich and Wesel, though they also didn't find any negative associations either, further indicating that differences in the types of greenspaces could also affect the impact they have on academic performance.

Aside from green spaces outside of schools, plants in classrooms can also have a positive impact on students. Lee et al. (21) found that interactions with indoor plants could reduce physiological and psychological stress in college students more than simple computer tasks. Moreover, in terms of academic performance, Doxey et al. (384) found that interior plants have a strong positive correlation with course performance in college students and through their study they concluded that interior plants could be a suitable alternative to windows. They determined this as students testing in rooms with plants and no windows experienced a similar increase in test scores and course evaluation as students testing in rooms with windows. Similarly, Oh et al. (796) also concluded that viewing living plants correlated with improvements in elementary school students' attention and concentration, demonstrating how plants could have academic benefits for many age groups. Fjeld (46) observed the effect of foliage plants and fluorescent lamps in three different work environments: an office building, an X-ray department in a Norwegian hospital, and a junior high school. In all three locations the presence of foliage plants helped reduce neuropsychological symptoms such as fatigue and headaches. Overall, these sources imply that interactions with plants are just as important and beneficial as viewing green spaces and that even small interactions or simply viewing plants can make a significant impact on academic performance. Plants are much easier to integrate into classrooms that currently don't have windows instead of rebuilding and if they could provide similar benefits for high school students, it could drastically impact not only their test scores but their overall academic performance as well with minimal effort on the part of teachers or students.

Research Gap

Previous research on the impact of interaction with green spaces and indoor plants, have focused primarily on elementary schools and workplaces, while very few studies have been

conducted on high school students, signifying a population gap in the research on this topic (Browning & Rigolon, 429). Due to the lack of research studies on high school students and the impact that interaction with green spaces can have on their academic performance, there is a need for increased inquiry. High school is a crucial and pivotal time in growth and academics and there is room for an increase in exposure to green spaces in high schools (Matsuoka, 273), thus an investigation of this group is important because of the positive impact viewing green spaces can have on students' academic performance and concentration, affecting how high school students interact inside and outside their classrooms and how their future will be shaped. And understanding how plants could possibly provide the same benefit without a need for windows, can help schools that cannot be built with windows in each room still provide academic improvement to their students.

Methodology

In order to answer the research question effectively, a true experimental design (Voxco) was implemented to collect quantitative data. The goal of this experiment was to see if green spaces and plants had a significant impact on test scores for high school students and how similar their impact, if any, was. However, because there haven't been many experiments conducted about this subject with a focus on high school students (Browning & Rigolon, 429), many other variables were also accounted for in case of a possible correlation.

Within this experiment, participants answered 11 questions from practice SAT tests in a room with varying amounts of greenery. A practice test for the new digital SAT was pulled from the College Board website and only questions from the Module 1 Reading and Writing section were used in order for the test to be more focused on comprehension and less dependent on previous knowledge. As these tests have not yet been given to students in class as practice, this decreased the probability that the participants had taken the test previously. Moreover, because the practice tests are formatted in level of difficulty, all the tests taken by the participant were determined to be the same level of difficulty. In order to analyze the data in an objective manner only quantitative data was collected and analyzed.

This method was based on Doxey's experiment (Doxey et al, 384) in that it looked for how effectively the presence of plants in a classroom could replace the benefit of viewing greenspaces. However, this research was different to Doxey's as it focused on high school

students not college students, had a much smaller pool of participants, and took place over a much shorter time period. Therefore this study focused only on test scores instead of overall course performance or evaluation.

Hypothesis

After looking over previous studies relating to plants and academic performance, the initial hypothesis formed was that high school students testing in a room with living plants will have a similar increase in scores as they would testing in a room with views of green spaces compared to their test scores in a room without any greenery. This was hypothesized as greenery improves concentration, attention, and overall well being, which are all factors that can improve test scores (Oh et Al, 796).

There are multiple studies that have researched the impact of plants on health and academics. Doxey et al (384) was particularly influential in this hypothesis as in that study, they measured college students' academic performance in rooms with plants and discovered that live plants in the classroom could replace the benefit of windows on academic performance. Despite looking at similar variables, due to the shorter time period and smaller subject pool, while a similar result may be found, the statistically significant difference would be much smaller, if there at all. Moreover, because many studies had mixed results, namely Doxey et al (384), Browning and Rigolon (429) and Matsuoka (273), while there might be a statistically significant difference, it would be very small considering the number of variables in this study.

Participants and Exposure to Greenery

The participants are all students at a DFW 9-12 high school. All the participants are highly gifted students who all had similar levels of exposure to SAT testing due to the Gifted and Talented (GT) program at the high school. Thus, their test scores are comparable and external factors such as previous exposure or different learning styles would not significantly affect the difference in scores. In order to recruit participants posters were put out in GT and AP classrooms as well as in the school's GT newsletter. Volunteer hours were offered in order to gather participants, which could have affected the sample population and generalizability of the results, however it would not affect the correlations or results collected (Johnson).

Participants took three tests of similar difficulty on three different days in varying levels of greenery. They took the practice SAT tests in the same room throughout the experiment to ensure that any elements of the environment, aside from greenery, were not changed. Students

also took all three of their tests at the same time each day, directly after school, to control for any changes in concentration and fatigue throughout the day. The three different environments were no greenery, windows, and plants. No greenery meant curtained off windows, no plants, and no other way to see natural elements in the room, but the rest of the room remained the same.

Windows in this experiment meant that the curtains were removed from the two neighboring windows which showed views of natural features including trees, bushes, and grass, but no plants or natural elements were present within the room itself. A classroom with windows outlooking natural features was chosen due to Kweon et al.'s (35) and Matsuoka's (273) study which found that natural features improve test scores, but landscaped areas do not. The windows which looked out into green spaces were 82.5" by 24" and 85" by 26", resulting in a total area of 4190 in² or 29.1 ft². The distance from the windows to each desk that students were testing on was measured as well in case any correlation could be found.

Plants meant that the windows were curtained off so participants could not see outside, however, there were five plants of varying sizes spread throughout the room (see Fig 1). The distance from each desk to all the plants visible at that location was measured and recorded. Different sizes of plants were used because of availability and to look for possible correlations between size.

Recording Data During Testing

Each student randomly selected a letter before their first test. This letter was written in place of their names on the test and was a way to reduce bias as the test scores could not be associated with the student participants. Using the same letter each time ensured that the students' tests could be measured against their own scores and outliers could be singled out.

Every day of testing students were given a list of information to write on their tests. The test number was already written on each test, but the students had to add the date, their table number, letter, and time remaining after they finished testing. Having the date helped determine what environment each test was taken in without alerting the students of that. The distances to each table number were previously recorded, so by including their table number, the distances could later be associated with each test. Including the time remaining acted as insurance to see if plants impact something besides just test score, because increased attention and concentration could also impact things like speed (Oh et al., 796).

Other factors were also recorded about the testing environment aside from what students wrote on their test to control for external variables. This included the number of students testing in the room, the amount of people in the room in total, the weather conditions when the window was visible, and any notes about testing speed and the actions of participants. Participants' names were also recorded separately on a spreadsheet for attendance in order to award volunteer hours, however their names were not associated with any of the tests in any way.

Analysis

The analysis looked into not only the main difference in test scores between the different settings but also the impact that the distance to windows and plants had on individual test scores, in order to determine if other variables impacted test scores more than overall environment.

In order to determine the impact on test scores that the different testing environments had, the average and median test scores for each group were calculated and then the percent difference from from the plant and window groups to the control of no greenery were compared to look for statistical significance.

The main analysis conducted was a correlational analysis. This was used to determine the effects of the other variables measured in the experiment. This test was done using the formula displayed in Fig 2 below (Johnson). In the equation, r is the correlation coefficient, n is the sample size and x and y are the two variables being compared. The closer r is to 1 the stronger its positive correlation is and the closer r is to -1 stronger its negative correlation is. As r approaches 0 the correlation becomes weaker (Bhandari).

$$r = \frac{n \times (\sum(X, Y) - (\sum(X) \times \sum(Y)))}{\sqrt{(n \times \sum(X^2) - \sum(X)^2) \times (n \times \sum(Y^2) - \sum(Y)^2)}}$$

Fig 2: Equation for the correlation coefficient

A correlation coefficient was found for the relationship between the distance to the windows and test scores. Another correlational analysis was conducted between test scores and average distance to visible plants. The last variable measured was the number of plants visible to the student and the correlation between that and test scores. All of these correlation coefficients were used to determine the extent to which plants and greenery affected test scores in more specific ways than simply the testing room.

Results

Three different aspects of the experiment were analyzed in order to form a conclusion. To see the difference between test scores in the three different environments, the average test scores for each environment were calculated. Then to quantify this, the percent difference from the control (no greenery) to both the windows tests and the plants tests were found.

Table 1

Test Scores Amongst Different Testing Environments

	No Greenery	Windows	Plants
Average Test Scores	10.18181818	9.454545455	9.454545455
Median Test Scores	10	10	10
Point difference to control:		0.7272727273	0.7272727273
% Difference For Average		7.407407407	7.407407407
% Difference For Median		0	0

The average test scores for the windows and plant settings were both the same, making the percent difference a 7.4% decrease for both groups, less than a point decrease in an 11 question test. Because there was one outlier in test scores which skewed the average unproportionally, the median was a better indication of the impact of greenery. The median test scores were the same in all three test groups, indicating that the three testing groups in this experiment did not produce a significant difference in test scores.

Table 2

Correlation between Distance to Windows and Test Scores

	Test Score (Windows)	Distance to Windows (inches)
Average Test Score	9.454545455	Correlation
		-0.7193831049

A correlation analysis (Johnson) was calculated between the test scores in the setting with windows overlooking green spaces and the distance to those windows. This test found the

correlation coefficient R to be -0.72. The closer the R value is to -1 the stronger the negative correlation is (Bhandari), indicating that there is a strong negative correlation between the distance to the windows a student was and their test scores. Suggesting that in this experiment, the closer students were to windows, the higher their tests scores were.

Table 3

Correlation between Distance to Plants and Test Scores

	Test Score (Plants)	Average Distance to Plants (inches)
Average Test Score	9.454545455	Correlation -0.2018533706

A similar correlational test was conducted for the plant setting with the average distance to the plants visible for each student. While there was a negative correlation, it was -.2 which is very close to 0, indicating a weak negative correlation between distance to plants and test scores. This suggests that generally students who sat closer to plants scored higher than those sitting further away, but not by a significant amount and not consistently for the entire sample.

Table 4

Correlation between Plants Visible and Test Scores

	Test Score (Plants)	Number of Plants Visible
Average Test Score	9.454545455	Correlation -0.6507936508

Another correlational test was run to find the relationship between the number of plants visible to each student and their test scores. A relatively strong negative correlation of .65 was found. This indicates that the more plants a student could see from their desk, the lower their test scores were compared to students who could see less plants.

Discussions

Conclusion

This experiment found that the relationship between plants and academic performance is much more complex than previously thought and that high schoolers may be affected by greenery in different ways than elementary or college students. This study seems to suggest that the closer a student is to plants and windows, the better their test score. However in terms of changes in test scores between a room with no greenery and a greenery, whether that be windows

or plants, no significant difference could be found, which is in opposition to the initial hypothesis. Because of the levels of nuance to this research and the small sample size used in this experiment, further research is essential in order to fully understand how greenery affects academic performance for high schoolers.

These findings align with those of Browning and Rigolon (429) as their literature review concluded that there was sufficient evidence about the positive effects of green spaces on academic performance to warrant further research. Similarly this experiment found that certain aspects of greenspaces, like proximity to a window, had a statistically significant relationship, however other aspects like the difference between windows or no windows, did not. Thus, this experiment also concluded that further research would be beneficial to better understand those relationships.

However, these findings also conflicted with many previous studies as well, indicating a need for more research into various aspects of how green spaces and plants affect academics. For example, in the experiment conducted by Doxey et al (384), they found that testing in rooms with windows and plants both benefited students' academic performance and course evaluation to a similar extent. However, in this study, while there was no difference between the scores with plants and windows, there was also no improvement or change in scores, contrasting with Doxey's experiment. This indicates that high school students may respond to green spaces and plants differently than college students.

Similarly, when comparing the results from this experiment to Oh's (796), there is an indication that high schoolers may behave differently than elementary students as well. Oh's study found that plants improved concentration and attention in elementary schools, which are factors in improving test scores. This experiment similarly found that proximity to plants did somewhat relate to an increase in score, however, in opposition to Oh's experiment, this study suggested that the number of plants visible had a negative correlation with test scores, implying that more plants actually harmed students' concentration and attention. Thus more research into how plants affect different age groups is crucial to understanding why the findings in this study differed from Doxey (384) and Oh's (796).

This experiment did correspond with a study conducted by Matsuoka (273). That study found that academic performance, including test scores were improved when looking at natural features, such as trees. While there was no significant difference in average or median test scores

from the two environments, despite the windows in this experiment also looking into natural features, there was still a significant correlation to distance to the window. Students who were sitting closer to the windows were able to view the natural features outside better, and students who sat closer to windows scored better on their tests, indicating that viewing natural green spaces can have a positive effect on test scores, corroborating with Matsuoka's study. However, as there were many variables all tested in the same round of experimentation, more studies would have been conducted to truly signify this relationship.

In terms of the initial hypothesis, while the experiment did find many avenues for future research, it disproved the initial hypothesis as it found no significant correlation between plants or green spaces and improvements in test scores. However, it did find similar changes in both, implying that these factors have a similar effect, but more research is needed in order to properly understand the relationship between those variables and other aspects of greenery.

Limitations

Aside from the small sample size and population, there were a few limitations that arose during the research process which were not previously considered. The most prominent of those being that students were allowed to choose where they sat. Studies have found that students who are higher achievers tend to sit near the front of the classroom (Wallace). In the classroom used, the windows were at the front of the classroom and less of the plants were visible when sitting in the front, so allowing students to choose their spots could have skewed the results in favor of the correlations seen in the study. Another major factor that could have influenced the change in scores is that participants were allowed to leave at any time. Despite having a 15 minute time limit, students often left earlier, which wasn't something that was anticipated when planning. As a result, after the first test when they realized they were allowed to leave, students might have rushed in order to leave, skewing the results. This factor may have been somewhat hindered by the fact that there was no clock or timer displayed for students, instead the timer was on a phone at the front and could only be seen when the students finished their test and came up to write down the time remaining, however that variable could have its own effects. As a result of these factors, more tests conducted in different, more controlled settings would be beneficial to determining what changes were truly a result of greenery and only greenery. Moreover, as all the participants were GT students, it would be difficult to properly generalize these findings to all high school students without more tests with a broader sample population.

Implications

While this experiment did not indicate that greenery or plants in a room improved test scores, it did suggest that distance to greenery can affect scores and highlights the nuance to the relationship between greenery and academic performance in high schoolers. This knowledge and the benefits of green spaces noted in other studies (Browning & Rigolon, 429) would have major impacts for schools. Not only would this affect the future design of schools to incorporate more windows but also if plants had a similar benefit than that would provide a simple method of improving academic performance for schools that have already been built with little access to green spaces. More tests and research would need to be conducted in order to find this correlation to be statistically significant, however, if it is true that would help high schoolers around the world.

Future research could look further into the impact of distance to plants and greenspaces as that was a relationship with a strong correlation in this experiment, yet the limitation of allowing students to choose what spots they sit in could have affected this. Thus future experiments where such variables are controlled for would be extremely beneficial in determining a relationship between windows and test scores, better helping teachers how classroom organization could help or harm students. Furthermore, if more long term studies such as Doxey et al's (384) were conducted in terms of high school students that would provide more concrete and generalizable findings of the relationship between green spaces, plants and academic performance. Another aspect of this experiment that was eye opening was the difference between distance to plants and number of plants visible, as the closer students were to plants the better they did, yet the more plants they saw the worse they did, which was in direct opposition to the current research in the field (Oh et al, 796), so looking more closely at those factors would help broaden the understanding of the impact of plants on performance and how to properly implement plants into classrooms.

Understanding that greenery can affect academic performance is essential to realizing what students' need to succeed in classrooms, and can influence future designs for schools. The fact that something as simple as a plant or windows could make all the difference in a students' academic life is a crucial step in furthering high school education and benefiting students all around America, making future research essential.

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Press Any Key to Continue: Experiences of Parser-Based Interactive Fiction, Narrative, and Mystery by Yiyi Ding

Abstract

This paper examines the reader's experiences and how they are affected by interactivity in the medium of parser-based interactive fiction. Parser-based interactive fiction, a kind of text game that can introduce a simple level of interactivity with readers and a text, often presents narratives common to literature. Specifically, narratives in the mystery genre can be mirrored to the narrative elements common to those in parser-based interactive fiction. In exploring the experiences of readers in mystery narratives and how they may differ from the addition of interactivity using sentiment analysis and post-questionnaire surveys, asking participants to recount their thoughts about key aspects of the narratives, this paper argues that the medium of parser-based interactive fiction generally may improve reader experiences with aspects of mystery narratives due to a heightened level of engagement felt with the text. Possible benefits of parser-based interactive fiction to reader's experiences implies interactivity in narrative presentations has potential for readers and authors alike.

Introduction

The medium of video games has exploded in popularity in the 21st century, due to advanced technology, allowing complex machinery to not only be in personal computers but also consoles that any consumer can buy. However, even though the major advancements of gaming technology seem to dominate most conversations about games and the "retro" games of the past have depreciated in use, there is one kind of digital game integral to the history of the development of games that still can be highly relevant today.

Parser-based interactive fiction (which will be from here on out abbreviated as parser IF) is a type of text game where players type in natural-language commands to connote an action such as examining or moving to a different area to then let the game's parser system interpret the command to return an appropriate response. For example, if a player typed "look at the book," the computer would parse for the words "look" and "book" and then return a response related to those keywords, like "you looked at the book, which had many pages." This was a popular type

of adventure game in the early era of personal computers but is now mostly a niche genre of indie games, despite having a lot of interesting unexamined qualities.

Although research into how interactive fiction can be analyzed is common, whether it be through narratology, ludology, or a combination of both (Neitzel), this paper aims to treat IF as an extension of literature and focus on the narrativity of it, as the cause and effect structure of parser IF and the lack of strategic or time-sensitive inputs common in games makes it more comparable to literature (Veli-Matti 64). More specifically, because most of parser IF centers around solving mystery puzzles in its gameplay, it will be examined in relation to a narrative of mystery fiction since it translates the best to the medium of parser IF. Through examining how structures of logic shape narrative to aid reader immersion and how the IF reader's experience of narrative could highlight the unique merits of interactivity to a narrative, this paper will explore if and how the structure of parser IF improves the reader's experience.

Literature Review

Understanding how a narrative in traditional-or non-interactive-fiction works is the first step in building future understanding of the way elements of interactivity can modify the way readers experience narrative. The structure of narrative in this kind of linear format can be traced back to the origins of logical structure; in fact, narrativity is connected to logic to a greater extent than the two concepts can operate completely separately (Doxiadis 87). In a similar vein, Roland Barthes and Lionel Duisit suggest that logic is an essential part of narrative, especially in aiding the immersion of the reader. They assert that it isn't necessarily realism that emphasizes the immersive experience but rather a consistent internal logic that informs reader immersion and investment, ultimately stating that narrative "does not make people see... [or] imitate; the passion that may consume us upon reading a novel is not that of a 'vision'... [rather it is the] passion to discover meaning, it is a striving towards a higher order of relation..." (271). These sources agree that narrative is modeled by ideas of logical cause and effect, and having a strong line of logic in a narrative that a reader can follow aids in their personal investment with the story.

These perspectives only take into account a linear narrative, but often in fields looking at interactive fiction as a whole genre, research centers around the IF works that take multilinear approach, or a narrative with multiple paths. There have been studies that show that stories with

multiple endings are rare in traditional fiction, which some suggest is due to a psychologically different way that readers approach linear narrative and non-linear narrative, but multilinear stories with multiple endings are much more common in IF stories as they touch on the game aspect of the genre (Cova and Garcia 110). However, parser IF in particular does not rely on a multilinear structure and often can be a linear narrative that incorporates interactivity. As a consequence of this, research over interactive fiction tends to focus on engagement in the player agency with choice in a multilinear narrative, but the actual element of interactivity by itself as it is present in parser IF has yet to be explored fully, even though it is a medium that directly can provide insight to how the experience of a linear narrative can be changed by interactivity.

Interactivity, Parser, And The Narrative Experience

Knowing the core structures of linear narrative found in traditional fiction and understanding the idea that analysis of parser IF can tackle the intersection of linear narrative and interactivity, it needs to be determined how the incorporation of parser in IF actually does change the narrative experience of a story. Parser-based interactive fiction differs from choice-based interactive fiction, works more akin to “choose your own adventure” books or narrative video games, since most parser IF is built with a set story that cannot be changed by reader choices. Older research closer to the inception of IF, when parser IF was more popular as a medium, suggests that IF can serve as an environment for readers to feel like a co-creator in a work and allow for the perceived idea of action and control, creating a more immersive experience overall (Kelley 56; Campbell 83). The idea was that “although constrained, the user is not “encumbered” ... creativity is amplified, not attenuated, within the confines of the carefully designed environment” (Kelley 59). Even the fact that the reader did not actually have the agency to change anything in a work of parser IF, pushing readers on a fairly linear narrative path with all ideas of “choice” being fairly “inconsequential” in terms of reader involvement in the story (Campbell 83) did not mean the reader could not still feel more in control of the progression of narrative.

More recent interpretations of IF after decades of the genre existing and examined more through art and aesthetic analysis also suggest that readers having personal control over their experience of the narrative particularly in parser IF contributes greatly to changes in experiences of narrativity. For example, in a 2017 journal about visual arts research, it is asserted that through

IF “Any two readers/players might reach the same point via different paths and then diverge to create different stories. Thus, playing the IF game is a unique art experience for each reader/player” (Liao 40). Similarly, this is something that author Marie-Laure Ryan explores in her writing, explaining how IF reflects narrative immersion specifically through the way IF implores readers to exercise their imagination and work in constructing a mental “storyworld” (54), implying that immersion in IF is heightened due to more mental engagement on the reader’s part. With parser in particular, the reader is required to build an understanding of the narrative world they engage with directly and build it themselves, and so the immersive nature of the narrative experience according to prior research is only greater, highlighting the way in which interactivity with parser IF does change narrative experiences even if it doesn’t actually lead to a changing narrative.

Research Gap

Within the field of interactive fiction, there is an emerging knowledge gap in prior research concerning the narrative merits of parser-based IF. The majority of the existing research surrounding parser IF focuses more on deciding if and how it can be analyzed in a similar method to traditional fiction, and its general aesthetic merit as an art form (Punday 117; Paul 266; Liao 36). Through structural analysis of traditional literary genres with a higher level of reader engagement such as the mystery and detective genre, it has been determined that fiction allowing readers to take a more active role in shaping narratives can heighten reader investment in the story (Hühn 465). Furthermore, narrative analysis of interactive video games have determined that choice and interactivity can also convey narratives in a similar way to literature with certain differences that can immerse the reader to a greater extent (Hayot 179). However, parser IF, which does not offer a choice-based narrative, serves as a unique experience not quite that of a novel or video game, and therefore should be explored further to understand how the narrative experience within the medium impacts the reader’s interaction with the story. The way a reader interacts with the narrative in parser-based IF can mirror that of a mystery novel, so analyzing the medium through the narrative experiences in the mystery genre would serve as valuable insight in filling this knowledge gap over unique narrative merits of parser-based IF, especially how it might enhance a reader’s experience of the story.

Research Question And Hypothesis

Based on this preliminary research, the following research question was formed: To what extent does the medium of parser-based interactive fiction benefit a reader's experience with a narrative in the mystery genre in comparison to traditionally written fiction? Using this question as a guideline, it was hypothesized that the medium of parser-based interactive fiction improves experiences with short narratives in the mystery genre in comparison to traditional fiction for readers unfamiliar or new to interactive fiction due to an increased amount of reader engagement with the text that is caused by interactivity was presented.

Methodology

To address the hypothesis and determine any benefit to a reader's experience that parser IF may provide, an experiment based on sentiment analysis of qualitative data was conducted. In this experiment, participants were alternately assigned either a short story or a short parser IF game and asked to answer a survey afterwards, with questions that gathered both qualitative long answers and numerical data from Likert scale questions. The contents of the story and game were from Agatha Christie's short story *The Case of the Missing Will*, chosen specifically due to its length under 5000 words, and its content, which contained a relatively simple mystery plot with a small cast of characters.

Creating Research Materials

A simplistic game structure was utilized to make the parser IF game. Coded in the open-source Inform 7 engine, the game has three kinds of interactions users can have with the text. EXAMINE [object], GO [direction], and ASK [person] ABOUT [subject/object]. Only three actions were implemented to keep the variable of interactivity simple and the perspective of the text was kept to the original first person and not altered to be a more standard second-person perspective as research has suggested the use of second-person has its own effect on reader immersion and identification in a narrative experience (Wake 193) and so its inclusion was avoided in order to minimize confounding variables.

Small alterations to the text, such as adding sentences for clarity, bolding interactive words and making minor segments of prose optional to the progression of the text (see fig. 1), were made in order to maintain the structure of IF so that it had obvious differences with the

traditional short story. However, overall, minimal changes to the actual text of the story were maintained so that the story's narrative did not change, just the medium. The baseline level of interactivity was maintained in the parser IF game so that the method could directly engage with the inquiry into interactivity.



Fig. 1. Format and Style of IF Game

The survey that all participants had to fill out was designed to have both open-ended answers that could be analyzed using sentiment analysis and Likert scale questions where only numerical data was gathered. This was done so that there could be number values that supplement the sentiment analysis. The questions focused on singular aspects of the experiences, as is commonplace for a post-experience survey measuring user experiences (Szilas 3). Three narrative aspects were focused on: engagement, immersion, and enjoyment. Research about interactive narratives from authors such as Neitzel and Chaouli suggest that these elements are important metrics to measure in IF because enjoyment from higher entertainment value or increased engagement with the text are all things that the structure of IF affects. By asking participants for both free-response answers about their personal feelings regarding each element and a Likert scale answer for each element, the full picture of each participant's experience with these singular aspects could be extrapolated. Other questions included asking about participant's regular habits with fiction, in case of correlation of sentiment towards each aspect with regular fiction consumption habits. A question of comprehension was also asked, as higher reader

comprehension would be counted as a benefit, and it is susceptible to change between mediums of fiction, so it was determined to be a notable point of comparison as well.

Data Analysis

In order to determine sentiment in these qualitative text-based answers, aspect-based sentiment analysis (ABSA) was used on the free response data, the steps of which include text extraction, sentiment classification, aspect extraction, and aspect polarity aggregation (Katrekar 6). Each sentence was analyzed for key aspects the question asked about, and then determined to either be positive or negative by looking at the adjectives, adverbs, other prefixes or surrounding words that connoted positive or negative feelings. Special cases of wording such as “I felt immersed” or “I felt engaged” were counted as positive sentiment and “I did not feel...” counted as negative sentiment as the presence of feeling these aspects are beneficial to a reading experience and thus count as a positive sentiment. Only positive and negative sentiment were acknowledged, but due to the predicted lack of enough different neutral, negative and positive sentiment, only the positive was focused on and negative and neutral sentiment were grouped together and used to help determine the overall amount of sentimental aspects in each response. Also, if responses contained a more specific insight, it would be determined as positive or negative based on if it reflected positively or negatively on the participant's experience with that aspect. Due to the manual nature of the analysis, these special cases were able to be accounted for and documented for clarity in results analysis. The average sentiment score for each response was calculated by taking the total number of times the aspect mentioned in the response (both positive and negative) and finding the percent of those aspects that were determined positive or had a positive implication. With this, a percent value for positive sentiment was calculated for each response. Then, for each narrative aspect, all these values were averaged to find a mean positive sentiment for each within the two mediums, which could be compared. Using ABSA effectively allowed for numerical data to be gathered from the free-response, which made for easier comparison between the two mediums and thus better served to answer the research question about comparative benefits between parser IF and traditionally written fiction.

Additionally, the Likert scale values were averaged in a similar way, by aspect for each medium, in order to supplement the sentiment analysis, and to provide another point of

comparison to corroborate any conclusions. Analyzing the data about the three main observed elements of narrative required the determination of sentiment codes that could be used to determine sentiment. The question surrounding comprehension was analyzed differently, utilizing a “scoring” system based on how free-response questions are commonly scored on standardized tests like AP exams. Crucial narrative beats were predetermined, and scores were also averaged for each medium, with a higher score out of seven used to signify a higher level of comprehension. Furthermore, the results of the comprehension question were valuable for specifically examining the role of IF in the mystery genre, as mystery narratives are greatly enhanced by reader understanding of the mystery plot.

Results

After the process of data analysis and collection, the sentiment percentage, Likert values, and comprehension scores were derived for the story and game. With five participants for each medium, these values were averaged to get values for each aspect and comprehension for the game and story so that they could easily be compared next to each other.

Table 1

Story (Likert)	P4	P6	P7	P9	P11	Average
Engagement	7	6	7	6	7	6.6
Immersion	4	6	5	4	5	4.8
Enjoyment	8	5	8	6	6	6.6
Story (Sentiment)						
Engagement	66.67%	66.67%	0.00%	66.67%	50.00%	50.00%
Immersion	0.00%	50.00%	50.00%	66.67%	0.00%	33.33%
Enjoyment	100.00%	0.00%	66.67%	50.00%	50.00%	53.33%
COMP. Score	6	4	5	3	2	4
Game (Likert)						
Game (Likert)	P2	P3	P5	P8	P10	Average
Engagement	10	8	9	7	4	7.6
Immersion	9	4	6	4	7	6
Enjoyment	10	7	9	8	5	7.8
Game (Sentiment)						
Engagement	100%	100.00%	100%	100.00%	0.00%	80%
Immersion	66.67%	0%	50%	0.00%	75.00%	38.33%
Enjoyment	100.00%	50.00%	100.00%	100.00%	0.00%	70.00%
COMP. Score	7	5	6	3	3	4.8

Analysis Results and Averages

Sentiment Analysis Results

In order to determine overall sentiment of each examined aspect, averages of the percent of positive sentiment from each response were taken and then compared, ultimately demonstrating that the positive sentiment percent for all examined aspects were greater for the parser IF game than the traditionally written short story. Most respondents did not end up having overly long answers, thus many of the responses were able to be categorized as 100% positive or 0% positive. Still, the percent was taken for instances where there were mixed opinions in the response, and the percent of positive sentiment for each instance of the aspect were possibly in between completely positive and exclusively negative. Higher percentages signified higher positive sentiment, and as the averages indicated, the parser IF game in comparison did have higher averages of positive sentiment percentage. While the aspects of engagement and immersion were both notably higher for the parser game than for the short story, the aspect of immersion was closer in percentage, and the lowest value for both. Thus, the data suggests the parser game provided a better experience than the short story in engagement and enjoyment, but for immersion there was only a little improvement and the overall positive experience for immersion was low in both mediums.

Likert Scale Analysis

The purpose of the Likert scale values were to supplement the values and conclusions drawn from the sentiment analysis, and to give participants a more quantitative way to respond. Like the averaging of the sentiment analysis, Likert scale values were also averaged for each aspect in each medium, except instead of being a percentage, they were presented as a value out of 10. For the Likert scale values, all values were also higher for the game than the story, matching the sentiment analysis rather closely. In other ways.

Comprehension

The last major aspect analyzed was comprehension, done not through sentiment analysis or measured with Likert scale, but was a free response question that had a “scoring” system. There were seven total main plot points (see table 2, Methodology section) and responses were graded by how many points they got. On average, participants interacting with the short story recounted less plot points in their responses than those with the game. Individual responses for

the game were higher than that for the story too, with the highest score of 7/7 coming from a participant who played the game and the lowest score of 2/7 coming from a participant who read the short story. However, the difference in the average scores is not greater than 1, indicating that comprehension, while slightly improved by the parser medium, the difference in comprehension was not drastically different.

Results on the whole demonstrated that the medium of parser IF did indeed have benefits for a reader's experience in comparison to traditionally written fiction within the mystery genre. The percent of positive sentiment, which matches with general Likert scale values, are on average greater than those for the story, and even in the situation where both mediums yielded a low sentiment, the IF game still had higher averages.

Discussion

The results suggest that the medium of parser-based interactive fiction benefits a reader's experience as a whole and improves certain aspects of that experience in comparison to traditional fiction in the mystery genre. Since the average percent of positive sentiment, average Likert scale values, and the average comprehension scores were as a whole higher for the parser IF game than the story, it could be inferred that readers overall had a more positive, more beneficial and more highly rated experience for the game on average.

These results supported assertions that engagement and enjoyment of the reader is improved by parser IF structures, and that IF can facilitate a more engaging reader experience due to a feeling of control, as well as a more active role in the process of reading. Much of the positive sentiment reflected in participant's responses contained reference to the fact that the incremented storytelling format which pushed readers to digest each section of text fully so that they could type in the correct action to move on, which suggests that the main element of interactivity in parser IF was what made the engagement generally higher for the participants playing the game. Participants also responded positively in terms of engagement with how the IF structure made them interact with the mystery in the story more thoroughly, feeling more as if they were in the role of a detective. These experiences support theories that similarly suggest that in mystery fiction, the ability for readers to have their own narrative agency in their experience can heighten their enjoyment as they feel more immediately involved and thus more intellectually thrilled (Hühn 465). With this, it can be inferred that in mystery stories, readers

having this ability to be more active in reading is a great benefit to their experience, and thus the interactivity in parser IF improves engagement in reader's experiences because of this.

Despite the fact that the results depict that overall all aspects of reader experiences were more positive and rated higher for the game than the story, the results for both suggested that immersion was overall very low for all participants, with only slight improvement that was far more minimal for the game. This contrasts against theories in the field on how a constrained but interactive experience heightens immersion (Kelley 59) or how more mental engagement increases a sense of immersion (Ryan 58). It is more likely that parser games with more detail, more open ended and reactive characters and setting would actually heighten immersion, and the basic level of interactivity does not do much to heighten immersion.

Implications

Although this research does not go into depth on the technical aspects of interactive fiction, this examination of basic parser IF structures primarily on participants unfamiliar with the medium can have larger implications of the usefulness of IF as a medium of literature and suggests that positive benefits of the medium are not restricted by unfamiliarity with the medium, and thus there is little drawback to introducing the medium to more audiences. As results suggest an improved reader experience with a narrative in IF, it could be posited that narratives may be better consumed through a parser IF experience. Specifically, mystery narratives that draw on the reader's active mental participation with the text. There are possibilities of this improvement to reader experience being used to better spread more esoteric works of mystery fiction by giving an option to adapt it into a more engaging reading experience to readers not already avidly familiar and interested in those texts. Furthermore, this research has pushed the idea that parser IF does have literary merit as it can affect and enhance a presentation of literature, and this could have implications on how IF is looked at as more of a literary medium than purely a game centered one. Lastly, there are also undoubtedly some implications of this research suggesting that nontraditional narrative formats that center around digital storytelling can be beneficial to readers and are worthy of further exploration. It suggests there is a lot of potential for digital mediums that creatively work with literature to enhance the narrative of these stories without completely changing the content of the works, and that within fields discussing interactive fiction, even with a linear narrative and simple interactivity, there are

interesting comparisons one can make between these mediums of storytelling with traditional fiction.

Limitations

Limitations of this research center around the simplicity of the experiment leading to some non-specific results that could be dissected further. The design of the experiment to only focus on three general aspects and only through a basic level of interactivity meant that certain aspects, like immersion, were too broad for participants to address and deliver their feelings truly without any further detail to it in both the game structure and the survey questions which did not focus on specifics. Immersion was hard to quantify as a general aspect itself, and may have ended up being lowest rated because to affect it there needed to be more complexity to the parser experience overall. There is also the limitation of the game material adhering to traditional story linearity. Parser IF has the capability to host a non-linear narrative with multiple endings or branching paths, and in terms of immersion, it is possible a non-linear narrative might change or have more effect on a reader's experience. This interesting possibility may have elucidated more clearly how parser IF could improve a reader's experience, especially within the aspect of immersion, and it is a limit on the research's results that more specificity and complexity could not be achieved. Additionally, the limitation of survey questions being open-ended leading to varying lengths and detail of responses could have meant results were not as accurate as a more standardized way of data collection could have been; this is another limitation that demonstrates not only adding but also asking for more specificity in participant responses could have been highly valuable. Due to the predicted small sample size for the research as well, the sentiment analysis was done manually, but if the experiment is done on a larger scale, having an automated system for this analysis would likely be needed. Furthermore, although there was a question in the survey that asked about the reading habits of participants, since all participants answered similarly, this didn't have much bearing on the results.

Conclusion

In observing and experiencing the unique qualities of narrative, it can perhaps be difficult to remember the unique ways a narrative really can be presented. Although technology over time has opened up many possibilities, the existence of hypertext and digital storytelling mediums are

still often forgotten. By taking a look and bringing a medium like parser IF into direct comparison with traditionally written narratives and highlighting the special benefits IF could have on certain literary genres, it may be possible to inform wider audiences about the fascinating avenues literature could evolve into digitally. Humanities and technology do indeed mix better than most may expect, as technology can open up all kinds of new ways to actually make and present narratives and literary subjects. It only takes a better understanding of technology that has fallen a bit to the wayside, but has a lot of potential as a medium. Through breaking IF apart from its elements so that the real benefits of it can be explored, maybe the potential of digital storytelling mediums can be found in due time.

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An Analysis of Solitary Confinement and Reform By Abigail Adane

Introduction

Solitary confinement is most commonly known as a system in which inmates are placed in a small room and isolated from others for 22-24 hours a day. Inmates can be placed into these cells for prison violations or even minor infractions. In this paper we are going to explore the extremely damaging effects of solitary confinement on inmates and society as a whole, as well as exploring the most efficient reform method that can mitigate the detrimental effects this system of imprisonment inflicts.

Historical Background

Solitary confinement was first introduced in the late 18th century by Quaker settlers through the Pennsylvania and Auburn system. These systems introduced the concept of isolation as punishment in small cells similar to what is seen in modern solitary cells. Taking place during an era dominated by religion-based means of punishment, solitary confinement was seen as a rehabilitation method, urging those in its hold a closer relationship with God. The original proposition of its founding implied that those who were cut off from the impurities of society, were able to purify themselves, ultimately leading to penitence (Scharff, 457). The implementation of this practice began to raise alarm, largely due to the significant number of suicides and negative psychological affects, which were evident even before psychological research was adequate for its time (Childress). But the use of solitary confinement continues on to the present day, and causes extremely damaging, long lasting effects to the individuals forced into this modern system of torture.

Stimulation Deprivation

The concept of depriving your brain of stimulation, more commonly known as sensory deprivation, is a modern method of meditation. The practice is only used in short periods of time, depriving the user of all senses, initially calming their mind. But depriving the brain of stimulation for long periods of time has been shown to cause harmful effects. One of the most well-known psychological experiments was done by Harry Harlow, in which infant monkeys were put into isolation for an extended period of time, being studied behaviorally. Throughout

the experiment, the monkeys showed 'disturbed behavior'. Some were even so deprived of stimulation that they began to mutilate themselves in desperation of any type of feeling (Harlow, 1958). This study highlighted the pattern of sensory deprivation effects that we see play out through present day isolation. The behavior seen through the monkeys, is eerily similar to the behavior observed by modern solitary confinement inmates.

Research has shown that with heavy, long-term deprivation of stimulation, once the brain is exposed to small amounts of stimulation, it becomes overwhelmed. The body starts to adapt to experiencing little to no stimulation, that even the smallest things such as a loud noise, can become unbearable and overwhelm the brain (Sincero). With such a lack of stimuli, the brain begins to grow an intolerance towards it. Along with that, while in isolation the brain's stress levels are increased, and with this increase in stress comes a paralleled detraction in the brain's cognitive abilities. "It's 'fight or flight' mode all the time.", Dr. Salinas, a Harvard behavior neurologist states. The brain's usual functioning ability is barely able to adapt to the new, heavily damaging circumstances it's been put under (Harvard Health). Hence why solitary confinement is infamous for wreaking havoc on inmates' mental states to the point of insanity. This mental damage makes it nearly impossible to rehabilitate and reenter society with a well functioning mind, causing a barrier towards those who desire to live normal lives post-release.

Social Isolation

Sensory deprivation is not the only aspect that shapes the cognitive experience in isolation. A study done on female prairie voles, whose behavioral patterns are extremely similar to humans', placed the animals in social isolation and found that it decreased cell proliferation and the animals began to display depression and anxiety-like behavior (Lieberwirth). While animal studies are not a direct parallel to humans, the results of the study ended up replicating what happens in humans during social isolation. A complete lack of social interaction in humans has been proven to be directly linked to cognitive development. Martina Luchetti, a professor at the College of Medicine at Florida State University, states that there has been a link between loneliness and the deprivation of neurotrophic factors, a protein responsible for neurogenesis and cognitive maturity (Luchetti). The lack of dopamine caused by loneliness has been linked to a number of other health deficiencies as well such as Parkinson's, degeneration in the brain, and even premature death (Franco). The human brain has evolved to thrive under sociality and

constant access to other human beings, solitary confinement deprives the brain of this needed sociality, that is even given to normal inmates (Young).

Social isolation has had intense effects on the function and stability of certain parts of the brain. The hippocampus, a part of the brain most responsible for memory, has been shown to detract in function when it is placed in periods of intense stress, such as isolation (Hatch). Connections have been made that correlate smaller hippocampuses towards generally socially isolated individuals (Offord). When negative stimuli is produced in stressful environments and situations, a glucocorticoid named cortisol is produced. Cortisol damages the hippocampus, hence the correlation between social isolation and a cognitively damaged hippocampus (Sapolsky, 925-926). The prefrontal cortex, a part of the brain most responsible for executive function, has been shown to have dysregulated signaling in socially isolated animals, limiting communication from different neuronal areas (Xiong). This sudden cutoff of sociality dysregulates the brain entirely, and the extreme neuronal detractions those who are isolated face inevitably cause long term damage. All of these factors come into play with increased recidivism rates considering that they inevitably cause societal reentry to be nearly impossible, and only increase the US' mental health crisis that lead to citizens being imprisoned in the first place.

This multitude of detractions towards an inmates mental health connects to the increased death rate in inmates post release, as shown in figure 1:

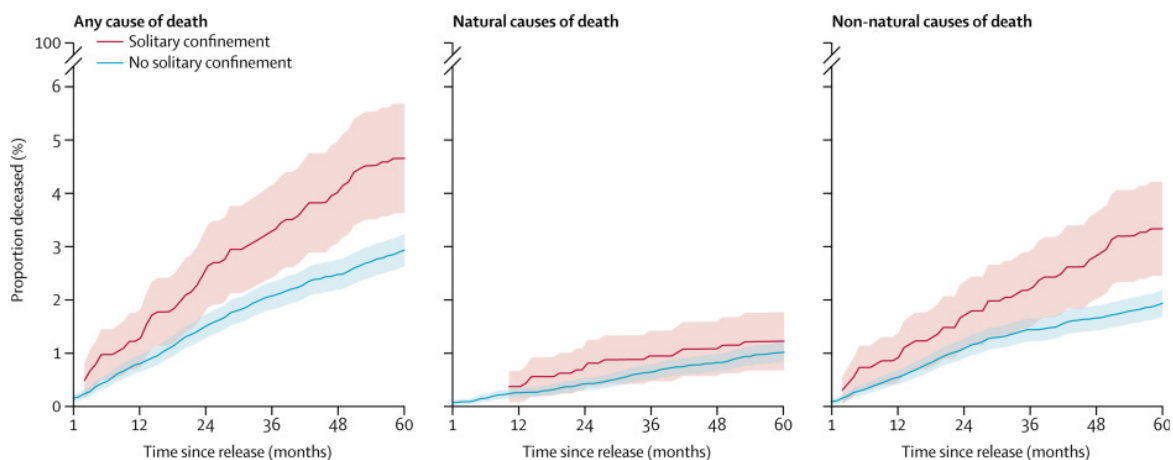


Figure 1 (Wildeman): There is a higher natural and non-natural mortality rate among those who received solitary confinement in prison, compared to those who haven't from 2006-2011.

Penitence Affect

With the prison system, and solitary confinement's overall goal being successfully inducing penitence in those under the system, much of the outcry for prison reform is in criticism of the fact that the current systems in place only hold the opposite effect. Florida State University held a study regarding 1,247 prisoners, finding that their placement in solitary confinement increased their risk of committing another crime after release, by 15%. A separate study also found that the recidivism rate for inmates in solitary was over 60% (Samarth). Solitary confinement lacks the necessary counseling aspects that would keep those in it from committing another crime, nothing is truly achieved with simply isolating individuals and expecting a positive outcome.

Constitutionality

With ongoing activism opposing the penitentiary system's cruelty in punishment, solitary confinement has become an iconography of the movement towards prison reform, and abolishment of inhumane prison practices. There have been a number of class action lawsuits challenging the unbearable conditions in correlation with undeserved punishments, yet the practice has maintained constitutionality. In the case of Peoples v. Fischer, LeRoy Peoples served 780 days in solitary confinement with another prisoner for non-violent misbehavior, this case not being the first time that has occurred for him. He had pressed charges claiming that the prison violated his constitutional rights. The case expressed that the system of solitary confinement in itself is not unconstitutional but "long stretches of solitary confinement can constitute cruel and unusual punishment" (Casetext).

Cases like this highlight the need and public want for prison reform. The cruel and unusual punishment being deemed constitutional begs the question, how is solitary confinement not a violation of the eighth amendment? The U.S court of appeals of the Fifth Circuit declared in 2022 that no matter the psychological or physical outcomes of a prisoner due to solitary confinement, it remains constitutional in regards to the eighth amendment. This precedent has constantly been combated with the fact that little to no rehabilitation occurs towards those who have experienced solitary confinement, and the psychiatric deterioration that occurs as a result should fall under the label of cruel and unusual. Yet the practice still remains as common as ever, and at this point in time abolishment seems out of consideration.

Racial Disproportionality

The United States has had a long history of racial disproportionality in correctional institutions. There have been hundreds of studies that have displayed the disproportionate African American population in the incarceration system, and that same standard holds for solitary confinement. In a study done to analyze ethnic prevalence in Pennsylvania prisons from 2007-2018, it was found that about 60% of black men in a birth cohort had spent some time in solitary confinement, while the same occurred for 3.4% of Latino men and 1.4% of white men in the same cohort (Pullen-Blasnik). This disproportionality occurs consistently, nationwide, and is one of the primary reasons there have been so many movements towards reform in our prison system. A system that is meant to serve and establish justice cannot function under prejudice. The greater quantity of people of color placed in incarceration, and particularly solitary confinement, serves as a societal roadblock towards equality and an anchor on colored communities attempting to rehabilitate themselves.

Exploring Reform Attempts – Reduction in use

One approach to solitary confinement reform is reduction in use and stricter guidelines as to why an inmate is placed into solitary. One of the most notable reform attempts of this was Obama's ban on solitary confinement use on Juvenile offenders, and reduction of the maximum time one can be kept in solitary confinement. This reform took place under the intention of lessening the intense mental health detractions that come with solitary confinement (Somander). This reform is one of the most effective in lessening the number of inmates placed in solitary due to essentially groundless violations, such as those in the previously mentioned Peoples v. Fischer case. This reform method also aids in lessening unnecessary, and psychologically damaging prolonged sentences.

The primary issue with this attempt at reform is lack of penitence or rehabilitation towards the inmates. For one, in no way is an inmate receiving any mental health guidance in any form to aid in compunction towards their violation or charged crime, hence the persistent high recidivism rates (Seigafoi, 2). While this reform results in a lessened number of inmates facing the intense effects of solitary confinement, it does only that, lessen the number. A truly successful reform method would rearrange the system holistically to keep any number of inmates from facing those effects.

Societal Re-Entry

This approach to solitary confinement reform has rarely been implemented as a permanent part of prison systems, and is usually done to study the effects of allowing those in solitary to gradually gain enhanced privileges and more access to socialization. One of the largest and most recent studies implementing this method of reform, is being taken in the Oregon Department of Corrections. The enhanced privileges for this institution include educational classes, media such as television or tablet use, and access to counseling. While the mental health data for this study has been delayed, there has been an overall positive response from prisoners. One of the primary responses prisoners gave towards the program was that it provided them with genuine life skills and advantages that regular solitary confinement could never provide. In an interview conducted, one prisoner had mentioned that the classes and counseling had helped them reevaluate their life and the choices they've made, establishing a penitence effect (Labrecque).

While this method of reform doesn't have quite a lot of data on it and is fairly recent in regards to implementation, it makes up for most psychologically degrading aspects of solitary confinement mentioned in this paper. It limits social isolation/sensory deprivation and therefore mitigates the effects of it on the brain and it institutes a penitence effect which would lower the recidivism rate.

Full Abolishment

The abolishment of solitary confinement is the primary goal of many prison reform activists, but currently abolishment seems off the table for a number of reasons. While abolishment would effectively eliminate all of the problems of solitary confinement such as the mental health issues it imposes upon inmates, there still remains a reason as to why solitary confinement is still standing in the first place. "The process of implementing solitary confinement was viewed as a suitable method to separate the most dangerous criminals from the rest of the inmate population"(Smith, 8). Many make the argument that solitary confinement is essential to this separation and to containment of inmates who are considered extremely dangerous (Smith, 8). While this argument is understandable we still see cases such as People's v. Fischer in which inmates are placed into solitary for minor violations. The system has downgraded from a containment of dangerous inmates to an overused abuse of power that only

causes damage to those in its hold. Because of these flaws we are able to see slight reforms but never full abolishment.

On the other hand, the argument in favor of abolishment mainly constitutes the damage solitary confinement imposes on prisoners. Many advocates argue, and prove, that solitary confinement only causes an increase in recidivism rates and makes no attempt to rehabilitate prisoners whatsoever, creating a never ending cycle of increased crime and an increase in the US' mentally ill population. This argument is completely valid, but realistically the argument in favor of solitary confinement is correct in regards to separation being needed between dangerous and peaceful inmates. A middle-ground, compromised method of reform is needed to efficiently mitigate all of the damages solitary confinement causes, while maintaining its ability to separate and punish prisoners who are dangerous or violate major rules.

Although there are many nuances to the argument, activists agree that full abolishment is one of the only clear solutions to ending the intense racial disproportionality in solitary. Due to the fact that minorities may always be seen as disciplinary threats, there is not a known reform method that may alter this internalized racial prejudice from guards and staff. Racial disproportionality in the criminal justice system is nearly impossible to solve with one solution or one single method of reform (Williams), which is why many believe fully eliminating the practice of solitary confinement may be the only solution to preventing even more minorities from being subjects of its damaging effects.

Conclusion

With all of the uproar against and for solitary confinement, we find the most effective way to compromise both sides while mitigating the problems is the societal re-entry method of reform. Going back to the original intention of solitary, this method successfully rehabilitates those who commit extreme violations or are considered dangerous in any sense, by providing them with resources and proper mental health counseling that will only help them in attempting to re-enter society as a normal person, replacing the mental damage caused by traditional solitary confinement, with a new mindset nurtured by counseling and educational resources.

As previously mentioned, this method of reform has little, but recent evidence and study behind it, but from the studies that have been conducted there has been a majority of positive feedback directly from the prisoners themselves. This method replaces the intense punishment

aspect of solitary with a focus on lowering recidivism and keeping citizens out of prison through guidance.

While this method is the most effective found through this research, there are still further ways solitary confinement can be reformed in an efficient manner that can effectively solve for all aspects of its flaws, including racial disproportionality, but as of right now there is no single solution to this issue and improvement comes with time, compromise, and consideration.

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A Correlational Analysis on Student Awareness of Plastic Pollution in the Gulf of Mexico and Beliefs on Issues in Modern Environmental Politics By Carson Harris

Abstract

This study's goal was to determine correlations between South Louisiana high school students' awareness of plastic pollution in the Gulf of Mexico and their environmental beliefs. Prior research shows that positive correlations between American adults and their knowledge about an environmental issue in the nation do exist; however, there is no research on how awareness of plastic pollution in the Gulf of Mexico is correlated with South Louisiana high school students' environmental beliefs. Data was collected through surveys posted around a local high school where a correlational analysis was completed. Participants included students of various demographics. Initial results showed that out of the eight environmental beliefs analyzed in this study, the only correlation that was proven statistically significant was between awareness and responses to the statement plastic pollution in America is exaggerated. Students with low awareness tended to respond with "Agree" more. However, as awareness rose, the amount of "Disagree" or "Strongly Disagree" responses rose. As awareness rose, there was a negative correlation with students agreeing with this statement. Therefore, the conclusion can be made that there is a correlation between awareness of plastic pollution in the Gulf of Mexico and South Louisiana high school students' beliefs on issues in modern environmental politics. Additionally, if this research is replicated a few years from now, this field of knowledge could see a change in the beliefs of youth over time, and potentially determine the future political landscape that modern generations might set.

Introduction

The recognition of environmental politics in the United States is becoming more prevalent. A 2020 study found that environmental regulation is nearing the top of American political agendas, as 64% of American adults acknowledge that the environment plays a significant role in politics and in their overall political attitudes (Pew Research Center). This rise in the awareness of environmental politics has led Americans to become more knowledgeable of ecological issues that surround them, with a prominent one being plastic pollution. While plastic

pollution is a widespread issue across America, one notable location of its occurrence is the Gulf of Mexico.

Plastic pollution reports in the Gulf of Mexico have been rising in recent years. According to a 2020 study, it was estimated that the annual amount of plastic present in the Gulf of Mexico was roughly 0.25 million metric tons, which equates to 551.16 pounds of plastic (Alvarez-Zeferino et al.). This accumulation of plastic in the Gulf of Mexico has led more Americans to understand the massive effects of plastic pollution on environmental politics. Iroegbu, et. al (2021) revealed in a review report that when awareness of plastic pollution in varying bodies of water, such as the Gulf of Mexico, increases, it typically leads to alterations regarding American adults' beliefs on miscellaneous issues in environmental politics, such as clean energy policies, environmental education, climate change politics, and even usage of biodegradable materials. Due to this relationship, it can be assumed that American adults' different levels of awareness of plastic pollution are correlated with their environmental beliefs. However, prior research does not indicate if there is a correlation between American teenagers, specifically high school students, awareness of plastic pollution and their beliefs on issues in environmental politics.

Despite experts researching potential correlations between American adults' awareness of plastic pollution and their environmental beliefs, there has been no research that focuses on the South Louisiana teenage population. Additionally, there has been prior research that addressed correlations between an individual's environmental beliefs and their awareness of plastic pollution in locations such as cities; however, there is no research that focuses on an individual's awareness of plastic pollution in the Gulf of Mexico, specifically, in correlation with their views on issues in environmental politics. The gap in the following research focuses on correlations between awareness of plastic pollution in the Gulf of Mexico and South Louisiana high school students' beliefs on issues in environmental politics.

Due to the insufficiency of research on this topic, the researcher's driving question is the following: Is there a correlation between South Louisiana high school students' awareness of plastic pollution in the Gulf of Mexico and their beliefs on issues in modern-day environmental politics?

Literature Review- Modern Day Environmental Politics

In modern America, there is a multitude of ongoing controversies regarding politicians and their policies regarding the environment. In 2017, President Donald Trump announced that the United States would withdraw from the Paris Climate Agreement⁵³, a decision that caused an outcry among many American environmental activists. Contrastingly United States Representative Alexandria-Ocasio Cortez (AOC), Senator Ed Markey, and supporting members of the democratic party attempted to reintroduce the Green New Deal⁵⁴ in 2019, which was highly supported by many American environmentalists⁵⁵.

Political participation has ascended over the past few years. According to the Pew Research Center (DeSilver, 2022), roughly 47.5% of the voting-age population participated in the 2018 midterm election. However, in the 2020 presidential election, the percentage of voter participation rose to 62.8%. Although this could be due to the fact that presidential elections tend to attract more attention than midterm elections (Skelley & Kondik, 2017), it still indicates that millions more Americans are participating in politics as time progresses. Due to the rise in political participation, Americans are becoming more aware of a multitude of political topics, with the environment being a dominant one.

Additionally, prior studies prove that rising awareness of environmental issues, through events such as political participation, leads governments around the Earth to typically address these issues in a strong manner. Marcus Haward, a political scientist at the University of Tasmania, conducted a study to determine the relationship between rising plastic pollution and government action. His analysis revealed that governments recognize the abounding dangers of rising plastic pollution levels, and how, in response, international governments have constructed elite organizations, such as the International Maritime Organization (IMO), in order to lower the abundance of plastic pollution in the Earth's oceans (Haward, 2018). In summary, the government's influence on modern environmental issues has significantly contributed to the environment's role in modern geopolitics and modern American politics.

⁵³ According to the United Nations (2015), it is an accord between 196 parties across the world created to reduce greenhouse gas emissions and slow down rising global temperatures.

⁵⁴ A public policy that claimed to address climate change and eco-economic issues in America. However, it initiated several controversies regarding its intentions and effectiveness among many politicians across the political spectrum in the United States of America (H.Res.109 - 116th Congress, 2019).

⁵⁵ Someone who is concerned about environmental quality, especially of the human environment with respect to the control of pollution (Merriam-Webster, 2023).

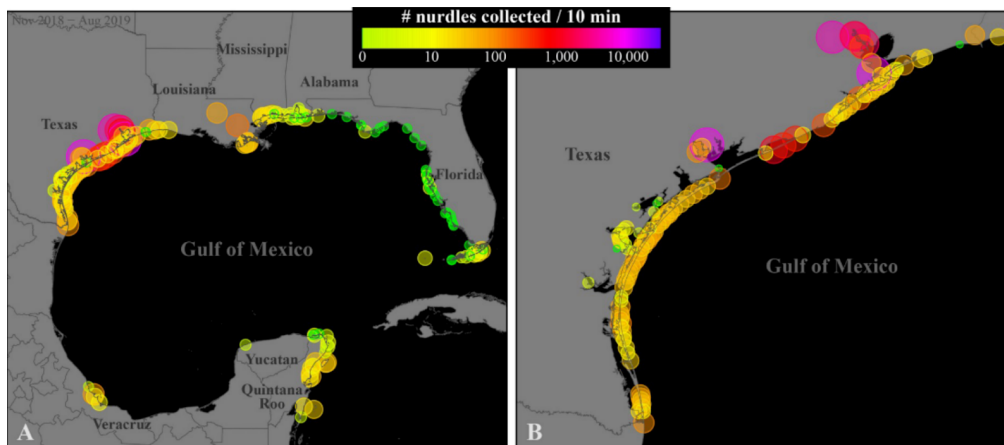
The number of environmental influences an individual encounters is also a major consideration when analyzing Americans' environmental beliefs. Robert Gifford, psychology researcher at the University of Victoria, and Andreas Nilsson, psychology researcher at the University of Gothenburg (2014), both assert Howard's analysis by conducting a correlational analysis to unveil correlations between environmental interactions and environmental beliefs. Results concluded that participants who were more engaged with the environment tended to have stronger feelings of environmentalism, leading to more environmentalist stances on various issues in environmental politics.

Plastic Pollution in the Gulf of Mexico

Throughout the past decade, studies focusing on levels of plastic pollution in the Gulf of Mexico have skyrocketed. Jace W. Tunnell (2020) advanced this field of research by analyzing the variation of microplastics along Texas coastlines. He discovered that along these coastlines, over 10,000 plastic nurdles were collected in the span of a 10-minute search period; moreover, thousands of plastic nurdles were also found along the coastlines of Louisiana, Mississippi, Alabama, Florida, and southeastern Mexico. **Figure 1** represents the locations where plastic nurdles were collected and the number of nurdles collected as a whole.

Figure 1

Abundance of Plastic Nurdles bordering the Gulf of Mexico



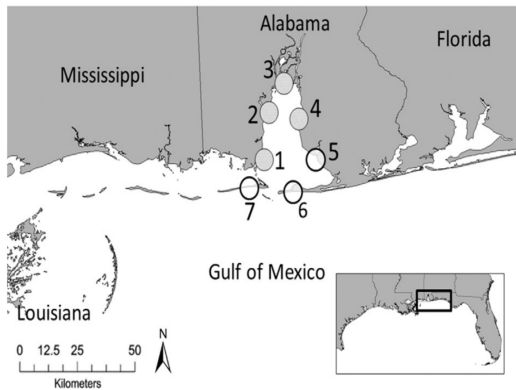
This map shows the abundance of plastic nurdles at different locations along coastlines bordering the Gulf of Mexico (Tunnell et al., 2020)

This suggests that over time, plastic in the Gulf of Mexico has moved hundreds of miles to the coastlines of various land masses, indicating that plastic pollution is becoming a widespread issue in this location.

Coastal ecologist Caitlin C. Wessel (2016) reaffirms Tunnell’s study by conducting correlational research between the presence of plastics in the Gulf of Mexico and the surrounding environment. Wessel conducted her research on different locations along the Alabama coastline (Figure 2) and she reported the various amounts and types of microplastics present at each location (Figure 3).

Figure 2

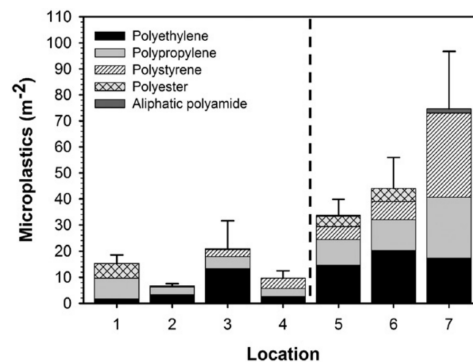
Study Locations around Mobile Bay, AL



This map represents the seven locations of which microplastics were taken from (Wessel et al., 2016)

Figure 3

Abundance of Microplastics at different locations



This graph represents the different microplastics present at each location, and how much of each microplastic is present at each location (Wessel et al., 2016)

It is evident that location seven contained the highest levels of microplastics. Since this location was the furthest from the land, it is safe to assume that as the location of the study goes further into the Gulf of Mexico, the number of microplastics and variation of microplastics significantly increases. Additionally, her research indicated that as more plastic was carried onto surrounding coastlines, there was a significant pattern of ecosystems and wildlife being disturbed. Given the evidence, it is clear that there is a positive correlation between plastic pollution levels and harm to the surrounding environment.

Rise of Teens in Politics

There has been a rise in the representation of political involvement among teenagers in America. Current research indicates that social media platforms such as TikTok, Instagram, Twitter, and Facebook have played a larger role in American political participation in recent years, with social media usage directly influencing higher voter turnout rates during major campaigns (Dimitrova et al., 2014). This idea is continued with sociology researcher Tanja Storsul (2014) conducting an analysis to determine if social media is a significant factor in American teens' beliefs on modern environmental issues. In her research, Storsul asked volunteers ages 16-19 questions about their political affiliation and their stances on current environmental issues. At the end of her survey, she asked participants if social media played a role in their ideologies. It was found that many participants felt strongly about their political beliefs regarding the environment; however, whenever they were on social media, they felt extremely pressured to conform to a specific idea regarding current environmental issues. This provides a strong correlation between teenagers' beliefs on issues in eco-politics but also provides an avenue of understanding how influential a role social media plays on a teenager's environmental beliefs.

Another phenomenon that could be related to American adolescents' environmental beliefs could be learning about environmental issues in schools. Human ecologist Constance Flanagan (2021) affirms Storsul's claims and explores a relationship between teenagers' environmental beliefs and learning about environmental activism in school. From her study, it was concluded that when schools educate teenagers about a multitude of issues in environmental politics, these teenagers tend to attempt to gather with their surrounding community and address environmental issues in their area.

Research Gaps and Goals

The first gap in this study is the focus on high school students in South Louisiana. Although American high school students may not be involved in environmental politics as much as adults, with more media outlets and discussions of environmental issues in schools, high school students are greatly impacted by issues in environmental politics. In modern times, high school students are in an age group where political topics and arguments are common and expected, as this is the time in an individual's life when political identities are beginning to be formed. Many students already have some knowledge about plastic pollution issues, which

prior research has shown to be a contributing factor to one's environmental beliefs. In previous research, American adults were the primary population for correlation studies between plastic pollution awareness and environmental beliefs. Although high school students had some involvement in these studies, there has been no research done on a correlation between the South Louisiana high school student population's awareness of plastic pollution in the Gulf of Mexico and their beliefs on issues in environmental politics. This study will close the population gap that is in current research to further understand how modern youth in South Louisiana might view different environmental issues in correlation with their plastic pollution awareness level.

Another major gap in this research is the focus on plastic pollution in the Gulf of Mexico. Despite prior research regarding this topic focusing on locations such as the Atlantic Ocean, Pacific Ocean, and cities, there has been no research on this topic involving the Gulf of Mexico. Additionally, prior studies indicate that high school students in modern times are more knowledgeable about environmental issues than previous generations (Bofferding & Kloser, 2015). However, no research concentrates specifically on correlations between high school students' environmental beliefs and their awareness of plastic pollution in the Gulf of Mexico. By focusing on the awareness of plastic pollution in the Gulf, it can be determined if correlations between awareness of plastic pollution in the Gulf of Mexico and South Louisiana high school students' beliefs on issues in environmental politics exist.

This focus of research is fundamental to determine possible correlations between awareness of plastic pollution in the Gulf of Mexico and South Louisiana high school students' beliefs on issues in modern-day environmental politics. High school students today are likely more knowledgeable about environmental politics than previous generations, and due to a lack of research directly connecting awareness of plastic pollution in the Gulf of Mexico and South Louisiana high school students' environmental beliefs, this population filled the gap of the study. Not only are high school students becoming more aware of environmental issues, but they are developing stronger beliefs within the field. Through this study, the future of environmental politics in South Louisiana might be predicted and future politicians will have more knowledge about how an extremely impactful environmental issue could potentially be correlated with a person's environmental beliefs. Additionally, we could see the growth of

environmental politics in South Louisiana in the future, leading to a stronger and possibly more protected environment.

Methodology–Research Design

To answer the research question, the researcher conducted a mixed methods approach that utilized a correlational-survey design and followed a self-entry style. For this research, this mixed methods approach was favored because it enabled participants to effectively respond to the questions in the survey so the researcher could examine the results to determine if there were any correlations between the two variables: awareness of plastic pollution in the Gulf of Mexico and South Louisiana high school students' beliefs on issues in modern environmental politics.

For a time period of three and a half weeks, participants were allowed access to respond to a digital form that was provided to them through quick response (QR) codes posted around the school or through teachers' *Google Classroom* streams. The survey consisted of three sections: the personal survey, awareness questions, and beliefs. These sections were chosen by the researcher because they would display diverse beliefs for the study and potentially show correlations between awareness level and belief. Demographics were taken into account through the personal survey of the form and asked questions concerning age, grade level, ethnicity, and gender. This allowed for numerous demographic backgrounds to be accurately represented in this study. Awareness level was reported by participants answering questions about whether they had heard about plastic pollution in the Gulf of Mexico from any platform, whether it be from parents, schools, the news, or social media. Then, participants were asked to define their own awareness of plastic pollution in the Gulf of Mexico. Given the timeframe for this research and the ability of participants to freely answer these questions, this method was favored. Beliefs were measured through an 18-question survey that asked participants about their stances on issues in environmental politics. Each question utilized a 5-point Likert scale that provided the following options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, and Not Applicable (N/A). This revealed participants' environmental beliefs, and the researcher could potentially identify correlations upon data collection.

Subjects and Participants

The population chosen for this research were students in grades 9th through 12th at a local high school. While earlier research concentrates on American adults, focusing on high school students, specifically in South Louisiana, will cover both the age and location gaps of this study, adding significance to this field of research. This population was chosen because of its large student population as well as its diversity of students. All participants in this study were volunteers; there was no use of incentives.

Instruments

To gather accurate results for students’ beliefs on issues in environmental politics, survey questions were created based on the format of a generalized 5-point Likert scale questionnaire (Taherdoost, 2019) that was adapted to fit the purpose of this study. **Figure 4** shows an image of the scale that was taken and altered for the purpose of this research.

Figure 4

5-Point Likert Scale for Political Belief Analysis

Options	1	2	3	4	5
5-points	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Neither Agree nor Disagree</i>	<i>Agree</i>	<i>Strongly Agree</i>

This table represents the 5 response options suggested for studies utilizing a survey to analyze political beliefs in correlation with another variable (Taherdoost, 2019)

This study was given in the form of a survey through *Google Forms*, which was posted in various locations around the local high school. The research utilized an online survey for this research as it would broaden chances for students from various backgrounds to participate at their own pace so diverse results could be analyzed. Additionally, due to this study only requiring the participant to have access to an internet-connected device, it was easily accessible and permitted students to effectively complete the survey.

Procedures

To gather participants for this study, teachers permitted the researcher to post the survey link in their Google Classroom streams. Additionally, administrators permitted the researcher to post QR codes around the local high school so that students can easily take part in the study. Once clicked or scanned, the QR code or link led students to a study sign-up and digital consent form that reviewed the confidentiality of the study and participants' rights. This was the best way to compile parental consent in the shortest interval of time, as well as gather more participants than with a physical copy of the study.

A summary of the study was attached to the sign-up portion of the survey, as well as what was being asked of participants and other ethical information (**Appendix A**). Additionally, the researcher's contact information was provided if a participant had any questions about the study. By attaching a summary of the study and ethical information, participants were informed of the importance of the study and formatting of the survey, giving participants a period of time to consider if they wished to no longer participate in the study any further. As a result, participants had a better understanding of the study, what was being asked, and more comfort throughout the study, which ultimately added to the validity of the results. Additionally, participants were informed that if they ever felt uncomfortable with a question, they could do any of the following: skip the question, mark the response choice N/A, or stop the study as a whole. After receiving consent to participate in this study, participants were allowed to start completing the survey.

During the study, the only personal data that was collected was the participant's age, grade level, gender, and ethnicity, as it allowed for potential relationships between demographic, awareness levels, and beliefs to be established. All other personal data, such as names and emails, remained anonymous. After completing the personal survey, students proceeded to the awareness section. The first question asked students if they had been informed about plastic pollution in the Gulf of Mexico through different sources such as schools, news channels, parents, and social media. Then, students were asked to define their own awareness of plastic pollution in the Gulf of Mexico. This method was chosen because it allowed participants to freely and honestly answer the questions, leading to more reliable results. The final section of this study was the beliefs section. In this section, students were asked to identify their stances on numerous issues in environmental politics. By using this

method, the researcher was able to use prior sections of the survey (demographics and awareness questions) to examine possible correlations between the two variables being analyzed.

A total of eight beliefs were examined in this research study. The beliefs that were analyzed in correlation to a student's awareness of plastic pollution in the Gulf of Mexico included:

The federal regulation of plastic pollution in America.

The ban on plastics with less than 50% of biodegradable materials.

The belief that plastic pollution is over-exaggerated in the United States.

The belief that climate change is primarily caused by human activity.

Taxes should be raised in order to better address environmental issues in America.

We should switch to sustainable energy resources and abandon fossil fuels.

America should become energy independent.

The student's political ideology that they reported.

These beliefs were chosen for this study because the usage of these eight beliefs was common in previous literature and studies. Additionally, previous studies indicate that these are some of the most common and well-known issues in environmental politics, so students participating in this study might be more familiar with some of the survey questions regarding these issues.

After responses were collected, three categories for awareness level of plastic pollution in the Gulf of Mexico were created: low awareness, medium awareness, and high awareness. In order to put each participant in an awareness category, keywords and phrases were identified in order to insert each participant into their accurate awareness group. **Table 1** represents each awareness category and states the phrases or keywords that determine a student's awareness level, which was an approach utilized in Kumar's (2021) study. This method was utilized because it would easily permit the researcher to compare the different awareness categories in this study to determine if correlations between a belief and level of awareness exist.

Table 1

Key Terms and Phrases used and their Awareness Level

<u>Awareness Level:</u>	<u>Key Terms and Phrases:</u>
Low	<p><i>Not much; not very; I don't think that I'm aware; not really; not that aware; quite unaware; not aware at all; none; not aware; I know nothing of plastic pollution in the Gulf of Mexico; very little aware; little aware</i></p> <p><i>*Or if participant explains that they have no knowledge or has never heard of plastic pollution in the Gulf of Mexico before</i></p>
Medium	<p><i>Aware, but not of everything; somewhat aware; decently aware; semi-aware; moderately aware; general awareness; kind of aware</i></p> <p><i>*Or if participant explains that they have some knowledge about plastic in the Gulf of Mexico, but they define their awareness by using the terms provided above</i></p>
High	<p><i>Well aware; pretty aware; very aware; very knowledgeable</i></p> <p><i>*Or if participant lists a lot of facts indicating that they are very knowledgeable and aware of plastic pollution in the Gulf of Mexico</i></p>

This table explains the different terms and phrases that participants might use, and the awareness level that each term and phrase puts the participant into (Kumar, 2021).

In order to accurately determine if correlations exist, the researcher then ran chi-square tests to determine the statistical significance of the correlation. If $p < 0.05^{56}$, then the null hypothesis was rejected and a statistically significant correlation was proven to be present. However, if $p > 0.05$, then the null hypothesis was proven to be accurate, rendering any correlation between awareness level and belief. Additionally, in order to calculate the strength

56

of the correlation between the variables, the researcher calculated the correlation coefficient (*r value*) to see if there was a significant correlation between the variables.

Appendices B through **D** contain all survey materials used in this study. Prior to conducting the study, the researcher presented the information regarding the survey to an Institutional Review Board (IRB) that approved the design and resolved any ethical issues.

Hypothesis

The researcher hypothesized that as the awareness level of plastic pollution in the Gulf of Mexico increased, more students' responses to issues in environmental politics would represent stronger environmentalist values. Though students with more awareness of plastic pollution would select responses that indicate stronger environmentalist values, similarly to how individuals did in Gifford and Nilsson's study (2014), it was also predicted that they would avoid selecting response choices "Strongly Agree" or "Strongly Disagree" for many questions on the survey due to the controversial nature of this topic.

Results–Descriptive Statistics

A total of 118 responses were collected from students. There was one additional response that was classified as an outlier because they marked their age to be "45" and marked their grade level as "N/A." Due to this, it was assumed that this participant was not a high school student. Since the population gap that this study is closing is high school students in South Louisiana, the participant's response was removed from the data analysis procedure. As a result, only a total of 118 responses were taken into account for this study.

The participants were comprised of 46 males (38.98%), 71 females (60.2%), and one student who identified as non-binary (0.9%). Of the eight ethnicity categories presented, only three showed statistically significant category sizes, including White/Caucasian at 64 respondents (54.2%), African American with 26 respondents (22.03%), and Hispanic/Latino with 13 respondents (11.02%). Nine respondents (7.6%) identified themselves as being a part of more than one of the ethnicities previously listed. The other ethnicity categories (Native American, Native Hawaiian, Pacific Islander, and Other) totaled 5.08% of the remaining participants. It should be noted that although originally planned in the methodology, the correlation between a specific demographic and an individual's awareness level and response

to a belief was not explored due to time allowance. Any reproduction of this research should include more examination between a participant's reported demographic, their awareness of plastic pollution in the Gulf of Mexico, and an environmental belief.

The majority of participants documented themselves as 9th graders (36.4%) with 10th-grade students following closely behind with 33.05% of the sample size. 12th graders had the third highest population with 18.6% of participants and 11th-grade students had the lowest number of participants with only 11.9% of respondents. A breakdown of participants for each grade level is shown below in **Figure 5**.

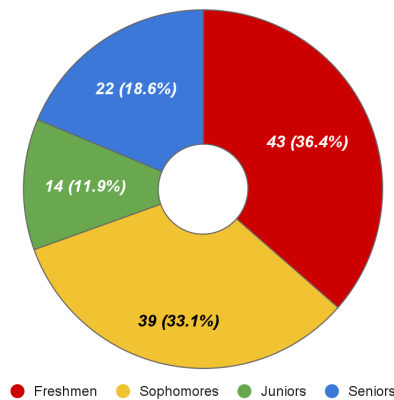
Figure 5

Number of Participants per Grade Level

Before analyzing the data to determine if there are potential correlations present between the two variables (awareness level of plastic pollution in the Gulf of Mexico and student's belief on an issue in environmental politics), it is first important to identify how many students were categorized into each awareness level (low, medium, and high). **Figure 6** below represents the number of participants categorized into each awareness level in regard to their awareness of plastic pollution in the Gulf of Mexico.

Figure 6

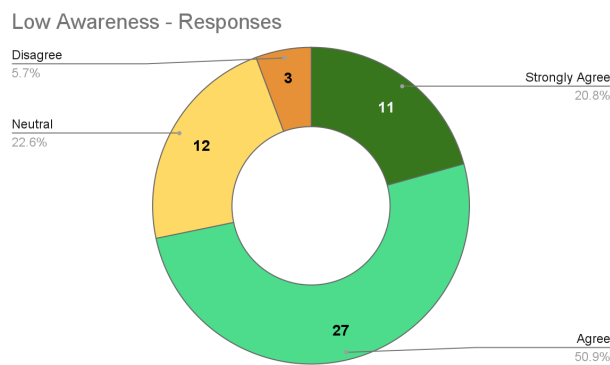
Levels of Awareness among all participants grades 9th-12th



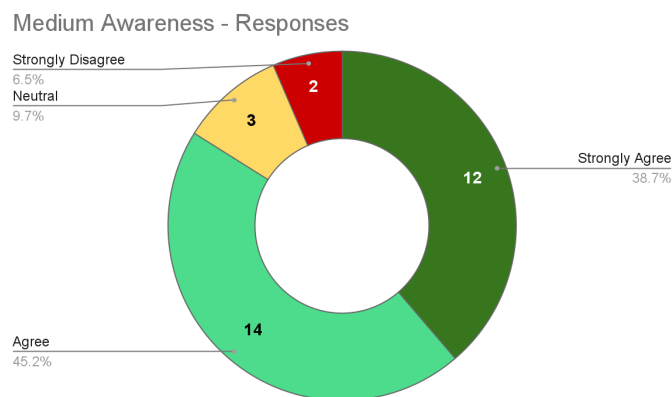
Data Analysis

In order to effectively determine if a correlation between a specific belief on an issue in environmental politics and a student's awareness level exists, it is important to analyze students' responses to the eight beliefs being analyzed in this study. **Charts 1-3** below represent students' responses to the following statement: Plastic pollution should be regulated by the federal government.

Charts 1-3: Responses to the statement "Plastic pollution should be regulated by the federal government." Charts categorized by the awareness levels: low awareness (Chart 1), medium awareness (Chart 2), and high awareness (Chart 3)

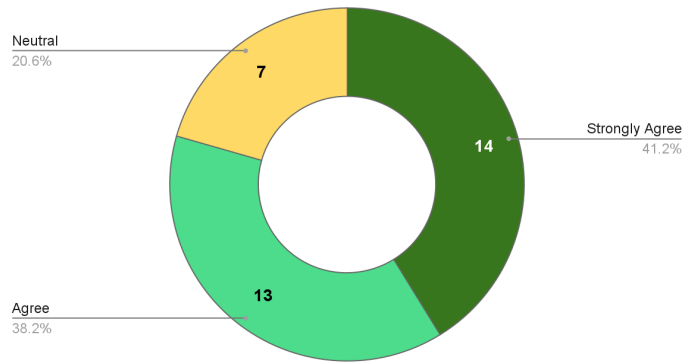


(Chart 1)



(Chart 2)

High Awareness - Responses

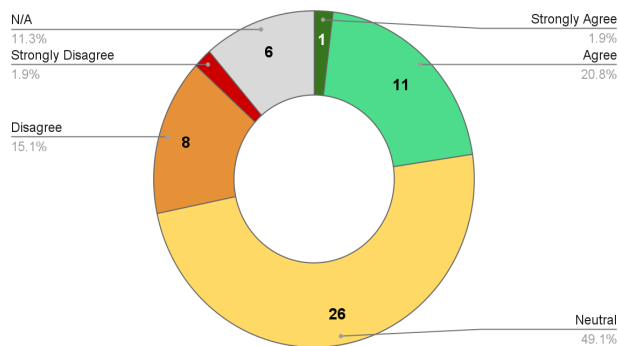


(Chart 3)

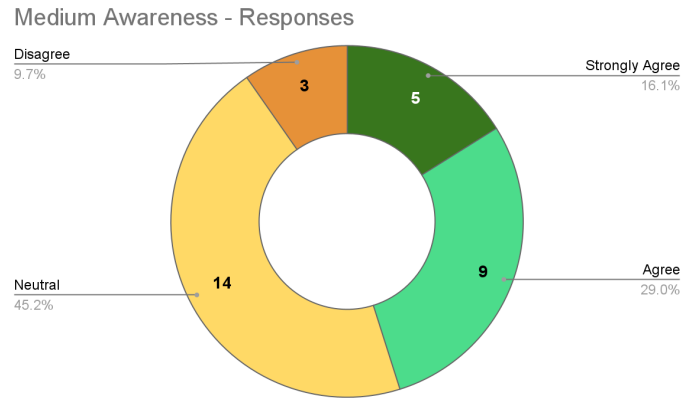
In **Charts 4-6** below, the responses to the belief regarding the banning of plastics with less than 50% of biodegradable materials are presented. It appears that a common trend among responses for this belief is that the response choice “neutral” was popular among participants of all awareness levels. This could indicate that many students may not have had strong opinions about this statement or that they might have felt the tendency to avoid marking a strong belief for this question due to its potentially controversial nature, as predicted in the hypothesis.

Charts 4-6: Responses to the statement “Plastics that contain less than 50% of biodegradable materials should be banned.” Charts categorized by awareness level: low awareness (Chart 4), medium awareness (Chart 5), and high awareness (Chart 6)

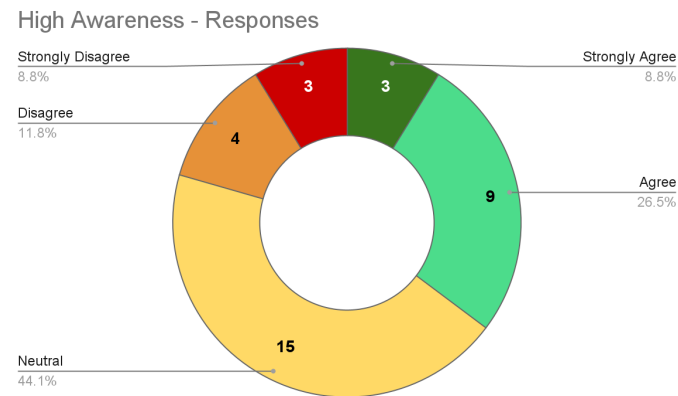
Low Awareness - Responses



(Chart 4)

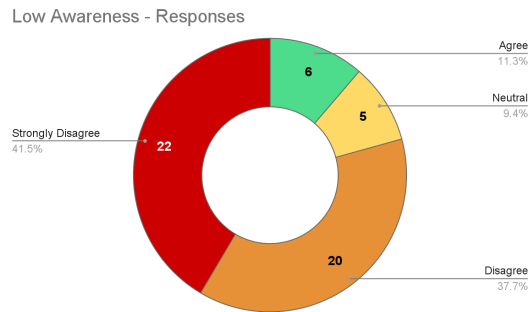


(Chart 5)

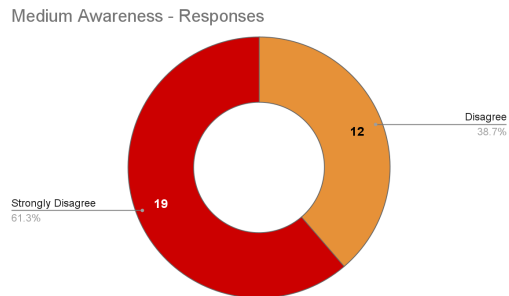


(Chart 6)

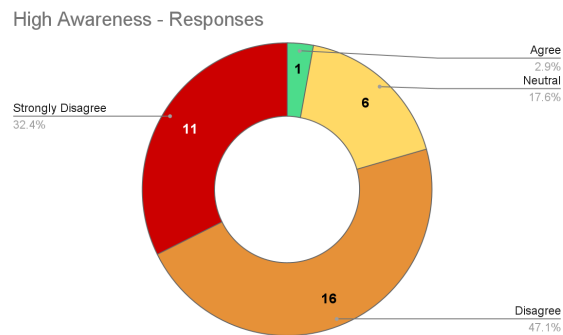
Next, the responses from the different awareness categories for the following statement were taken: Plastic pollution in America is “overexaggerated” and doesn’t need to be taken as seriously as people say. **Chart 7** below demonstrates that students with low awareness of plastic pollution in the Gulf of Mexico had a total of 6 participants (11.3%) agree with the statement. However, only a total of one student in both **Chart 8** and **Chart 9** (medium awareness and high awareness) agreed with the statement above, potentially indicating that students with a higher awareness of plastic pollution in the Gulf of Mexico tended to have stronger environmentalist beliefs towards for this statement, which could potentially support the researcher’s hypothesis. **Charts 7-9: Responses to the statement “Plastic pollution in America is “overexaggerated” and doesn’t need to be taken as seriously as people say.” Charts categorized by awareness level: low awareness (Chart 7), medium awareness (Chart 8), and high awareness (Chart 9)**



(Chart 7)



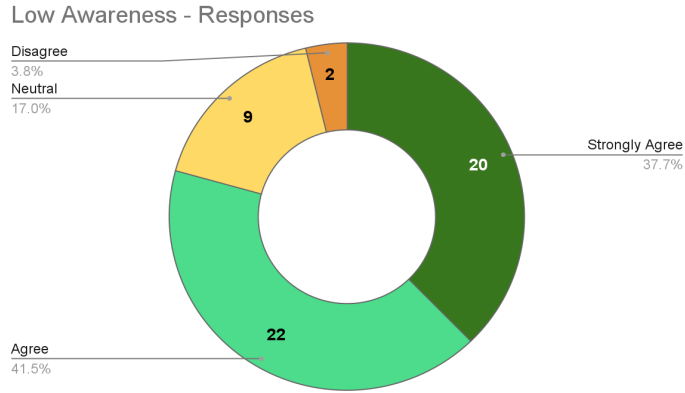
(Chart 8)



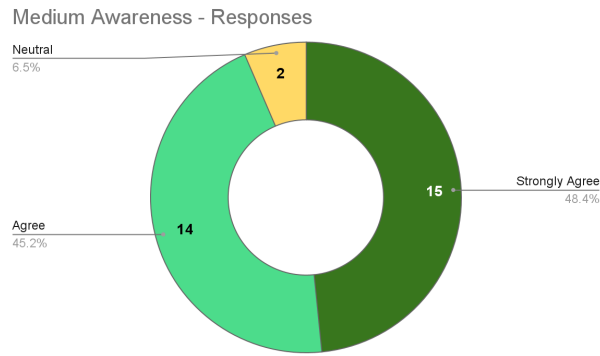
(Chart 9)

Charts 10-12 below represent the responses of students for the belief that climate change is primarily caused by human activity. More than 95% of students for each category tended to support this belief, rendering any potential correlation between awareness level and this environmental belief.

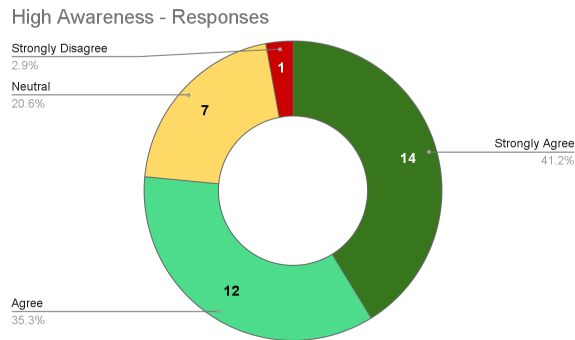
Charts 10-12: Responses to the statement “Climate change is primarily caused by humans.” Charts are categorized by awareness level: low awareness (Chart 10), medium awareness (Chart 11), and high awareness (Chart 12)



(Chart 10)



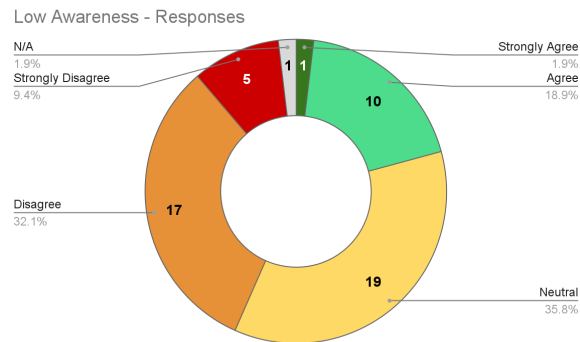
(Chart 11)



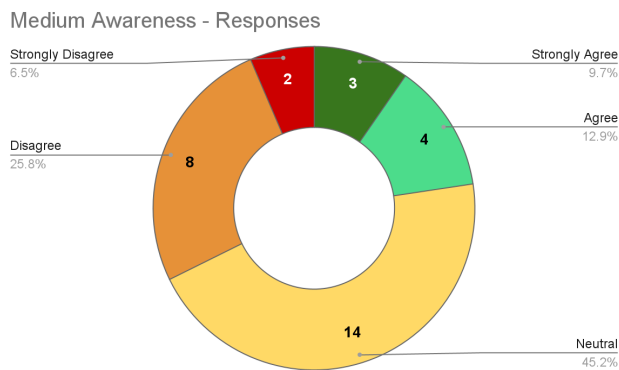
(Chart 12)

Charts 13-15 below represent the responses of students regarding the belief that taxes should be raised in order to better address environmental issues. Across all three groups, the response choice “neutral” tended to be common throughout all three awareness levels, potentially indicating that many participants didn’t have strong opinions about this statement, similar to the results indicated by **Charts 7-9**.

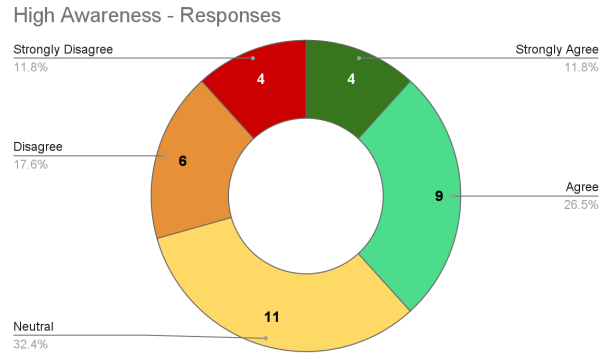
Charts 13-15: Responses to the statement “We should raise taxes to help fund programs that could potentially reduce current environmental issues in the USA.” Charts are categorized by awareness levels: low awareness (Chart 13), medium awareness (Chart 14), and high awareness (Chart 15)



(Chart 13)



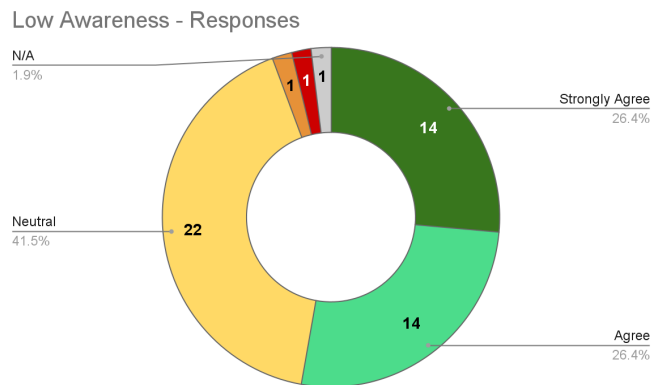
(Chart 14)



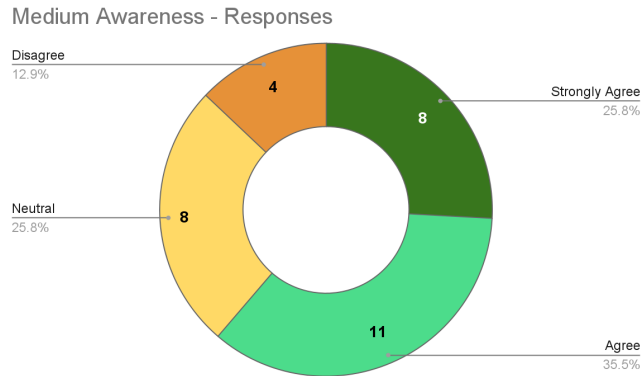
(Chart 15)

Charts 16-18 depict the responses of students to the following statement: The United States should switch to sustainable energy and abandon fossil fuel usage. One surprising observation is that participants with lower levels of awareness tend to support the abandonment of fossil fuels while students with higher levels of awareness tend to support the usage of fossil fuels in America, which potentially rejects the researcher’s hypothesis.

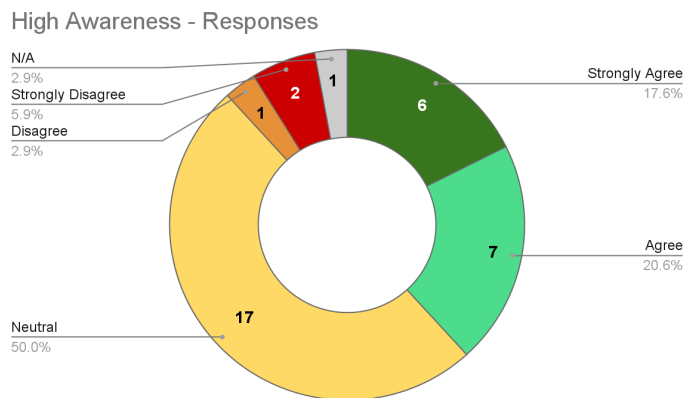
Charts 16-18: Responses to the statement “The United States should switch to sustainable energy resources and abandon fossil fuel usage.” Charts are categorized by awareness level: low awareness (Chart 16), medium awareness (Chart 17), high awareness (Chart 18)



(Chart 16)



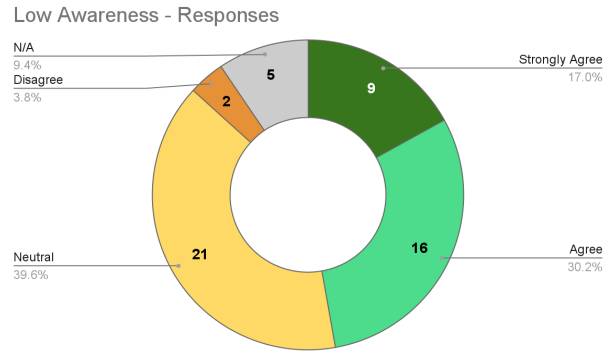
(Chart 17)



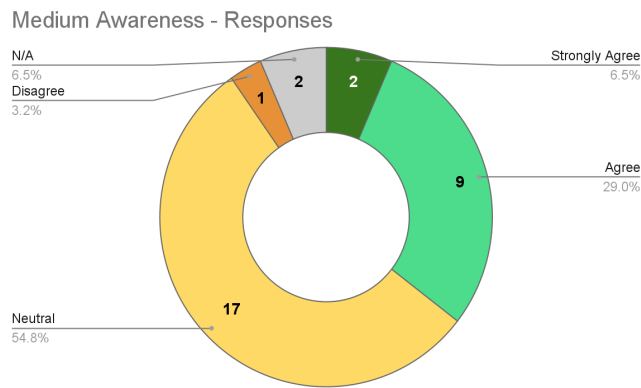
(Chart 18)

Charts 19-21 represent participants’ responses to the belief that America should become energy independent. Once again, the response choice “neutral” tended to be the most popular response choice, with 39.6% to 54.8% of participants in each awareness category selecting this response. This indicates that participants may not have had strong opinions regarding this belief. However, it is also apparent that 35.5% to 47.2% of participants in each awareness group either agreed or strongly agreed with this belief.

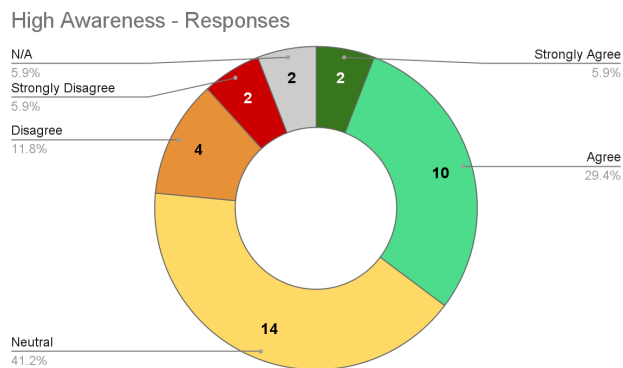
Charts 19-21: *Responses to the statement “America should become more energy independent.” Charts are categorized by awareness level: low awareness (Chart 19), medium awareness (Chart 20), and high awareness (Chart 21)*



(Chart 19)



(Chart 20)

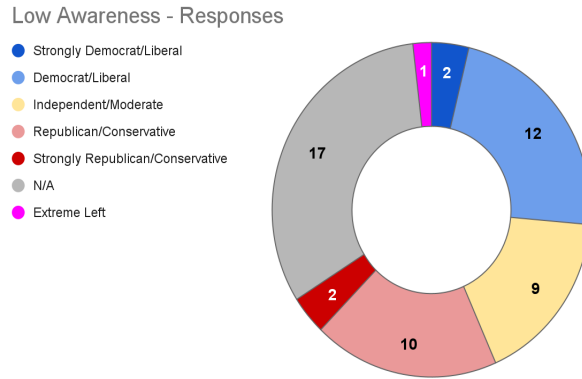


(Chart 21)

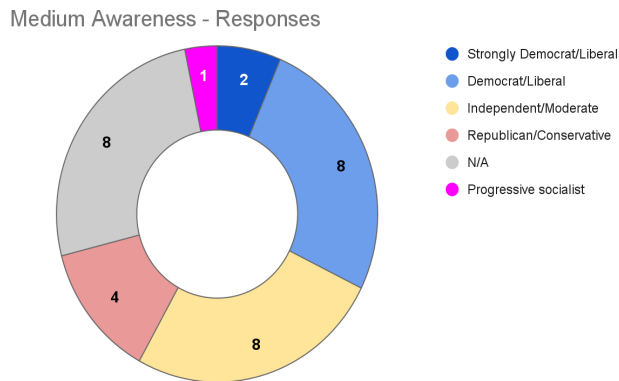
Finally, **Charts 22-24** below represent the student's identified political affiliation. For the low awareness category, the "neutral" response choice appeared the most frequently with 17 participants (32.08%) selecting this. Additionally, it appeared that political ideologies across all

three categories of awareness tended to be similar, potentially indicating that there is no correlation between political affiliation and awareness of plastic pollution in the Gulf of Mexico.

Charts 22-24: Responses to the statement “The political mindset that I primarily align myself with is:”. Charts are categorized by awareness level: low awareness (Chart 22), medium awareness (Chart 23), and high awareness (Chart 24)



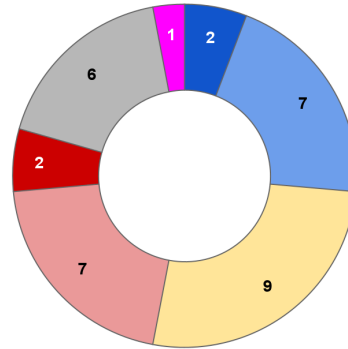
(Chart 22)



(Chart 23)

High Awareness - Responses

- Strongly Democrat/Liberal
- Democrat/Liberal
- Independent/Moderate
- Republican/Conservative
- Strongly Republican/Conservative
- N/A
- I believe in what is logical and right, political party's are stupid as both just try to make themselves richer at the expense of their voters.



(Chart 24)

Chi-Square Analyses and Significant Correlations

After responses were collected and examined, a correlational analysis eight chi-square tests were conducted between each belief and students' level of awareness to determine if there was a statistically significant correlation between the two variables (**Appendix E**). Out of the eight beliefs analyzed in this study, only one correlation was deemed to be statistically significant, which was for the following statement: Plastic pollution in America is over-exaggerated and doesn't need to be taken as seriously as people say. Participants categorized as having low awareness tended to have more students agree with the belief that plastic pollution in America is over-exaggerated, while students with higher levels of awareness tended to strongly disagree with this belief, $X^2(6, N = 118) = 14.07, p = 0.0289$. Also, the correlation coefficient calculated for this study was $-0.0208 [r(6) = -0.0208, p=0.0289]$, indicating that there was a negative correlation between the two variables. Since $p < 0.05$, it was deemed that this belief had a significant positive correlation with the level of awareness, proving that a student with higher levels of awareness of plastic pollution in the Gulf of Mexico tended to represent stronger environmental values, which proves the researcher's hypothesis to be accurate.

Inconclusive Results

The remaining data in this study produced results with $p > 0.05$. Due to this, it was concluded that these beliefs had no significant correlation with a student's awareness level. This includes responses to the following beliefs in environmental politics:

The federal regulation of plastic pollution in America, $X^2(8, N = 118) = 15.37, p = 0.0524$.

The ban on plastics with less than 50% of biodegradable materials, $X^2(10, N = 118) = 18.24, p = 0.051$.

The belief that climate change is primarily caused by human activity, $X^2(8, N = 118) = 8.18, p = 0.4164$.

Taxes should be raised to better address environmental issues in America, $X^2(10, N = 118) = 9.182, p = 0.5149$.

We should switch to sustainable energy resources and abandon fossil fuels, $X^2(10, N = 118) = 12.862, p = 0.2315$.

America should become energy independent, $X^2(10, N = 118) = 12.349, p = 0.2624$.

The student's political ideology that they reported, $X^2(14, N = 118) = 9.078, p = 0.826$.

Discussion–Conclusions

The purpose of this study was to answer the question: Is there a correlation between South Louisiana high school students' awareness of plastic pollution in the Gulf of Mexico and their beliefs on issues in modern-day environmental politics? The accomplished gap in the research from this study was the focus on the correlation between awareness of plastic pollution in the Gulf of Mexico and beliefs on issues in modern environmental politics. Also, this study determined the correlation between the two variables among South Louisiana high school students, a population that has yet to be studied. Based on the results from the study, only one correlation was found.

The correlation discovered in this study was between the level of awareness and participants' responses to the statement "Plastic pollution in America is over-exaggerated and doesn't need to be taken as seriously as people say." Results indicated that as awareness level among participants rose, responses that agreed with the statement decreased and responses that strongly disagreed with the statement increased. This rejected the null hypothesis in this study and supported the researcher's hypothesis that as awareness of plastic pollution in the Gulf of Mexico increased, more participants would select responses that represent stronger environmentalist values. This could potentially be due to participants receiving more knowledge about plastic pollution in the Gulf of Mexico through sources such as social media (Storsul,

2014). Additionally, this could potentially be due to participants being surrounded by more environmental influences that cause them to be engaged with more knowledgeable sources surrounding a specific environmental issue (Gifford & Nilsson, 2014). Additionally, it should be noted that many participants stated that they became aware of plastic pollution in the Gulf of Mexico through an environmental science class at school. Due to the rise of environmental education in America, it could have potentially caused students to have a stronger awareness of environmental issues in their surrounding environment and community, with one potentially being plastic in the Gulf of Mexico (Flanagan et al., 2021). The remaining results produced by this study showed no statistically significant correlations and were deemed inconclusive.

Limitations

Because of the small population scale of this study, as well as limited resources and time constraints, this study cannot remain fully accurate or conclusive. The largest limitation to the accuracy and reliability of the results, as mentioned previously in the analysis, is that not all options were able to be explored. Originally, the methodology of this research involved a demographic analysis between a student's demographic background, awareness, and environmental beliefs. However, there was inadequate time to effectively determine if a correlation between these three variables existed, limiting the scope of the overall results.

The method style of this research is a self-entry survey that participants were able to complete at their own discretion. Due to this, there is the possibility that students selected random responses, skipped numerous questions, or accidentally marked response choices that they did not agree with. Participants were encouraged to email the researcher if they had any questions in regards to the study; however, there is still the possibility that participants misinterpreted the questions or might not have enough knowledge about the issues in environmental politics presented in this study to effectively provide reliable results.

An additional limitation is the number of beliefs analyzed in this study. In this research, a total of eight beliefs in environmental politics were analyzed in correlation with a student's level of awareness of plastic pollution in the Gulf of Mexico. However, various beliefs in environmental politics were not able to be examined in this study due to time constraints. Due to this, participants might not be knowledgeable on the environmental beliefs presented in this

study, but perhaps they would be knowledgeable on other beliefs on issues in environmental politics if they were presented as well.

Implications

The results of this study can be used as an identifier for how adolescents in South Louisiana are beginning to shift their beliefs on issues in environmental politics. The results showed that there was one statistically significant correlation out of the eight beliefs tested. It showed that as awareness of plastic pollution in the Gulf of Mexico rose, so did the number of responses that disagreed with the belief that plastic pollution was over-exaggerated in America, indicating that participants who had a higher level of awareness tended to represent stronger environmentalist values for this belief.

By analyzing the correlations present in this study, environmental researchers, activists, and politicians will be able to examine how youth today are beginning to have stronger beliefs regarding the environment and its protection. Additionally, this personnel could compare previous studies with this one to see how environmental beliefs among a group of individuals in South Louisiana have changed over time due to more encounters with environmental issues and being heavily influenced by them. Furthermore, this study could be used to see if environmental education could be a major influencing factor in these individuals' ideologies surrounding the environment (Flanagan et al., 2021), and help policymakers decide if more environmental education is beneficial to the protection of the environment.

Before any future research or political analysis is taken place to determine further correlations between South Louisiana high school students' awareness of plastic pollution in the Gulf of Mexico and their environmental beliefs, this research should be replicated to ensure that the results of the study are completely accurate and reliable.

Future Directions

To increase the accuracy of results in this research, a future suggestion would be to broaden the sample size. This study only had 118 participants from one local high school. This study can be replicated with participants from other high schools in South Louisiana to gather more accurate data. Also, by broadening the sample size, there could be more diversity among gender, ethnicity, age, and grade level, furthering the reliability of the results. Additionally, by

broadening the sample size to other high schools in South Louisiana, one could compare data between varying school districts and demographics.

Another future direction would be to have the survey open for a longer period of time. Due to time constraints, the survey had to be closed after three and a half weeks to allow time for data analysis. In the future, the researcher should allow extended time for the length of time the survey can be opened to obtain more responses and more reliable data.

One step further would be to analyze correlations among different grade levels. Instead of primarily analyzing correlations between environmental beliefs and levels of awareness among participants, future researchers can focus on individual grade levels at different high schools to compare specific grade levels' awareness with their belief in environmental politics. This analysis method takes into account the correlation between specific grade levels and their awareness levels with their responses to the statements that determine their beliefs, leading to the most accurate results.

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An Analysis of Relationships in *A.I. Artificial Intelligence*: A Comparison to A.I. Thought in Popular Culture by Elaine Kim and Lee Conrad

I. Introduction

It is no doubt that the concern of an AI Apocalypse is high on the doomsday list. The end of the world is a popular thought, one profoundly explored in the imaginative genre of science fiction—defined dealing “principally with the impact of actual or imagined science upon society or individuals” (Sterling 2019).

The aim of the literature review is to answer: what is the depiction of AI in popular culture? Addressing the gap, the purpose of this paper is to answer the question: how do the robot-human relationships (emotional aspects) in *A.I. Artificial Intelligence* compare and reflect the thought of AI in other popular culture? The means to the answer is a comparative content analysis.

Situated in the science fiction genre, the selection to the film *A.I. Artificial Intelligence* was narrowed down for the reason that it was understudied despite its great box office revenue and positive reactions (“Artificial Intelligence: AI (2001) - Financial Information”). A criteria for a good box office is when a film gains 50% or more of its budget globally (Anders 2011). With a budget of \$90-100 million, *A.I. Artificial Intelligence* reaped \$235,926,552 worldwide (“Artificial Intelligence: AI (2001) - Financial Information”).

II. Literature Review—II-I. AI in Other Popular Culture

This section of the literature review aims to explore fears of artificial intelligence (AI) and dissect thoughts of AI in popular culture.

Science Fiction

To begin holistically, the film of study—*A.I. Artificial Intelligence*—is science fiction, which is defined as a form of fiction that focuses on the impact of science on society (Sterling 2019). The genre is coined to emerge from the West during the Industrial Revolution which first enlightened intellectuals to ponder the future implications of improving technology (Sterling 2019). In the internet age, researchers now look towards an “AI apocalypse,” where science fiction in popular media depicts modern issues such as epidemics, floods, fires, and famines,

demonstrating a struggle in seeing future implications of more complex nightmare scenarios (Berlatsky 2019).

Writer and film critic Noah Berlatsky writes about the intersections between cultural fear and science fiction. Every era in history contained its own concerns: during the Cold War, people feared infiltration of spies and deadly nuclear weapons, which is shown in *The Terminator* (1984); President Reagan admitted after seeing *The Terminator* to being inspired to push for arms control which clearly shows the impact of popular media on the public (Berlatsky 2019). Common themes moved on to climate change with *The Day After Tomorrow* (2004), and replacing nuclear technology fears to intelligent AI fears was depicted in *Avengers: Age of Ultron* (2015) (Berlatsky 2019).

AI Apocalypse

Public insecurity on an AI apocalypse is only fueled when renowned people in the area such as SpaceX CEO Elon Musk tweets that “we need to be super careful with AI” because it is “potentially more dangerous than nukes” (Shermer 2017, 77). Shermer references other notable people such as Stephen Hawking and Bill Gates to express their apprehension towards the further improvement of AI. Similarly, Victor Luckerson devotes his article to expound on smart people who believe in an AI apocalypse.

Luckerson also mentions philosopher Nick Bostrom’s argument that once AI intelligence becomes greater than humans’, they could decide to eradicate the human race, which Shermer clarifies. He mentions specifically Bostrom and his famous thought experiment known as the paperclip maximizer (Shermer 2017, 77). The thought is that a superintelligent AI can arbitrarily work on any goal forever; the paperclip maximizer AI would continuously make paper clips using every atom available, including humans, to achieve its goal in making more paper clips (Rogers 2017). However, despite the proliferant discussion on an apocalypse, Shermer expresses skepticism on its occurrence as the progression of AI has been slow throughout the decades.

Addressing the scientific community, Luckerson discusses singularity in his article—meaning that at some point in time, AI will be created that humans have little control over (Luckerson 2014). Luckerson reveals that it could either create utopia or cause destruction. Stuart examines Quantic Dreams’s narrative game *Detroit: Become Human*, which looks into the future implications of relying on smart AI (Stuart 2017). Like Luckerson discussed with a utopia

or destruction, the game demonstrates the theory exactly. It is set in the future and androids are performing menial tasks while humans' purposes are to find pleasure, which directly shows a utopian scenario of the incorporation of AI into society (Stuart 2017). The game's narration however progresses to show a group of androids that demonstrate human awareness, and start demanding rights, causing destruction; of this act, humans are afraid (Stuart 2017).

Jacob Brogan from *Slate* acknowledges the fear of artificial intelligences rising up to kill the human race, however he presents a counterargument that the caution surrounding the topic is excessively alarmist and, similar to Shermer's skepticism, that an apocalypse itself would take much longer than anticipated (Brogan 2016).

Androids and Public Opinion

The topic of *A.I. Artificial Intelligence* is on androids. Riper defines androids as “robots designed to look and act human,” where true androids would “have full, fluid mobility” and be “intelligent enough to interact in flexible and adaptable ways” which is shown in *A.I. Artificial Intelligence* through high-technology robots such as David (Riper 2002, 8). Realistically, we are far from AI development with fluid mobility, however in popular culture, androids are depicted as easily fluid; they are like perfect human imitations (Riper 2002, 8). Following Riper's evaluation of the realisticness of AI in popular culture, Shultz critiques ten movies on AI and examines what they get right and wrong based on realism and gives it a score out of ten. *A.I. Artificial Intelligence* by Steven Spielberg he rates low on the scale (3/10), with the reason being that the film made it seem too easily achievable for such a conscious robot to be invented; to make it more unrealistic, a single team of scientists created the mecha from scratch in 18 months (Shultz 2015). In the opinion of AI expert Russell, the AI was too well accepted into the society of the film (Shultz 2015). This examination by Shultz differentiates popular culture from the scientific community, in which this paper will have a focus on the former.

Baobao Zhang studied public opinions toward artificial intelligence, and he found variations in attitudes based on gender and demographics. Women and those with lower socioeconomic status tended to be less supportive and trusting of AI than others (Zhang 2021, 3). He explained that this statistic could be supported with gender discrimination, where AI tends to be discriminatory against women. For instance an AI job selector excluding women from selection (7). Partisanship and race can affect attitudes toward specific applications of AI, such

as facial recognition technology, where he concluded that the public is not “monolithic in their attitudes” (7).

II-II. Analyses on *A.I. Artificial Intelligence* (2001)

This segment of the literature review examines previously made analyses on the film. Four authors will be discussed, each contributing to a different perspective of the film.

Jackson & Imitation Humans

Retrograding, Riper briefly mentioned AI in popular culture being effortlessly perfect imitations of humans (contrasting to reality). Dr. Tony Jackson first defines imitation as “a purposeful creation that looks or sounds like something else that is not an imitation” (JACKSON 2017, 48). In his analysis of *A.I. Artificial Intelligence*, Jackson applies cognitive, scientific, and social neuroscientific research as a foundation for looking into human imitations in the film (48). He discusses humans’ interest in imitations of themselves (imitative identity) by referring to professor Alan Hobby, as Hobby explains the historical dream of mankind creating artificial humans (56). Jackson connects this psychological thought to his film analysis by explaining how understandings of imitative identity provide a basis to interpreting cultural works.

Referencing the science behind imitative identity, Jackson compares the movie to humans’ hardwiring for attraction and fascination of imitations of themselves (52). He specifically discusses “overimitations” which are imitations that so closely resemble humans to the point of dissonant illusionment where the brain knows one thing and the eyes see another (51). Jackson analyzes the movie with this dissonance in the human characters when interacting with David (AI), the perfect imitation.

Jackson concludes that all stories on imitation humans, or AI, are essentially stories about humans and their imitative identity.

Kreider & A Story of Humans

Agreeing with both Jackson and Riper, Tim Kreider makes it one of his main points that *A.I. Artificial Intelligence* (2001) is a story on humanity rather than an artificial boy searching for real love (Kreider 2002, 32). Kreider reflects on a sequence of scenes where the audience follows the emotions of the characters shown as they move from laughter to suspense and horror; just

like the robot David, the audience as people imitate the expressions shown to them, disquietingly equating humans to robots (33).

Kreider also focuses on David's constant Oedipal fixation, explaining how David is hardwired to dream about receiving his mother's love (33). Shultz commented that this aspect of David is what earned the movie realism points as a robot can only do as it is programmed (in David's case, to love and seek it). This, however, Kreider claims, is what makes David human, and this is what makes every human character in the film seem as hardwired as David. They each are obsessed with a love that they lost (34).

Kreider analyzes the movie as a depiction of the death of humanity, explaining the grotesque cruelty demonstrated by the human characters. As an example, Professor Hobby stabbed a female AI to show his audience that the generation of emotionless mecha cannot really *feel* pain. He ordered the AI to undress in front of his crowd, and he split her human-like head to reveal her mechanical parts, where Spielberg makes an artistic choice to zoom in on her face tearing up. Hobby did this to demonstrate that his AI does not have the capacity for real love and hurt, but Kreider asserts that this demonstration really demonstrated Dr. Hobby's inhumaneness, where *A.I. Artificial Intelligence* is not a film on robots but about the cruelty of human beings.

Rosenbaum & the Prophecy Factor

Rosenbaum focuses on the prophesying factor of science fiction works, explaining that science fiction movies obtain their value by prophesying futuristic events (Rosenbaum 2012, 75). He claims that *A.I. Artificial Intelligence* is a limited prophecy movie because the only prophesying element is the destruction of Earth which is demonstrated with the sinking of Manhattan and the takeover of humans by intelligent lifeforms with advanced technology (76). He refers to a dialogue between two AI characters, Gigolo Joe and David, where Joe tells David that the reason the humans hate them is due to their own fault that they made the AI "too smart" and "too many" that they are going to be the only ones left once humanity dies (76).

The reduction of the world to solely America also limits the prophesying factor of the movie (76). Rosenbaum dissects the settings and narration, where the setting of the exposition briefly bricked over Europe, him commenting that doing so already confined the world to the West.

Tibbetts & Literary Choices

Tibbetts divides the film into three sections: a domestic drama, a road picture, and a digitally-enhanced dream (Tibbetts 2001, 257). He claims that each section is distinguished by its tone, where the first one is a “soft-edged pastel fable of childhood,” the second a hard adult world, and the third, a blurry, dreamy technicality (257).

He transitions into a discussion of two prominent metaphors in the film: the processes of adoption and the story of Pinocchio. David, as a robot seeking love, is too eager to please—which Tibbetts says is a quality that makes him harder to love—which he claims is a metaphor for the processes of adoption (258).

Tibbetts examines both the original story by Carlo Collodi and the Disney adaptation of Pinocchio, claiming that on a surface level, the film compares Collodi's Pinocchio with all the characters from *A.I.* aligning to the story's (258). However, in a deeper dive, the film aligns more with the Disney adaptation because the robot never develops a moral sense, but is only driven by his desire to receive love from Monica (258).

Tibbetts mentions that the depictions of the relationship between man and robots that permeated throughout *A.I. Artificial Intelligence* was not a new thought. These relationships are what will be dissected in this study.

II-III. The Gap

The gap is in comparing the relationships between humans and robots in *A.I. Artificial Intelligence* and relating it to how it depicts thoughts of AI in popular culture. Although there is numerous literature on reviews of *A.I. Artificial Intelligence* like the four authors mentioned above, and even research on how relationships of humans and robots depicted in popular culture may affect the public, there is no comparison between human and robot relationships specifically in *A.I. Artificial Intelligence* to determine to what extent that it (and generally popular media) depicts popular culture or contributes as an influence to the public (Mubin, et al.). With this, the inquiry examined in this study is: **how do the robot-human relationships (emotional aspects) in *A.I. Artificial Intelligence* compare and reflect the thought of AI in other popular culture?**

III. Methods

Film is a reflection of society (Shah and Sherak 2015). Movies tell someone's story, and it comes from their culture: where the society has been, where it is presently, and where it is going (Shah and Sherak 2015). Theoretically, reflecting on the proliferation of their depictions in science fiction movies, that means that America as a culture values technology, artificial intelligence, and humanoid androids with emotional capacities. For this reason, a film study was chosen as a means to first explore the gap and research inquiry.

The film *A.I. Artificial Intelligence* was selected for the reason that it was understudied despite its great box office revenue and positive reactions (“Artificial Intelligence: AI (2001) - Financial Information”). A criteria for a good box office is when a film gains 50% or more of its budget globally while *A.I. Artificial Intelligence* reaped \$235,926,552 worldwide with a budget of \$90-100 million (Anders, 2011 & “Artificial Intelligence: AI (2001) - Financial Information”). It is likely that this film has minimal studies because artificial intelligence with emotional capability is unreplicable in science currently. In support, one study examined works of artificial intelligence in science fiction, and filmatic robots were chosen based on their influence on the real world (like Wall-E for Fujitsu's RoboPin) (Mubin et al. 2019).

The film is characteristic of having a protagonist who is a robot with emotions, specifically love, fulfilling the purpose of my research in looking at the emotional relationships between robots and humans to find the implications of emotional robots on society.

III-I. Comparison Factor

To address the inquiry, a comparison factor for AI in popular culture was first established. For determining a comparison factor for AI in popular culture, multiple papers and articles about science fiction and AI in popular culture were read and analyzed based on a content analysis procedure. For clarification, the themes that came out of this comparison-factor content analysis were applied to the film where the relationships between robots and humans were analyzed. This was done in order to conclude the extent that the movie aligns to real life popular culture, so that the implications of this study can be more applicable.

A separate Google Document was created in order to organize and interpret information and create codes of comparison for themes in *A.I. Artificial Intelligence*. Important aspects of certain articles (such as segments that answer the question “What is the depiction of AI in pop

culture?”) were excerpted into the Google Document under headings of “General Concerns and Fears,” and “Depiction and Effect” (the headings were decided after a general search for AI in pop culture and organizing themes). Underneath “General Concerns and Fears,” excerpts about the general public’s concerns about artificial intelligence were noted. For example, evidence that AI takeover is a human concern was under this heading. Underneath “Depiction and Effect,” excerpts about examples of AI depictions in media and the public’s reaction were noted. For example, evidence of AI depictions being correlated with feelings or thoughts of the public were under this heading. For organization, similar themes that appeared were highlighted in a congruent color (for instance, a theme of AI takeover will be colored yellow, and public fear will be green). The different themes that were color-coded were deemed the determinant codes of “AI in popular culture” that determines the extent to which *A.I. Artificial Intelligence* reflects and compares thoughts of AI in the public domain. Any code that deterred from one extracted from this step was determined as a “deviation from theme” and named a limitation.

The coding framework, or comparison factor, is as follows: numerous accounts for concerns of AI overtaking humans were observed (Daley 2022) (Hao 2020) (Rainie et al. 2022). The concern was mainly over the workforce (Daley 2022) (Rotman 2022). This is justified by the fact that human jobs in factories, hospitals, and institutions have been replaced by machines that are faster, more efficient, and cost effective. Thus people are afraid of losing their jobs. The theme named for this category was “competition.” Fear and discomfort towards the implementation and improvement of AI were also abundant, especially towards losing privacy, being overtaken by smart, autonomous AI, and the threat of the unknown and potential (Daley 2022) (Hao 2020)(“AI in Pop Culture” 2020). From this, “fear” and “discomfort” were also added as comparison factor themes. In contrast to the aforementioned concerns, there was also positive excitement and expectation for the improvement of artificial intelligence to improve societal functions and increase leisure (Rainie et al. 2022). The final themes were competition, fear, discomfort, and excitement.

III-II. Content Analysis

A content analysis was applied for this study as large amounts of communicative content, like this film can efficiently be organized through succinct codes that are customizable to the excerpt (Columbia Public Health). It would reveal patterns within the open ended work and

examine the strength between correlation of the relationships between robots and humans in *A.I. Artificial Intelligence* (Columbia Public Health). Applying the codes from the comparison factor framework, a content analysis of the film allows a comparison of the film to real life.

To narrow down the scope of the research inquiry (how do the robot-human relationships in *A.I. Artificial Intelligence* compare and reflect the thought of AI in other popular culture?), a relationship was defined by its emotional aspects, especially because the comparison framework to popular culture consisted of emotions. Emotions in the film during analysis were defined through facial expressions and body language as they are two physical symptoms of emotional expression that can be clearly and easily noted.

A.I. Artificial Intelligence was watched initially. Impressionable thoughts, themes, impressions were noted (especially emotions exchanged between the relationships) on a separate document. The film was rewatched. Each occurrence of robot-human interactions were noted with timestamps. Upon watching, the David (robot protagonist with emotions)-Monica (adoptive human mother of David) and David-Martin (biological human son of Monica) relationships were believed to be the most significant as they had the most frequent and longest interactions while contributing to the movement of the plot. These two relationships were chosen to be further analyzed.

Transcripts were written for each of the timestamps between the two relationships and then their conversations were analyzed based on whether they exhibited the four comparison factor themes. Clips of the timestamps were also rewatched to determine emotion by facial expression and body gestures.

III-III. Limitations

This study was limited due to an inevitably biased framework as well as its narrow parameters. The search engines used may have already been catered to specific search results due to previous searches, and may have had faulty searches for defining AI in popular culture.

The study was constricted to relationships being defined through their emotional aspects, and further, emotions were defined with their physical expressions. Although this allows the study to be specific and could be a good start to address the gap in research, there are many more factors that can be confounding variables in relationships.

IV. Findings

IV-I. David and Monica



Figure 1. “Monica and David Discomfort” Dreamworks Pictures and Warner Bros. Pictures, 2001. Presenter’s Screenshot.

In Figure 1, in the picture to the left, David was staring at Monica reading her newspaper and drinking her coffee. Monica is interpreted to be bothered in this scene as she glances to the side on multiple occasions, noticing David’s presence. Later on, shown on the right, she completely faces her back towards David, indicating discomfort in looking at him or being in his presence and gaze.



Figure 2. “Monica and David Apprehension” Dreamworks Pictures and Warner Bros. Pictures, 2001. Presenter’s Screenshot.

In Figure 2, Monica is doing chores around the house and David follows her out of curiosity and attachment. She looks at David and reverts her gaze shown on the leftmost screenshot. The aversion of eye contact sets an awkward atmosphere and starts building tension. After some suspenseful time, Monica quickly jumps away from David to do a task out of his presence. As she walks back to her spot, she flinches at David, showing a release in the tension that was there before. Monica's relationship with David demonstrates the fear and discomfort of AI depictions in popular media through her nervous facial expressions and aversive, defensive body language. Even her avoidant behavior.

IV-I. David and Martin



Figure 3. "David and Martin Compete Over Supertoy" Dreamworks Pictures and Warner Bros. Pictures, 2001. Presenter's Screenshot.

Figure 3 depicts the first interaction between David (left) and Martin (Right), and the first thing they participated in was a competition to who can attract the bear robot toy (middle) to them. Martin has hasty movements in his hands and arms, invisibly pulling and strongly urging the toy to come to him. His face is marked by vigor as his eyebrows and eyes are propped up and open. David's face is more worried and serious, as if this competition would determine who is the better son.

David and Martin's interaction began with a competitive tone and set the route of the relationship to be based on jealousy and overtaking each other for Monica's love.

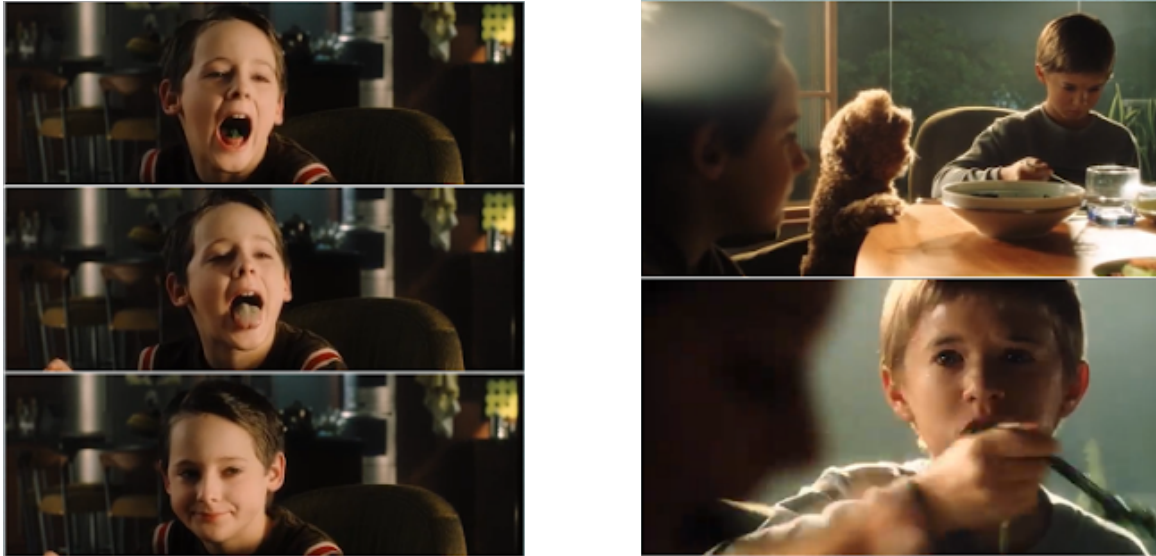


Figure 4. “David and Martin Compete Over Eating” Dreamworks Pictures and Warner Bros. Pictures, 2001. Presenter’s Screenshot.

The scene represented in Figure 4 is another example of the competitiveness between David and Martin, stemming from their mutual jealousy and feelings of inferiority towards each other. David is pretending to eat along with his human family as he is unable to eat real food, and Martin provokes him by showing David that since he is real, he can eat real food, and he sends him a smug smile. David looks upset and falls prey to Martin’s provocation. David starts eating with intensity, glaring at Martin who also starts eating faster.

Their relationship is marked by challenges to each other, trying to compete for the top dog position of the most love from monica. Their competitiveness is shown through their glaring facial expressions and hasty body language that aligns with thoughts of AI comparison factors.

V. Discussion and Conclusion

The findings of this study exhibited alignments to the initial comparison factors set up to determine whether the relationships in *A.I. Artificial Intelligence* matches AI depictions in popular culture. The research inquiry—how do the robot-human relationships in *A.I. Artificial Intelligence* compare and reflect the thought of AI in popular culture?—was answered as David and Monica’s relationship was characterized by the comparison factor themes of fear and discomfort which was indicated by Monica’s nervous facial expressions and aversive, defensive

body language. David and Martin's is marked by competition shown by their glaring facial expressions and hasty body language.

IV-I. Limitations

Additional limitations that were revealed after data collection and analysis were deviations from themes and the fact that this study is strictly qualitative. There were four comparison factor framework codes (competition, fear, discomfort, and excitement). In *A.I. Artificial Intelligence* excitement was noted as absent from the film and between the relationships of David-Monica and David-Martin. Although there were moments of awe as well as disappointment, they were both indicative of creepiness and unacceptance rather than the positive connotation of excitement for the implementation of AI. This may imply that especially in the primordial stages of the introduction of robots with emotions into society, there will be more concerns and fears than positive emotions.

Other deviations included guilt, acceptance and love, and protection. Monica especially struggled with her feelings of guilt while experiencing dissonance from David looking and acting like a real boy, but is really a robot. At some points, Monica accepted David as her son and loved him to the extent she could. In the film, David attaches to Martin in safety mode and they fall into the swimming pool. David is named too dangerous for Martin and Monica's husband demands she take him to be destroyed. In guilt and love Monica abandons him in the forest instead to let him free. Martin even demonstrates protecting David as Martin's human friends harass David for being a robot.

Other than the deviations from themes, another limiting factor revealed from the data analysis is that this study is strictly qualitative. There are no numbers to run statistical analysis and measure the correlation coefficient. This study does not quantify whether these results are statistically significant.

There is room for future research to quantify the emotional exchanges between these relationships as well as expand on the definition of a relationship.

IV-II. Implications

The implications of this study are that it shows a demonstration of humans' reactions to a robot with emotions without needing to develop and introduce emotion-capable robots to the

public. As competition, fear, and discomfort was demonstrated in the film as well as some conflicting emotions such as guilt, it can be implicated that the public will react this way, especially with minimal excitement.

The change from apprehension towards David to acceptance of him in the film propagates normalcy of robots in society and quells fears towards AI. It even may “prepare” humans for robots to come.

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Perspectives from the Buyer and Seller on Mergers and Acquisitions of Private Companies

By Aarav Khedkar

Introduction

Mergers and acquisitions mean 2 different things. The buyer usually gets the profits of the company that is bought. A Merger usually refers to 2 companies joining together as partners to become one company. An Acquisition is the process of one company buying another. In an acquisition one company purchases the assets or shares of another, usually in the form of payment cash.

Mergers and acquisitions are essential in the world of business. Mergers and acquisitions played a major role in the formation and growth of many big companies, private and public. M&A started in the United States in the 18th century⁵⁷. Over the course of time, M&A has gone through six different waves.¹ The first wave was from 1897 to 1904.¹ In this wave, M&A became more popular in firms and organizations that wanted to benefit from their manufacturing.¹ Most of the deals in the first wave, however, were unsuccessful.¹ The second wave was from 1916 to 1929.¹ In this wave, the purpose was to enter business in M&A that didn't want to enter monopoly and instead wanted to enter oligopoly.¹ The third wave occurred from 1965 to 1969.¹ In this wave, many of the deals were conglomerated.¹ The wave ended and moved on to the fourth wave.¹ The fourth wave was from 1981 to 1989.¹ In this wave, hostile mergers were found to be a tolerable type of business.¹ A hostile merger is when one business purchases a target business without the target's management's approval.⁵⁸ The merger that was started between the oil and gas, pharmaceutical, banking, and airlines are recorded in the fourth wave.¹ The fifth

⁵⁷ Malik, Muhammad Faizan, et al. "Mergers and acquisitions: A conceptual review." International Journal of Accounting and Financial Reporting 4.2 (2014): 520.

⁵⁸ GoCardless. "Hostile Takeover Definition." United Kingdom, GoCardless, 26 July 2021, gocardless.com/en-us/guides/posts/hostile-takeover-definition/#:~:text=Mergers%20and%20acquisitions%20aren%E2%80%99t%20always%20mutually%20beneficial%20or,target%E2%80%99s%20management%2C%20this%20is%20called%20a%20hostile%20takeover.

wave was from 1992 – 2000 and occurred in banks and telecom segments.¹ In comparison to debt financing, the deals were supported by equity capital.¹ The sixth wave was from 2003 – 2007 and occurred by merging the metals, oil & gas, utility telecoms banking, and Health care center.¹ Growing globalization and government assistance for particular countries like France, Italy, and Russia to produce strong national and international champions served as the fuel for this wave.¹ Because businesses were willing to extend loans at low-interest rates, private equity buyers acquired an important role, accounting for 25% of the whole takeover trend. Deals with cash as the financing were much more common during this time.¹

Negotiations

The term negotiations in general refers to 2 or more parties attempting to come to an agreement on a specific issue.⁵⁹ In the sense of M&A, Negotiations are a series of important steps that are deciding what is being acquired, the correct form of payment, and deciding the proper choice of legal structures that best fits the acquisition of the business and operating the acquired business and closing. As with many firms that have gone through mergers and acquisitions over the years, Pfizer, a public company, followed the same pattern: management decided that an acquisition would be the most effective way to implement the firm's business strategy; a target was chosen that matched the strategy, and a preliminary financial analysis yielded satisfactory results.³ Public companies and private companies have many similarities when it comes to negotiations. In private company negotiations, the next step is to approach the target and begin negotiations, a process that generally begins with the buyer setting an initial offer range based on preliminary information.³ Before releasing additional information to the buyer, the seller may ask for some indication of the price.³ After performing adequate due diligence, a wise buyer will provide a tentative purchase price or indication of value for the target firm.³

Two parties typically proceed to negotiate specific preliminary legal documents after it is assumed that the target company will accept the buyer's preliminary acquisition bid.³ A confidentiality agreement and a term sheet or letter of intent are also included.³ There are situations when the buyer and seller both decide to forego the letter of intent and begin

⁵⁹ DePamphilis, Donald. *Mergers and acquisitions basics: negotiation and deal structuring*. Academic Press, 2010.

negotiations for purchase and sale.³ A confidentiality agreement, also known as a nondisclosure agreement, is typically desired by all parties to the deal and is usually mutually binding, covering all parties to the transaction.³ In order to challenge the confidentiality agreement, the buyer demands as much more information and audited historical data as the seller is prepared to give.³ Similar information about the buyer is requested by the cautious seller in order to evaluate the buyer's financial reliability.³ Early on in the process, the seller must assess the trustworthiness of the buyer in order to avoid wasting time on a candidate who cannot secure the funding necessary to complete the sale.³ Only non-public information should be covered by the agreement, and it should have a realistic expiration date.³ The buyer asks for as much additional information and audited historical data as the seller is prepared to supply when negotiating the confidentiality agreement.³ In order to evaluate the buyer's financial credibility, the seller wants similar information about the buyer.³ Early on in the process, the seller must assess the trustworthiness of the buyer in order to avoid wasting time on a candidate who cannot secure the funding necessary to complete the sale.³ Only non-public information should be covered by the agreement, and its expiration date should be fair.³

It is helpful to establish any points of disagreement at the start of a negotiation.³ This can be accomplished by having everyone evaluate the pertinent information about the deal.³ In general, parties may agree on the majority of facts quite quickly. From there, locating the subject of disagreement is simple.³ The next step is for each side to assess any potential deal-breakers.³ A deal breaker is a point that one of the parties to the negotiation cannot accept without rendering the agreement unworkable.³ A deal breaker could be that the companies just aren't a good fit, it could be legal challenges, or financial issues.³ Negotiators should make concessions on conflicts that aren't regarded as deal breakers, but only in exchange for something.³ When all disagreements are resolved and a price has been agreed upon, the negotiations have been completed.

Due Diligence

Due diligence is used by buyers to verify the valuation's underlying assumptions.³ Due diligence is important because it protects an individual's company. Identification and confirmation of prospective sources of value or synergy, as well as risk mitigation by searching for fatal faults that lower value, are the main goals of the buyer's due diligence.³

Due diligence contains three main reviews. First, a financial evaluation is overseen by financial and accounting staff.³ Second, a strategic, operational, and marketing assessment is carried out by senior operations and marketing management.³ Third, a legal review is carried out by the buyer's legal counsel.³ Thorough due diligence demands the development of extensive checklists.³ The management team, operations, and sales and marketing strategies of the seller are the main topics of the strategic and operational review questions.³ The quality, completeness, and timeliness of the seller's financial statements are the main topics of the financial review questions.³ Lastly, legal difficulties relate to corporate documents, financial matters, management and employee issues, tangible and intangible assets of the seller, and significant contracts and obligations of the seller like litigation and claims.³ The information obtained through the interview process is very important. The acquirer can verify the validity of their findings by posing identical questions to a number of senior managers.³ The buyer usually wants more time to do the due diligence while the seller would want to lessen the time. The seller does this because due diligence rarely benefits the seller.³ In due diligence, a thorough investigation is likely to turn up issues that the buyer will use as justification for negotiating the price down. Due diligence may therefore be terminated by the seller before the buyer thinks it is acceptable.³ By locking the acquirer's team in a data room, sellers can limit the amount of due diligence that is performed.³ This usually involves a conference room that is crammed with file cabinets and boxes of paperwork that the buyer's due diligence team has asked for.³ Key managers of the seller deliver formal presentations in the data room, which is frequently crowded. In other cases, the information on a password-protected website may only be accessible to a limited number of buyers.³ Unsurprisingly, a visit to the seller's facilities cannot be replaced by using the data room.³ Virtual data rooms are increasingly popular, allowing prospective buyers access to a password-protected website that contains financial and other pertinent information about the seller.³

So, overall, there are different types of due diligence for buyers and sellers, but they are equally important to the mergers and acquisitions process. Due diligence is a vital part of Mergers and Acquisitions.

Deal Structuring

Deal structuring is the process of deciding how the transaction will be structured. There are three primary ways to structure a deal: Selling stock or equity, mergers, and selling assets. The main types of deals are stock sales and asset sales.

In a stock sale, the seller sells their equity interest in the company to the buyer, and the buyer then becomes the owner of the company.⁶⁰ However, an asset sale is different. In an asset sale, the seller itemizes all the assets of the business and transfers them to the buyer. Sellers usually want to sell stock because by doing so they can get favorable capital gains treatment, while buyers want to purchase assets because they can mark the value of those assets up to their fair market value and depreciate them again.⁴ Buyers also want to purchase assets rather than stock because if they buy the stock, then they also take over the liabilities of the company which would not be in their favor.⁴ However, there are ways to carve out certain liabilities, or the seller could indemnify the buyer for certain liabilities. Stock sales are considered a capital gains item, and if they have held the stock for longer than a year, they can get long-term capital gains treatment.⁴ Additionally, if it's qualified small business stock, a special type of corporate stock, they potentially can have no tax.⁴ On the other hand, buyers usually prefer to buy assets because they can then mark up the value of those assets to their fair market value and then depreciate them again.⁴

Because they can receive favorable capital gains treatment, sellers prefer to sell stocks in terms of tax treatment.⁴ Stock sales are regarded as capital gains items, and if the stock was held for more than a year, long-term capital gains treatment may be available.⁴ Additionally, they could not owe any taxes if the stock it's qualified small business stock or a certain kind of corporation stock.⁴

There are, however, variations among each of the two primary types of deals, stock sales, and asset sales.⁴ The seller could sell common stock or preferred stock in a stock sale, for instance.⁴ The buyer of an asset sale could choose to buy all of the assets or specific ones.⁴ Due to this, the deal's structure should be adjusted to take into account the buyer and seller's goals as well as the specific situation.⁴

⁶⁰ Cenkus, Brett, director. Merger & Acquisition (M&A) Deal Structures Explained. YouTube, 25 Jan. 2018, youtu.be/ASUM5iIII98.

There is no one-size-fits-all solution, even though each sort of transaction structure has benefits and drawbacks. Every trade is different, so the structure should be adjusted to fit the circumstances. To choose the best structure, it is important to speak with an expert, such as a business attorney.⁴

The simplest and most popular method of payment for purchasing shares or assets is cash. Although cash payments typically result in an immediate tax liability for the target company's shareholders, as long as no portion of the payment is delayed, there is no doubt regarding the value of the transaction.³ Many variables, such as the acquirer's present leverage, potential near-term earnings per share dilution, the seller's preference for cash or acquirer stock, and the degree to which the acquirer desires to preserve control, will determine whether cash is used as the primary method of payment.³

Non-cash is another payment method. Tax benefits for the parties involved, particularly shareholders of the selling company, may result from the use of common equity.³ Yet, utilizing shares is more difficult than using cash since it needs to adhere to current security requirements.³ Additionally, if investors think the newly issued shares will lead to a long-term dilution in earnings per share (EPS), or a decrease in a single share-claim holder's future earnings and the assets that generate those earnings, the acquirer's share price could suffer.³ Real estate, intellectual property rights, royalties, earnouts, and contingent payments are some more non-cash payment options.³ A parcel of real estate is an example of real property.³

After the deal structure and contracts have been completed and the business has been merged or acquired, then the Mergers and acquisitions have been completed.

Conclusion

After the mergers and acquisitions process has been completed It will have a major impact on the company.

First, the company's management team may alter. For workers who are used to their previous bosses, this may be challenging. Because they might need to abide by new rules, it might also make things more difficult. Another possibility is that the businesses will need to collaborate. It may take a while and be challenging for the workers. If the new business no longer needs them, they could potentially lose their jobs.

Another variable is the amount of money. The corporation which buys the other one occasionally has more money, but it also occasionally has less. Depending on the outcome, this may or may not be good for the employees. Competition may change as a result of M&A. The size of the new corporation may differ from the size of the old one. Depending on the outcome, this may or may not be good for the employees.

Finally, M&A might provide the new firm with fresh resources including personnel, money, and technology. The new business could develop and improve as a result. Therefore, a lot of things could change if a company is acquired or combined. Businesses must use caution and consider all potential outcomes before acting. To make sure everything goes smoothly, they also need to collaborate with attorneys and financial specialists.

Overall, Mergers and acquisitions are complicated business deals that can have good and bad results. They can make better products and make more money. But there are also risks involved like when different cultures don't get along and it can be hard to put everything together. From Negotiations to due diligence, and to deal structuring, they are all important in M&A. To make mergers and acquisitions work, people need to plan carefully, do their research, work well with others, and talk to each other. This is not for every company, but some companies can benefit from it if they want to grow and be more competitive in the business world today.

The Industrial Revolution, Capitalism, and The Patriarchy By Arielle Kouyoumdjian

The Industrial Revolution spurred the rise of today's dominant nations, and affected the economic inertia of today's developing countries. The Revolution cleaved a socio-economic class system that evolved from the egalitarianism of the pastoral lifestyle to one of frenzied modernization and production. While the Industrial Revolution's failures spawned a slew of backlashing counter-theories, its successes became the genesis of today's global market. The period boasted unparalleled innovation, urbanization, and increasingly efficient manufacturing. Though the Industrial Revolution is credited with the formation of countless social, economic, and theoretical factions, it also animated a new beast: unfettered capitalism. Capitalism in the Industrial Revolution resulted in the dehumanization and commodification of the entire working class, it hinged on and perpetuated the exploitation of women for their biological machinery and culturally prescribed roles. The Industrial Revolution created many new, divisive classes, but it depended on at least one pre-existing social schism: gender-based inequality, specifically the sexual division of labor. Though gender-roles existed in their incipience prior to the time period, the oppression of women enabled the emergence of unfettered capitalism during the Industrial Revolution, birthing the interdependent patriarchal and capitalist society we know today.

Females occupied a double role in the Industrial Revolution; their biological capabilities served as the means of production for the workforce, and their domestic labor enabled the workforce itself to produce merchandise/perform at their highest capacity. It is widely understood that the production system in the Industrial Revolution began with manufacturing plants, in which workers transformed raw materials into valuable goods. However, this product-centered interpretation of the Industrial Revolution undermines the commodification of the laborers themselves, and overlooks the true enabler of mass production: women's unpaid reproductive labor.⁶¹ We can re-examine the Industrial Revolution through a female-dependent model of capitalism in which the male workforce was an expendable commodity, produced and operated by the women who propelled the capitalist industry. Karl Marx, who coined the term "social reproduction" emphasized that capitalism revolved around the propagation of the workforce. He wrote, "The maintenance and reproduction of the working class is, and must ever

⁶¹John Bellamy Foster and Brett Clark, "Women, Nature, and Capital in the Industrial Revolution" *Monthly Review* 69, no. 8 (2018), <https://monthlyreview.org/2018/01/01/women-nature-and-capital-in-the-industrial-revolution/#fn57>

be, a necessary condition to the reproduction of capital.” Thus, the commodification of male workers mirrored the patriarchal exploitation of female reproductive labor. Additionally, the ambitions of capitalists and the sexual desires of working class men compounded the reproductive exploitation of women.

Not only were females discouraged from factory labor and confined to the household, they were expected to see to the pleasure of their husbands. Elizabeth Sanford, the 19th century author of *Woman in Her Social and Domestic Character*, a manual for domestic housewives, wrote, “[A woman] may make a man’s home delightful, and may thus increase his motives for virtuous exertion.”⁶² During the Industrial Revolution, male laborers were essentially commodities with financial potential; a worker’s value depended on his ability to produce sellable goods more efficiently. Thus, Sanford suggests, women could increase the profitability of the male workforce (i.e., the human “goods” they had birthed) by ensuring that their husbands left for work with a pleasurable disposition. Without access to contraception, women had little control over their fertility. This coincided with the market’s demand for an expendable and rapidly replaceable workforce. These social and economic pressures for human production equated to what can be crudely described as a compulsory breeding operation.

Capitalism during the Industrial Revolution not only relegated women to a role analogous to that of production plants, but factory workers both inside and outside the home, as well. The term “reproductive labor” refers to the unpaid domestic services provided by women, including child-rearing, cooking, transportation, and other culturally designated feminine roles.⁶³ In the relatively egalitarian Pre-Industrial America, the household was the centralized hub for bread-making *and* bread-winning. However, capitalism and industrialization separated the spheres of production (factory work) and reproduction (family work). Instead of familial collaborations to produce marketable goods, men began to sell their time and skills to factory owners outside the home, thereby transferring the domicile authority to women. Women shouldered the responsibility of their husband’s happiness (thus increasing their husband’s monetary value), propagated the workforce, managed the household, and wrangled the once

⁶² Mrs. John Sandford (Elizabeth Poole Sandford), *Woman in Her Social and Domestic Character* (Boston, MA: Otis, Broaders and Co., 1842), 5-7, 15-16.

⁶³Gary Blank, “Production and Patriarchy in Capitalist Society: A Comparative Review of Hartmann and Young,” *Analyze: Journal of Gender and Feminist Studies* 2, (2014) https://www.analyze-journal.ro/wp-content/uploads/issues/numarul_2/review_2_gary.pdf.

free-roaming children (soon-to-be factory workers and mothers).⁶⁴ Scholar Denise Comanne describes the antithetical cultural demands for women during the Industrial Revolution. The valorisation of the homemaker/ “productive housework” emerged, paradoxically, during a time when the majority of families still needed at least two wage-earning parents to survive. Comanne writes, “This new ideology of the housewife, which started in the bourgeoisie, bred disdain for the woman who “had” to go out to work, not having a husband to support her... However, contrary to popular belief, women in the lower classes never stopped working, caught in the web of contradictions linked to their tasks within the family and their difficult working conditions.” The Industrial Revolution relied not only on lower-income women’s day-to-day factory labor, but also on the unpaid services they provided upon returning home. Though male workers employed the term “wage slavery” as a tongue-in-cheek criticism of their low-paying jobs, women were unsalaried producers within the home *and* in the factory. Until the late 1800s, women comprised 57% of the factory workforce, though their salaries hovered at a quarter of their male counterparts’.⁶⁵ Capitalists sold commodities and bought human labor. Thus, the home was the true center of production during the Industrial Revolution, and women manned the “human-factory” that prepared and produced laborers for the market. Admittedly, capitalism resulted in the commodification of *both* male and female laborers. The objectification of factory workers paralleled the denigration of women to biological machines. As Eleanor Marx described it, “women...have been expropriated as to their rights as human beings, just as the labourers were expropriated as to their rights as producers. The method in each case is the only one that makes expropriation at any time and under any circumstances possible—and that method is force.”⁶⁶ However, while the commercial viability of male factory workers often directly correlated to their physical prime, capitalism exploited women for more than their biological assets. The system’s demand for reproductive labor, in terms of sustaining the household beyond childbearing, transformed womanhood itself into a lifelong, unpaid career that far outlasts the relatively narrow window of fertility. The stigmatization of women’s factory labor eventually

⁶⁴Denise Comanne, “How Patriarchy and Capitalism Combine to Aggravate the Oppression of Women,” CADTM (CADTM, May 28, 2020), https://www.cadtm.org/spip.php?page=imprimer&id_article=5981.

⁶⁵ Joyce Burnette, “Women Workers in the British Industrial Revolution,” EH.Net Encyclopedia, edited by Robert Whaples. March 26, 2008. URL <http://eh.net/encyclopedia/women-workers-in-the-british-industrial-revolution/>

⁶⁶ Eleanor Marx-Aveling and Edward Aveling, *Thoughts on Women and Society* (New York: International Publishers, 1987), 17.

condemned many wives to the home, stripping them of financial independence, and interlocking capitalism with the subordination of women for centuries to come.

Capitalism revolves around social reproduction, the process of generating laborers and assembling a new workforce, considerations that first surfaced during the Industrial Revolution. Interestingly, capitalism and the patriarchy are so closely intertwined that the cycle-breaking mechanisms of one system are contingent on the participation of the other. The most widely criticized paradoxes in capitalism parallel the flaws in patriarchal society. For example, the “chicken-or-the-egg” problem in economics asks which came first in capitalist society: the producer, or the consumer?⁶⁷ Regardless, the continuation of capitalism depends on the reproduction of both producers and consumers. Likewise, in the most literal sense, women’s reproductive labor and capitalism can be likened to the chicken and the egg: did women’s reproductive labor lay the foundation for capitalism, hatch the workforce and nurse the system? Or did capitalism and industrialization beget the exploitation of women, establish the framework for a patriarchal society? Which came first, the sexual division of labor and societal roles, or unfettered capitalism?

Marxist feminism asserts that “empowerment and equality for women cannot be achieved within the framework of capitalism.”⁶⁸ Ending one exploitative system would necessitate the termination of the other. As a result, the promotion of birth control expanded women’s ability to decide when and how many children to have (and some even undertook “birth strikes) in the late 19th century as a means of “undermining capitalist exploitation”.⁶⁹ Reproductive rights were and are essential to female autonomy and the resistance of patriarchal oppression. While Marx and his contemporaries did not comment on the capitalism-fracturing power of contraception, they did pose another possible strategy for female empowerment. Marx’s colleague Frederick Engels wrote, “Since large-scale industry has transferred the woman from the house to the labour market and the factory, and makes her, often enough, the bread-winner of the family, the last remnants of

⁶⁷ Andrei Hagiu and Julian Wright, “The Chicken-and-Egg Problem of Marketplaces,” The chicken-and-egg problem of marketplaces (Platform Chronicles, October 19, 2021), <https://platformchronicles.substack.com/p/the-chicken-and-egg-problem-of-marketplaces>.

⁶⁸Christine Di Stefano, “Marxist Feminism,” Wiley Online Library (Wiley Online Library, September 15, 2014), <https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118474396.wbept0653>.

⁶⁹“Social Reproduction.” Encyclopedia.com. Encyclopedia.com, November 24, 2022. <https://www.encyclopedia.com/social-sciences/encyclopedias-almanacs-transcripts-and-maps/social-reproduction>.

male domination in the proletarian home have lost all foundation – except, perhaps, for some of that brutality towards women which became firmly rooted with the establishment of monogamy. . . .It will then become evidence that the first premise for the emancipation of women is the reintroduction of the entire female sex into public industry.”⁷⁰ Thus, liberation from the home and a return to the workforce are essential tools for the dissolution of the patriarchy—but do not necessarily imply the termination of the capitalist/Industrial system.

While the Industrial Revolution, the rise of capitalism, and the emergence of the patriarchy are fundamentally intertwined, they are not mutually exclusive in today’s society. Though modern-day capitalism still hinges in large part on systemic inequities that originate in Industrial-era America, a vibrant and innovative economy *can* exist without marginalization. The idea that capitalism depends on the sexual division of labor makes a prejudiced assumption about gender roles. Of course, reproductive labor will always be necessary, not just for the propagation of the workforce, but for the perpetuation of humanity. Reproduction inevitably requires the division of labor eventually, though not necessarily the sexual division of labor. Sexual reproduction itself requires the participation of both genders, and both genders are capable of performing either the role of wage-earner and caregiver (and sometimes these roles are shouldered by the same individual.) In today’s workforce, it is common to hire a caregiver to help with domestic labor. Some feminists argue that instead of accepting reproductive labor as womens’ generous donation to the capitalist society, parents who choose to care for family at home rather than enter the workforce should be compensated using the proceeds of capitalism. However, incentivizing women to remain within the home and rewarding them for reproduction only deeper entrenches gender-roles. In a truly egalitarian and capitalist society, all individuals should have equal access to education, labor, and bodily autonomy. It is only then that our society will reach ultimate productivity, and more importantly, fulfillment.

⁷⁰ Frederick Engels, *The Origin of the Family, Private Property and the State, in Karl Marx and Frederick Engels: Selected Works*, New York: International Publishers, 1986, p. 508, 510.

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The Effects of Tempo and Mode in American Pharmaceutical Advertisement Music on Louisiana High Schoolers By Cole Hewitt

Abstract

The purpose of this study was to determine how tempo and mode in background advertisement music affect consumer traits such as emotion, joyfulness, and memory in high school students. Prior research shows that different aspects of music influence consumers in different ways, however none has been conducted on the American pharmaceutical genre of advertising nor has any been targeted towards high school students. Data was collected through self-entry experimental research in which a survey was administered that yielded quantitative results on emotion, likeability, and memory. The 163 participants of this study were local high school students between grades 9-12. Results support the hypothesis that major-moded music creates more positive emotions and higher levels of enjoyment in participants as opposed to minor-moded music. It also suggests that a quicker tempo results in greater auditory recall compared to slower tempos. Therefore, it can be concluded that musical mode has strong influences on emotional connotation and enjoyment of an advertisement, while tempo tends to have a greater effect on memorability. However, this conclusion is limited due to a small sample size and the generalization of the American pharmaceutical advertising genre present in this research. Future research could expand the sample population size and include more diversity in the advertisements used to test consumer traits.

Introduction

Humans have different superficial responses to music, including tapping their feet, swaying, humming, or singing along. The power of music is so immense that advertising companies spend millions of dollars in time and effort to enhance music in advertisements to maximize profits. Previous researchers have conducted studies on different advertising genres' utilization of formulaic music in the past. However, such patterns have not been researched in American pharmaceutical advertisements. This research will examine how musical tempo and mode influence consumer behaviors like emotion, enjoyment, and memory after viewing an American pharmaceutical advertisement. Emotion, in this study, refers to how participants felt after watching an advertisement. Likeability refers to how well participants enjoyed watching an

advertisement. Memorability refers to how well participants remember aspects of an advertisement. Tempo refers to the beats per minute (BPM) of the music. And finally, mode refers to either the ionian (major) or aeolian (minor) sets of seven pitches found in the synonymous musical scales. The research question is as follows: How do tempo and mode in music played in modern American televised pharmaceutical advertisements influence Louisiana high school consumer behavior?

Literature Review–Historical Context

Pharmaceutical companies have been televising advertisements in the U.S. since the 1980s due to global changes in technology and culture. Mackey and Liang explain that health product marketing has skyrocketed in recent decades because of globalization and faster advertiser-consumer communication through innovative televised advertisements (Mackey & Liang, 2012). This new form of televised advertisements was aptly named “Direct To Consumer” (DTC) advertising. Advertising corporations have built up their reputations over decades by producing increasingly effective DTC advertisements. Companies invest thousands of dollars into focus groups and similar consumer testing until they receive desired evaluations and engagement ratings in the participants. In his book, Zager, an American record producer, composer, and arranger of original music for commercials, discloses that a company will air an advertisement only after extensive testing, feedback, and discussion (Zager, 2015). To the researcher’s knowledge, the testing and experiments led by advertising corporations typically find music without defined procedures. One goal of this research is to provide specific procedures that could be used for pharmaceutical companies to match music to their commercials.

Music’s Effects on the Mind

Experts have conducted multiple studies to analyze the various effects of music on the mind and its functions. Sharma, a doctorate in psychology, observes in her inquiry that the mind interprets music as subliminal messages - stimuli below the threshold for conscious thought. The auditory cortex interprets these subliminal messages, releasing dopamine, a neurotransmitter that affects mood, actions, and behavior (Sharma, 2015). When music is paired with similarly themed or congruent visual information, the stimuli become so immense that the conscious mind can

comprehend them. In their study, Hanser and Mark of the Tilburg University Department of Cognitive Neuropsychology note that musical and visual congruency in a presented advertisement invests consumers in the storyline. Similar to Sharma's research, Hanser and Mark agree that subliminal messages found in advertisements with congruent music and visuals have a larger effect on consumer emotion (Hanser & Mark, 2013). A study by Ausín, a Ph.D. in Consumer Neuroscience, and his associates proves that subliminal messages from differently themed or incongruent music and visuals do not affect emotion but, instead, influence viewers to focus on and memorize the narrated information presented to them (Ausín et al., 2021).

Current Research on Advertisement Music

In a study measuring the qualitative likeability of different advertising music on consumers, Kupfer, the professor of Music History and Theory at the University of Chicago, tests how advertisements appeal to specific target audiences based on sociodemographics (specific population characteristics) and consumer upbringing. He concludes that sociodemographics play little to no part in providing specific factors to be targeted by music in advertisements (Kupfer, 2017). Though music cannot target a specific demographic, certain factors in music can influence consumer perceptions of brands. The tempo and mode of music in advertisements can influence a consumer to feel or behave a certain way. Tay and Ng of the Linguistics and Multilingual Studies Department at the Nanyang Technological University find in their empirical study that modal changes in advertisement music produce different emotions in participants. Their experiment involved playing advertisements with music of different tempos and modes while participants selected emotion words that they felt best related to what they heard. Their results concluded that major-moded background music led to more positive emotional responses than minor music at all tested tempos (Tay & Ng, 2019).

Experts agree on the influential power of music in advertisements, yet most argue over which genres of music are most effective at influencing the behavior of consumers. Some assert that modern pop music is the best genre for advertisement music because it is one of the favorite genres of younger generations, who are maturing into a large consumer demographic (Cha et al., 2019). Others feel that classical music is superior. Kupfer explains in a 2019 paper that classical Bach, along with other classical music, is most effective in advertisements because it instills a sense of trustworthiness in a brand or product (Kupfer, 2019). Lastly, some experts feel that

high-energy (percussion heavy and fast tempo) music is the best genre for advertisement music. The logic is that up-beat dance music, when played to participants, increases the likelihood that consumers will buy a product, while classical music leads to purchasing hesitation and the perception that the product is too expensive (Oakes & North, 2013).

Methodology–Design

The design of this study follows the guidelines of self-entry experimental research. Willing participants had two weeks to fill out a digital survey. This design allowed the researcher to examine three variables - emotional connotation, likeability, and memorability - while collecting enough data to answer the research question. Because of the self-entry design, participants could complete the study at their own pace. Multiple research projects in the body of knowledge showcased similar experimental designs aside from the self-entry portion. Previous research has put the anonymity of participants and confidentiality of their responses at stake by performing experiments in person with a proctor (Ausín et al., 2021; Tay & Ng, 2019; Kupfer, 2019; Russell et al., 2017). This study filled a gap by including a survey in the digital form to protect the anonymity of participants. The survey was always available even when there was not an administrator present to proctor it, allowing participants more privacy and comfort.

This study had a mix of both qualitative and quantitative results, but all data was converted to quantitative values. The stimuli were six edited advertisements from Allegra®, an American over-the-counter product that provides non-drowsy allergy relief for all ages. Each edited advertisement contained identical visuals from the original but differing background audios with modified tempos and modes. **Table 1** represents the six different advertisements that were synthesized for the experiment to test for the array of both independent variables.

Table 1: *Array of Three Tempos and Two Modes*

	Slow Tempo (50% Original)	Original Tempo	Fast Tempo (150% Original)
Minor Mode (Tomaso Albinoni - Adagio in G Minor)	Minor Slow	Minor Original	Minor Fast

Major Mode (Beethoven - Symphony No. 6, 3rd movement)	Major Slow	Major Original	Major Fast
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After the selection of the advertisement and background music, the six unique advertisements (**Appendix A**) were created using websites and software that did as follows -

- Extracted the narration and original background music (<https://www.lalal.ai/>)
- Edited new background music to fit the desired tempo (<https://online-video-cutter.com/>)
- Combined the narration and new background music then attached the completed audio file back to the unaltered visual advertisement (<https://www.veed.io/>)
- Allowed for the edited content to be linked within the survey (<https://www.youtube.com>)

The survey was divided into three sections to analyze the three consumer behaviors - emotion, enjoyment, and memory. The first involved three multi-select questions gauging the emotional connotations of the visuals, the audio, and the entirety of the advertisement shown to each participant. The participants had the option to choose one or multiple emotion words after watching their advertisement. They could also, in addition to selecting words, add their own in an “Other” textbox if they felt it was needed. To convert this qualitative data into quantitative, numeric values based on valence levels in Tay and Ng’s work (2019) were assigned to every emotion word. **Figure 1** contains the emotion words used in Tay and Ng’s work that was adapted for this study. If participants selected the “Other” option and input their own unique emotion words (all of which are in **Appendix B** with their valence values), the researcher assigned them fixed values based on their close connotation to others in **Figure 1**.

In the next section, three Likert scale questions with answers ranging from “Extremely Disliked” to “Extremely Liked” were converted to numeric values (1-7) to express how much a participant enjoyed the visuals, audios, and entirety of the advertisement they watched.

Finally, two multiple-choice questions followed that collected data on the participants’ memory of the visuals and audio of the advertisement they watched. For the first question - the visual memory question - the correct choice was screenshotted from the advertisement the participant watched, and the three incorrect options held images taken elsewhere. The second question - the audio memory question - contained a 5-10 second excerpt of music from the advertisement the participant watched, and three snippets of music taken elsewhere. This research is similar to others in the body of knowledge in that the raw data holds a mix of

qualitative and quantitative information (Kupfer, 2017; Hanser & Mark, 2013). However, this research converts all qualitative data to quantitative for easier comparison and discussion.

Subjects

The participants of this study were local Louisiana high school students in grades 9-12. This demographic filled an age gap seen in other research because no relevant research on advertisement music's effects has solely focused on Louisiana high school teenagers. The participants' high school consists of multiple genders, races, and cultures which displayed conclusions that could correlate effectively with the general nationwide high school population. The survey was disseminated to students over two weeks using flyers containing a link and quick response (QR) code that directed the to-be-participants to a Google Form. The form began with a digital consent form which included a summary of the study and the participants' rights (**Appendix C**). This form was adapted from a local unpublished manuscript (Frank, 2022). All participant information aside from grade level was left anonymous to compare the percentages of each grade collected.

Instruments and Setup

The base advertisement selected for the survey is titled "Live Your Greatness" with the tag "Allergens Won't Faze Me" (**Appendix A**). It aired in 2022 and promoted 24-Hour Indoor/Outdoor Allergy Relief. The selection of this advertisement for the experiment was determined based on the following criteria -

- Under 30 seconds (to keep the survey short)
- One tone throughout (to keep the mood consistent)
- Advertise an American pharmaceutical product (to address the genre gap)
- Relate to the teenage demographic (to pique participant interest)

The two excerpts of music used in this research were the same as pieces excerpted in Ausín's experiment as opposing major and minor pieces. Beethoven's third movement of his sixth Symphony was the major-moded piece, and Tomaso Albinoni's Adagio in G Minor was the minor-moded piece (Ausín et al., 2021). Because they differ in musical mode, these pieces were used to determine how mode affects participants' emotions, enjoyment, and memory.

Procedure

The Google Form (**Appendix D**) started with participants filling out a digital consent form and answering a grade-level question. After participants filled out consent information, they were given a link to a Google Die where they rolled a number from one to six. Then, based on what number they rolled, the participants watched one of the six advertisements with no prior information other than “Please watch this advertisement with sound,” to determine how the participants would react in a real-world scenario without knowledge of them being tested. After the video was over, the next page was the emotion section where participants chose emotion words. Next, participants would answer the Likeability section including Likert scale questions on the enjoyment of the advertisement. Then, they filled out the two memory questions: a visual question and an audio question. On submission, the form displayed a thank-you note that contained the researcher’s contact information and confirmation of completion. These methods were approved by an Institutional Review Board.

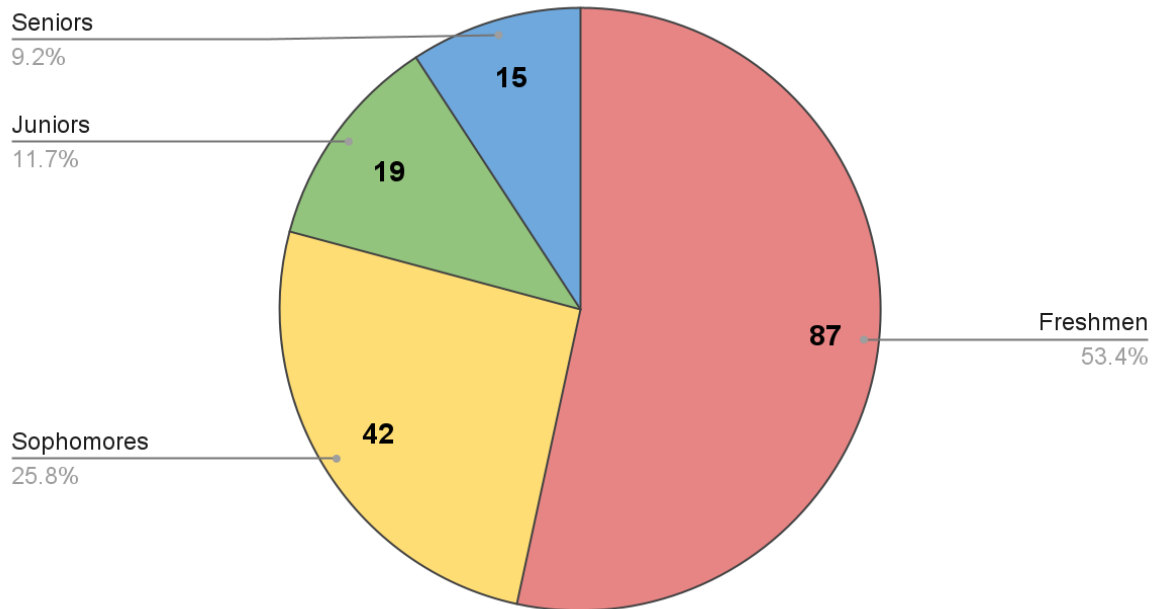
This design and method allowed for an accurate mixed methods study similar to others in the field to determine how pharmaceutical advertisement music affects high school consumer behaviors.

Results–Participant Demographics

After two weeks of active surveying (11/29/22 - 12/13/22), the researcher gathered 165 responses. However, two were blank, dropping the response count to 163. **Figure 2** displays the grade breakdown.

Figure 2: *Grade Level Totals and Percentages of Freshmen, Sophomore, Junior, and Senior Participants*

Number of Participants Per Grade Level



Emotion

The first questions of the survey asked how participant emotion was affected by the advertisement shown. The researcher converted all emotion words to their assigned valence values, as seen in research by Tay and Ng (**Figure 1**). The researcher then added each valence value to compare how participants felt about each aspect of each advertisement aspect: visuals, audio, and advertisements as a whole. Positive emotional valence totals mean that, on average, participants selected more positive emotion words than negative ones and vice versa for negatively valenced totals.

Figure 3 showcases the emotional valence totals for the visuals of each of the six advertisements. In all three tempos, the major-moded advertisements had higher valence sums than the minor-moded advertisements of the same tempos. The original tempo advertisements had the highest totals for both modes, which means participants felt more positive emotions when the tempo was left unchanged.

Figure 3: *Emotional Valence Totals of Visuals in Each Advertisement*

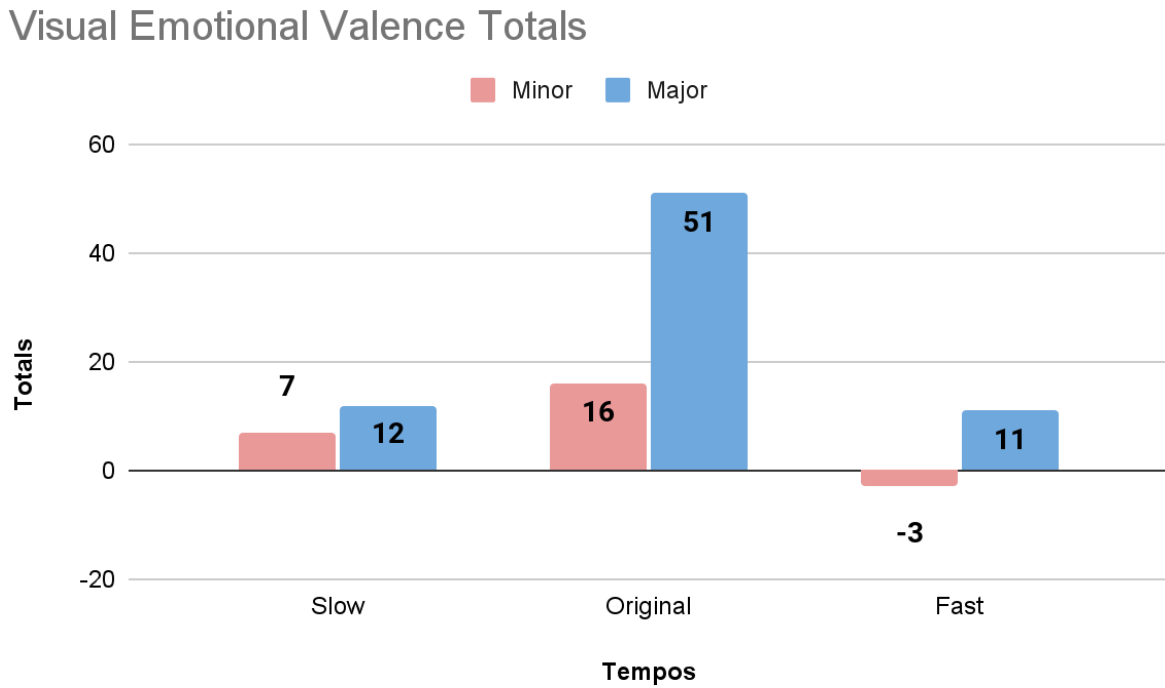


Figure 4 analyzes the emotional valence totals of the different advertisement audios. Similarly to the visual emotional valence totals, major-moded music had higher, more positive valences than the minor-moded music of the same tempos. Only in the fast tempo did a minor-moded advertisement evoke a net negative emotional response from participants.

Figure 4: *Emotional Valence Totals of Audios in Each Advertisement*

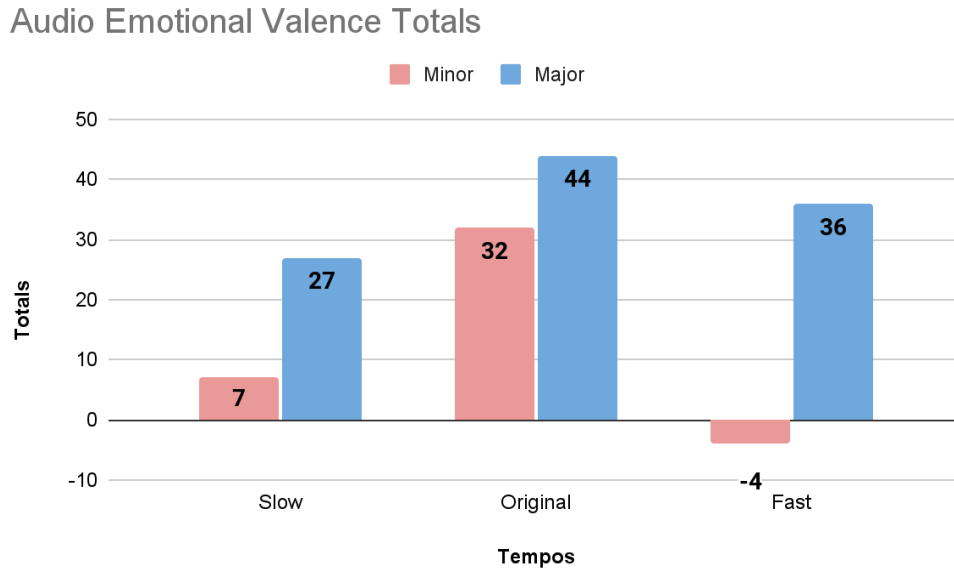
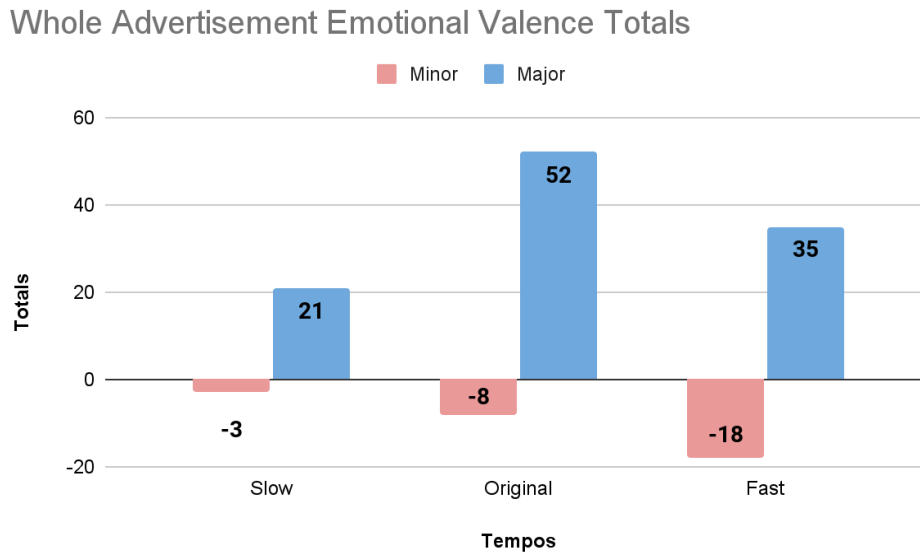


Figure 5 illustrates how participants felt emotionally about the advertisement as a whole. At each tempo, major-moded music totaled above zero, while minor-moded music fell under. This means that major-moded music evoked positive emotions in participants while minor-moded music evoked negative ones.

Figure 5: *Emotional Valence Totals of the Entireties of Each Advertisement*



Likeability

The second section of survey questions asked how well participants liked the visuals, audios, and entireties of each advertisement. Participants were to select between “Extremely Disliked,” “Greatly Disliked,” “Slightly Disliked,” “Neutral,” “Slightly Liked,” “Greatly Liked,” and “Extremely Liked.” Respectively, these choices were assigned Likert scale values of 1-7 and were averaged by advertisement. An average higher than 4.0 means that participants generally liked the tested aspect, and an average lower than 4.0 implies that participants disliked the tested feature.

Figure 6 tabulates the Likert scale averages for how well participants enjoyed the visuals in the advertisements. Most participants preferred slow-tempo music with the advertisement visuals than fast-tempo music. Major-moded music averaging over 4.0 suggested that participants generally liked the visuals when paired with major-moded music, while minor-moded music, with the exception of the slow-tempo average, averaging below 4.0 suggested that participants disliked the visuals when paired with minor-moded music.

Figure 6: *Likeability Averages of Visuals in Each Advertisement*

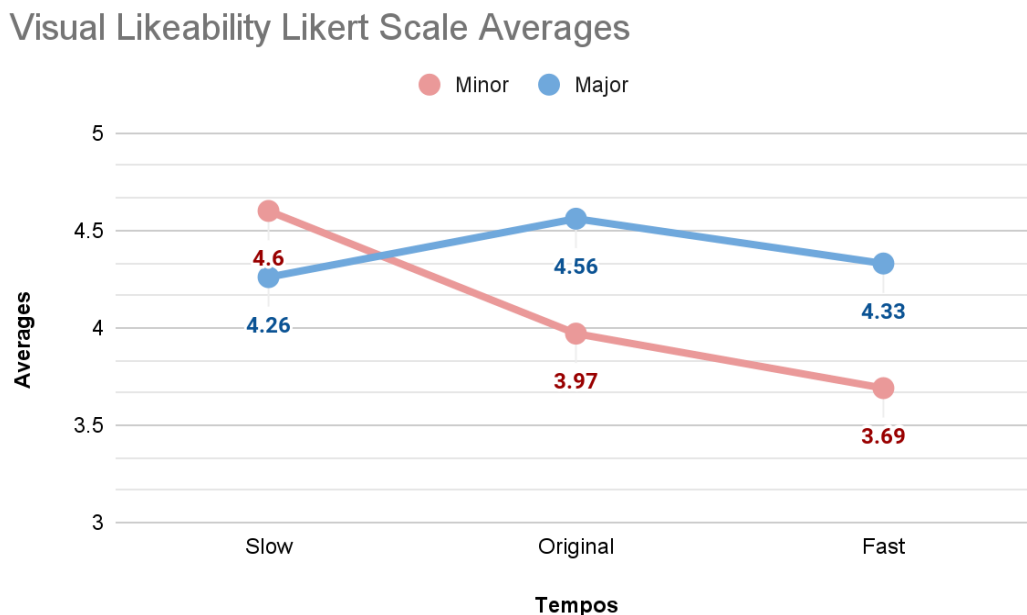


Figure 7 illustrates that participants liked major-moded audio more than minor-moded audio at every tempo. Also consistent with previous findings, participants preferred original-tempo music over altered-tempo music.

Figure 7: *Likeability Averages of Audios in Each Advertisement*

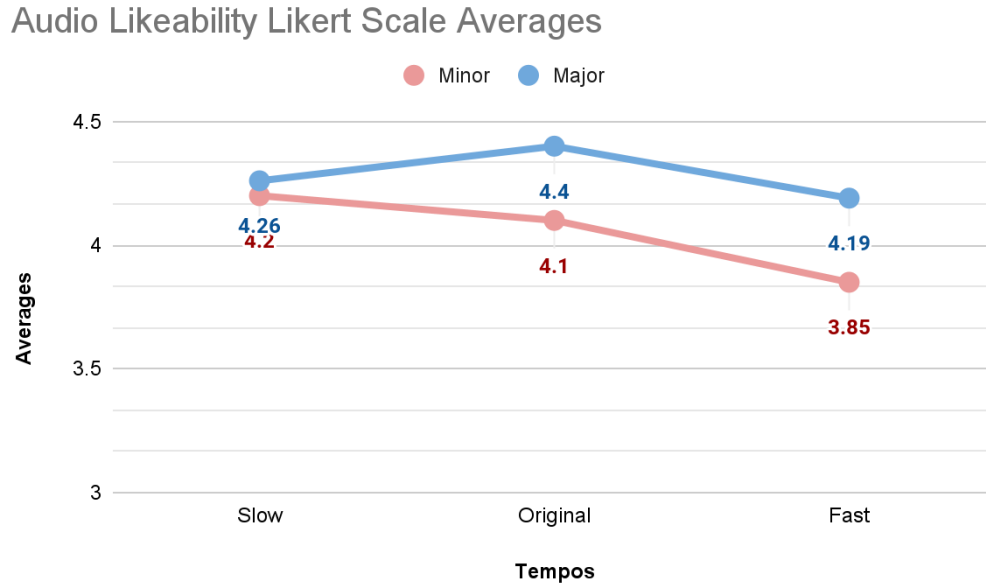
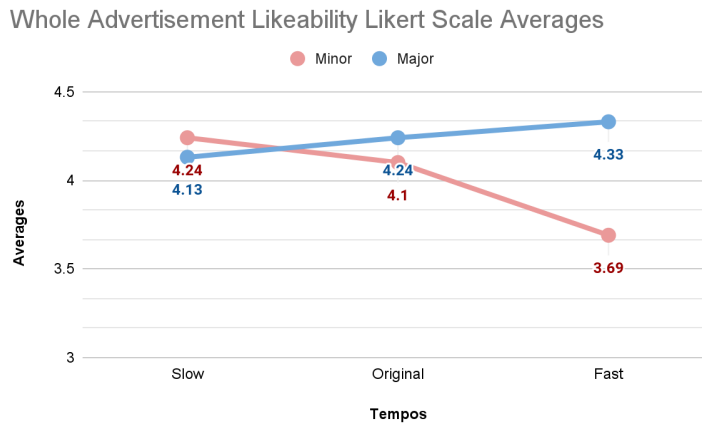


Figure 8 displays the average likeabilities of each advertisement as a whole. It exhibits that participants only disliked the fast-tempo, minor-moded advertisement but generally enjoyed the other five. Though all but one was enjoyed, only at the slow tempo was a minor-moded advertisement enjoyed more than a major-moded one.

Figure 8: *Likeability Averages on Advertisements as a Whole*



Memorability

The last section of the survey tested participant memory of the advertisement. The researcher tested the recall ability of the visuals and background music present in the advertisements. Each question included four options, of which only one was correct. The researcher collected the percentages of correct answers for the visual and audio questions for each of the six advertisements.

Figure 9 displays that participant memories of the visuals were more accurate in the slow and original tempos when the music was major-moded. It also supports that participant memories were more accurate in the fast tempo when the music was minor-moded. Five of the six advertisements resulted in less than 25% accuracy, while the sixth only resulted in 32% accuracy - just above random chance. An outlier is the data point for fast-tempo, major-moded music, in which only 3.7% of the participants correctly remembered that advertisement's visuals.

Figure 9: *Percentages of Participants that Correctly Recalled the Visuals in Each Advertisement*

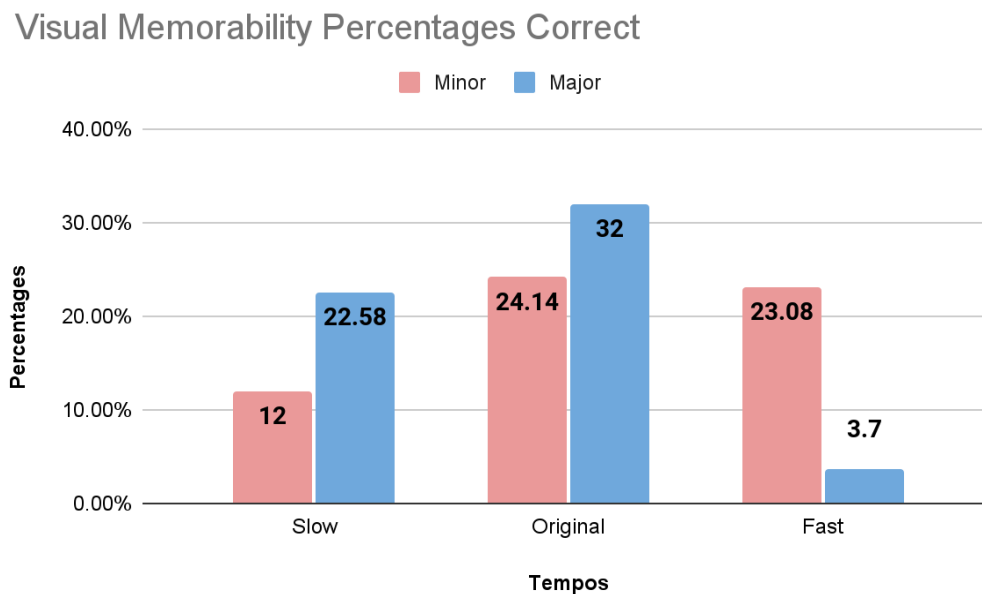
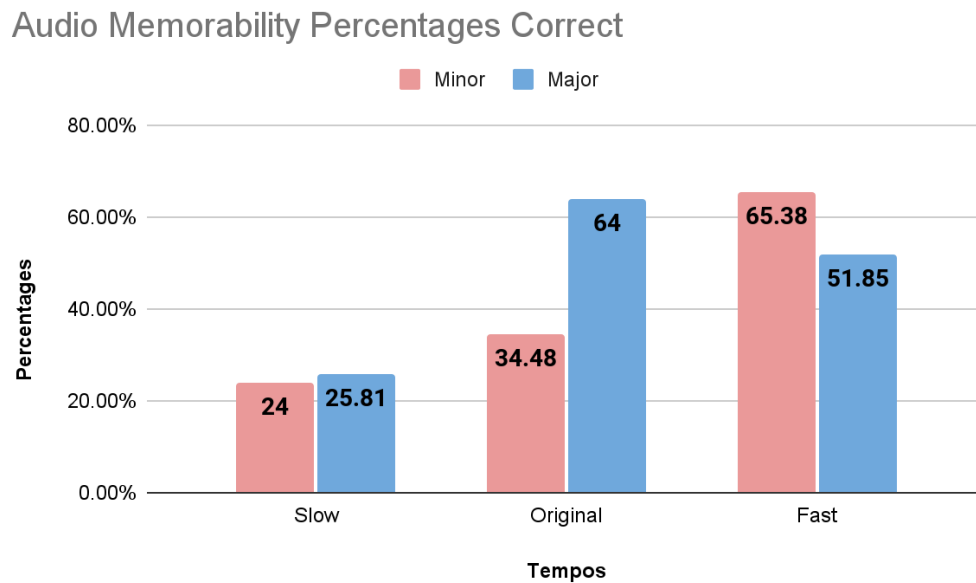


Figure 10 displays the percentages of participants who chose the correct audio from the advertisements. Similar to the visual memorability trends, the slow and original tempos, when paired with major-moded music, caused participants to have better auditory recall, while at the

fast tempo, minor-moded music caused participants to have better auditory recall. Participants also seemed to have a substantially higher auditory recall ability in comparison to visual recall.

Figure 10: *Percentages of Participants that Correctly Recalled the Audios in Each Advertisement*



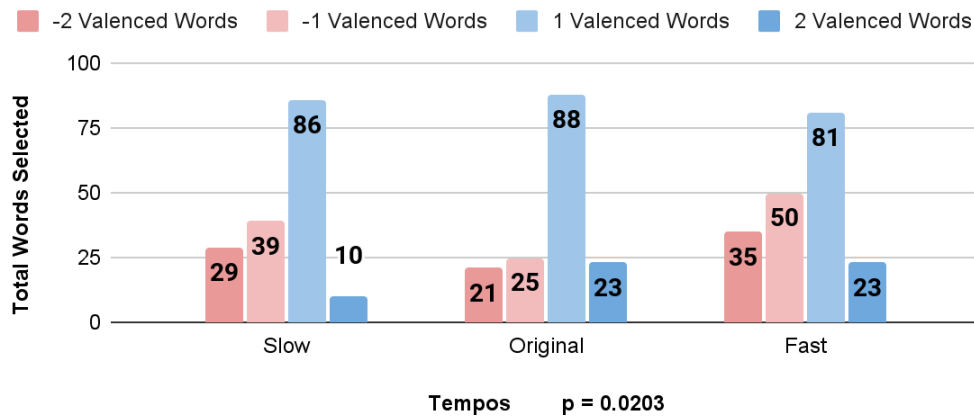
Significant Correlations

The researcher ran chi-square tests to test for any correlations between tempo and mode variations on each consumer behavior. The significance level established for this research was 0.05. Any p-value below 0.05 suggests a significant correlation, while anything above suggests a lack of correlation and likelihood of random chance. All chi-square tests can be found in **Appendix E**. The tests resulted in four significant correlations.

The first significant correlation was between the variation of tempo and the emotional connotation of the visuals in the advertisements. Shifts in tempo did have a significant correlation ($p = 0.0203$) with the frequency of words chosen. **Figure 11** displays the total words selected in each valence value category used to run the chi-square test and calculate the p-value. Original-tempo music had the most positive emotion words and least negative emotion words selected while fast-tempo music had the highest count of negative words.

Figure 11: *Total Emotion Words of Each Valence Over All Tempos Related to Advertisement Visuals*

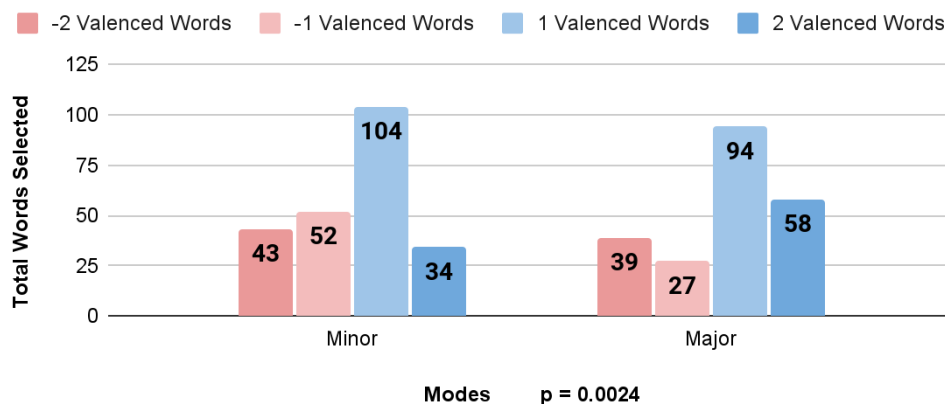
All Tempos' Emotionally Valenced Words Selected - Visuals



The researcher ran chi-square tests on the potential correlations between tempo and mode and the number of emotion words per valence category relating to advertisement audios. As shown in **Figure 12**, the second strong correlation involved the variation of mode on the frequency of emotion words chosen with a p-value of 0.0024. Minor-moded music led to participants selecting the most negative emotion words, while major-moded music led to participants picking a higher number of positive, high-valenced emotion words.

Figure 12: Total Emotion Words of Each Valence Over Both Modes Related to Advertisement Audios

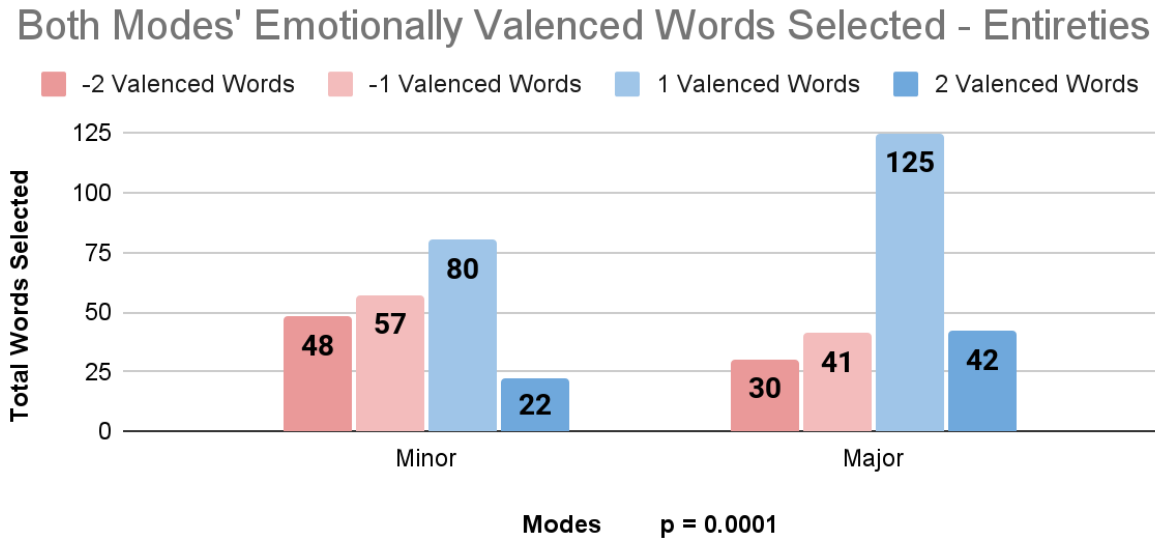
Both Modes' Emotionally Valenced Words Selected - Audios



The researcher discovered the third strong correlation between the variation of mode and the number of words per valence category relating to the entire advertisements. The chi-square test determined that the variation between the modes, shown in **Figure 13**, did correlate to the

total words selected in each valence category related to the whole advertisements ($p = 0.0001$). Minor-moded music elicited a more negative emotional response, while major-moded music elicited a more positive emotional response.

Figure 13: *Total Emotion Words of Each Valence Over Both Modes Related to the Whole Advertisements*

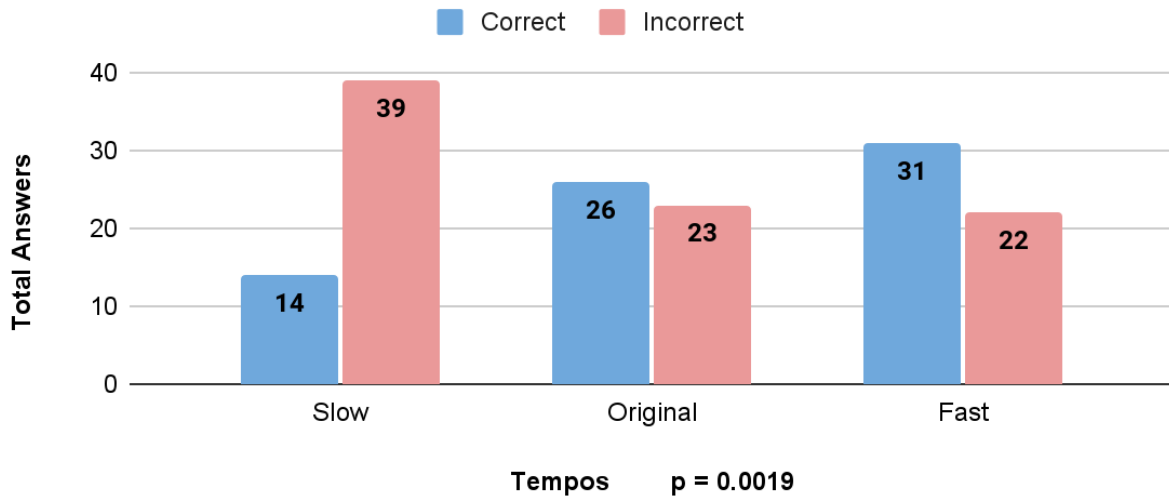


The likeability section of the study resulted in zero significant correlations. Previous research in the field has shown similar results, that likeability generally remains uncorrelated with any specific factors in music (Ausín et al., 2021; Cha, et al., 2019; Strick, et al., 2015). This lack of correlation is most likely due to the unique musical tastes of each participant.

The fourth correlation involved the variation of tempo and the number of accurate and inaccurate auditory recall responses. **Figure 14** shows the significant correlation between the fluctuation of tempo and the total correct and incorrect auditory recall responses ($p = 0.0019$). As tempo increased the number of correct responses also increased, suggesting that quicker tempo increases auditory recall.

Figure 14: *Total Correct and Incorrect Responses of Each Advertisement Over All Tempos Related to Auditory Recall*

All Tempo's Correctness of Recall - Audios



Trends

Although the study resulted in only four significant correlations, all other data was still utilized to determine participant preferences and trends. These trends were present with the small number of respondents and would be accentuated further if the survey size was larger making these trends notable. Listed below are prominent trends and the figures that showcase them:

- Major-moded music produced more positive emotions, while minor-moded music produced more negative emotions (**Figure 3, Figure 4, & Figure 5**)
- Original-tempo music consistently produced the most positively valenced emotions, while fast-tempo music consistently produced the most negative emotions (**Figure 3, Figure 4, & Figure 5**)
- Participants generally liked major-moded music more than minor-moded music (**Figure 6, Figure 7, & Figure 8**)
- Both the slow and original tempos produced the highest likeability, while the fast tempo always produced the lowest likeability (**Figure 6, Figure 7, & Figure 8**)
- For all advertisements, most participants could not effectively remember the visuals; in comparison, participants could much more effectively remember the audios (**Figure 9 & Figure 10**)

Discussion–Conclusions

This research aimed to answer the guiding question: How do tempo and mode in music played in modern American televised pharmaceutical advertisements influence Louisiana high school consumer behavior? This research solely focuses on the pharmaceutical advertisement genre and high school participants, which are gaps that remain unaddressed in similar studies. The results of this research discovered four correlations and five trends.

One trend is that major-moded music produces more positive emotional responses, while minor-moded music produces more negative emotions. This may be a reason for the significant correlation between variation in tempo and the emotional connotation of the audio. This trend and correlation were to be expected based on the research by Tay and Ng that concluded that major-moded music generated more positive emotions as opposed to minor-moded music (Tay & Ng, 2019). The confirmation of Tay and Ng’s research resulting in the same conclusions help to validate this research further.

The trend that original-tempo music produces the most positive emotions while fast-tempo music brings out the most negative emotions aligns with the correlation between the variation of tempo and emotional connotation of visuals. These findings were expected based on previous research in the field. Tay and Ng summarize this best when they write that participants’ emotions were more positively affected when the music was played in its original tempo instead of when the music was altered to be faster or slower (Tay & Ng, 2019).

This research found that major-moded music was more liked than minor-moded music. Though most results are inconclusive, one study supports a different stance; major-moded music was generally liked less than minor-moded music (Ausín et al., 2021). Ausín’s contrasting findings, however, may be attributed to his adult, all-female participants, who could have held different modal preferences than the high school participants of this research. Future research could analyze deeper into how sociodemographic factors influence musical taste.

Auditory memory was found to be correlated to tempo, and participants answered much more accurately than on the visual memory section. Compared to the audio recall averages, which were all above random-chance except for the slow-tempo minor-moded advertisement, the visual recall was significantly lower. This disparity might be due to the fact that, compared to adults, teenagers lack substantial visual memory because their brains are still developing (Isbell et al., 2015).

Limitations

One limitation of this research is the relatively small sample size with only 163 students fully participating in the study. Though this would be a decent sample size, after dividing the participants among six advertisements, the average number of participants per advertisement dropped to an average of 27. Having this few participants per advertisement could have led to inaccurate results and unreliable correlations. This may limit the ability of the research to be applied to the general population.

Second, there was a noticeable difference in the grade level percentages of the participants. 53.4% of participants were freshmen, 25.8% were sophomores, and the remaining were juniors and seniors (**Figure 2**). The freshmen majority dominated the results, outweighing the other grades. If the freshmen had a unique preference, the results would be skewed towards that preference, not allowing the other classes equal representation. The researcher had no control over the demographic split but acknowledges that it may have contributed to some inaccuracies.

A third limitation was the lack of control over the emotional states of participants prior to taking the survey. Participants' mindsets before watching the advertisements influenced all of the consumer traits tested, especially something as subjective as emotion or likeability.

The last major limitations of this study are the generalizations about the genre of pharmaceutical advertisements along with major and minor music. The researcher chose the Allegra® advertisement because it was relatable to the participants, even though it does not encompass all American pharmaceutical advertisements. The major-moded and minor-moded music selections also do not cover all the musical variations in their respective genres but were selected due to previous success in Ausin's research.

Implications

The results of this research are applicable to both the telemarketing and consumer awareness fields. This research could aid pharmaceutical corporations by outlining how to create background music that pragmatically increases consumer buying behaviors and profits. For example, if a corporation wanted to design an advertisement to be memorable and produce negative consumer emotions towards symptoms highlighted in the advertisement (that the product alleviates), fast-tempo, minor-moded music would be most promising. This research also

spreads awareness of marketing tactics used on oblivious consumers. As aforementioned, American pharmaceutical advertisements are notorious for manipulating their viewers and potential consumers. Though understanding background music's effects on consumers may not be the most effective means of protection against American pharmaceutical manipulation, it could amplify the conversation about the ethics of advertisement creation.

Future Directions

For comparison of this study's results, increasing the sample size of participants would be a beneficial future direction for other research. To potentially extend the sample size, the site of future studies could include multiple high schools on a district or state level instead of a singular local high school.

Another future direction studies could take would be introducing more variation in the advertisement visuals and background music selections. For this research, the researcher made broad generalizations of pharmaceutical advertisements and major-moded and minor-moded music by choosing one Allegra® advertisement and two contrasting music excerpts. Future works could include a variety of advertisement and music selections with more diversity within their respective genres.

Though this research was focused on studying background advertisement music's effects on high school consumers, examining visual cues in pharmaceutical advertisements could be explored in the future. Previous researchers have noticed that visual cues were a confounding variable in their results, but were not the major focus of their studies. Knowing that both the mode and tempo of advertisement music have unique effects on high school consumer emotion, enjoyment while watching, and memory, could be used to future works' advantage when analyzing visual cues and other topics.

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Addressing Misinformation, Social Media Habits Among Indian Online Users in the COVID By Pranav Karthikeyan and Lauren Young

Abstract

Misinformation has become a global crisis, posing a huge threat not only to our fundamental right to correct information but also to public health, as seen during the COVID-19 pandemic. India emerged as the largest misinformation producer during the pandemic likely due to the excessive and unregulated circulation of information on social media. In this paper, we examined, using the survey method, whether sociodemographic factors like age, education, economic status, and attitudes toward the COVID-19 vaccine play a role in influencing people's social media habits and vulnerability to misinformation. Our findings showed that older adults are more likely to trust social media in general, have poor sharing/forwarding habits when online, and believe most information on COVID-19 vaccine side effects on social media. Furthermore, people who were hesitant towards receiving the COVID-19 vaccine behaved more like older adults, placing more trust in social media and believing most information on COVID-19 vaccine side-effects found on social media than their vaccine-unhesitant counterparts. Most importantly, the majority of the participants expressed that they were open to having their social media behaviors corrected. This research provides insight into the causes of and efforts to curb the spread of misinformation.

Keywords: Misinformation; COVID-19; India; Vaccines; Social Media

Introduction

We are surrounded by misinformation everywhere. According to the WHO, the spread of misinformation reached historic proportions during the COVID-19 pandemic. India has emerged as the world's leading producer of COVID-19 misinformation with the internet, particularly social media, playing a significant role.¹ With over 560 million internet users, India is the world's second-largest online market, and it is predicted to grow by more than 650 million by 2023.² With India accounting for one-fourth of social network users, there is widespread concern over the spread and impact of misinformation.

Misinformation is defined as false or inaccurate information that is deliberately created and is intentionally or unintentionally propagated.³ Misinformation threatens not only our fundamental right to correct information but also acts as a barrier to the right information at the right time. Misinformation during the COVID-19 pandemic slowed the preventive and recovery processes, leading to devastating consequences. Therefore, it is important to understand what factors influence the spread of misinformation so that efforts can be made to prevent and slow its spread. Sociodemographic factors like age, education, and economic status seem to play a role in shaping social media habits and influencing people's vulnerability to misinformation in general. Individuals with a higher socioeconomic status and education level were less likely to fall for health misinformation compared to those from lower socio-economic groups.⁴ Also, people over the age of 65 were seven times more likely to accept or spread misinformation compared to their younger counterparts.⁵ Individuals' attitudes towards COVID-19 and COVID-19 vaccines appeared to influence vulnerability to misinformation. A U.S. national survey showed that Americans who were COVID-19 vaccine-hesitant were less willing to receive the vaccine, knew less about the COVID-19 virus and were more likely to believe COVID-19 vaccine myths and misinformation.⁶

In this study, we examine if demographic factors like age, economic status, and attitudes related to the COVID-19 pandemic influence social media habits among Indian social media users.

Results-The Purpose of Social Media

The majority of participants (119 out of 128) stated that social media was used to interact with relatives while 44 of the participants said they also use social media to get their news.

Age vs. social media practices (N: below 45 yrs = 66; above 45 yrs = 62). Age emerged as an important variable in shaping some social media habits. Older adults (those over the age of 45) were more likely to trust information in social media (Fig. 1, t-test, $p < 0.01$), had poorer sharing habits (Fig.2, $p < 0.01$), and were more likely to believe the social media messages on COVID-19 vaccine side effects on social media (Fig.3, $p = 0.001$) compared to their younger counterparts. 45.7% of older adults reported more trust in social media, as opposed to 38% of their younger counterparts. In terms of sharing habits, 61% of the older adults and 23% of the younger adults reported that they did not read the entire article before forwarding it but either just forwarded it

without reading, read only headlines, or just skimmed the article. 50% of older adults expressed belief in COVID-19 vaccine side-effects information on social media as opposed to 23% of younger participants. However, age appeared to have no significant impact on time spent on social media, vaccine hesitancy, or belief in COVID-related information on social media, in this present study.

Figure 1: Age vs Trust in social media (Assigned numerical values to the responses: Lots of trust-3; Some trust -2; No trust-1)

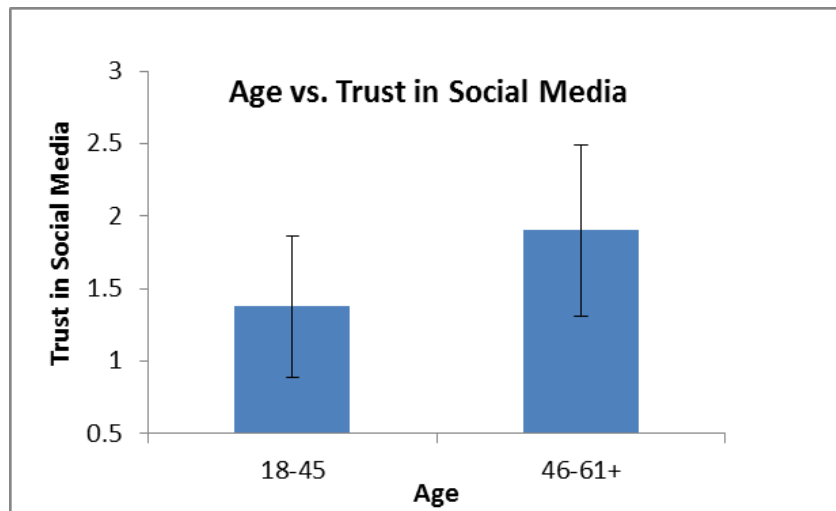


Figure 2: Age vs Sharing Habits (Read the entire article:-4; Skim article- 3; Read only headlines -2; Just forward- 1)

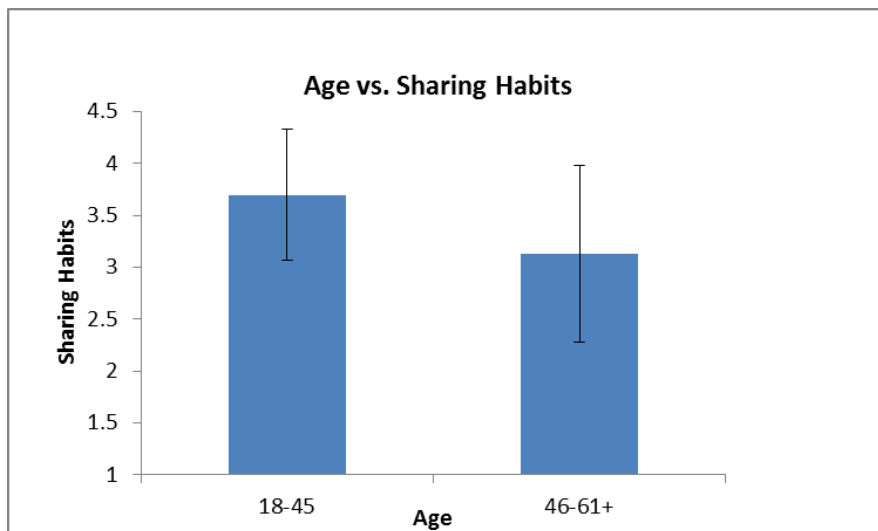
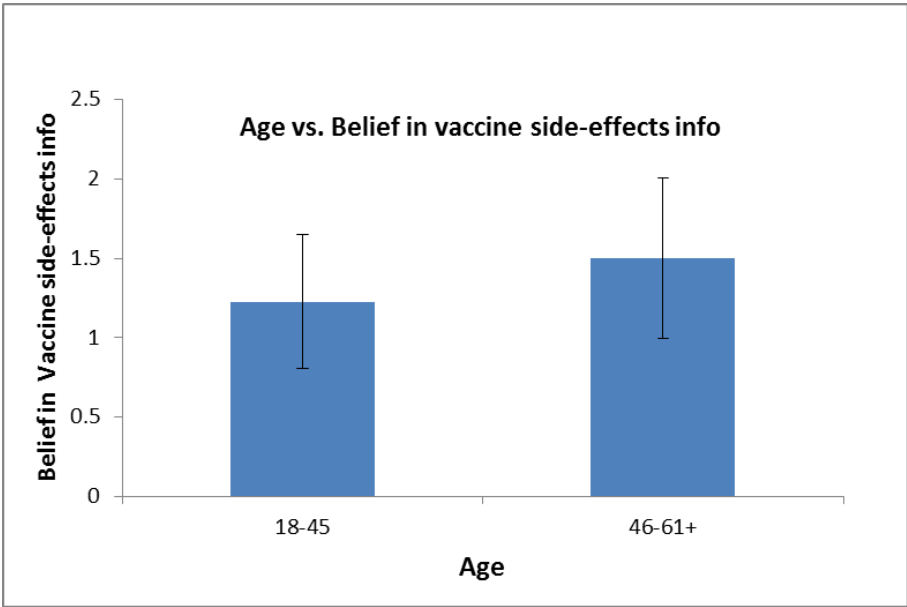


Figure 3: Age vs Belief in COVID-19 vaccine side-effects information (No Belief- 1; Belief- 2)



Vaccination Hesitancy vs. Social media practices (N: hesitant= 69; not hesitant = 59)

When participants were divided into vaccine-hesitant and non-hesitant groups based on their attitude towards receiving COVID-19 vaccination, those who expressed hesitancy toward the vaccine were more likely to trust news on social media (Fig. 4, $p = 0.06$; Borderline significance) and believe in most information about COVID-19 vaccine side effects on social media (Fig. 5, $p < 0.01$). However, there were no appreciable differences in the groups' sharing habits, time spent on social media, or trust in COVID-related information on social media.

Figure 4: Vaccine Hesitancy vs Trust in social media (Lots of trust-:3; Some trust-2; No Trust-1)

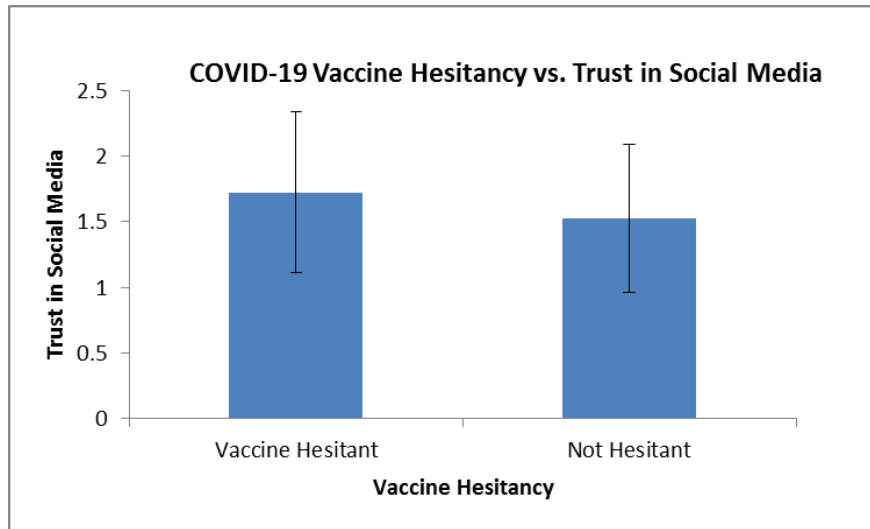
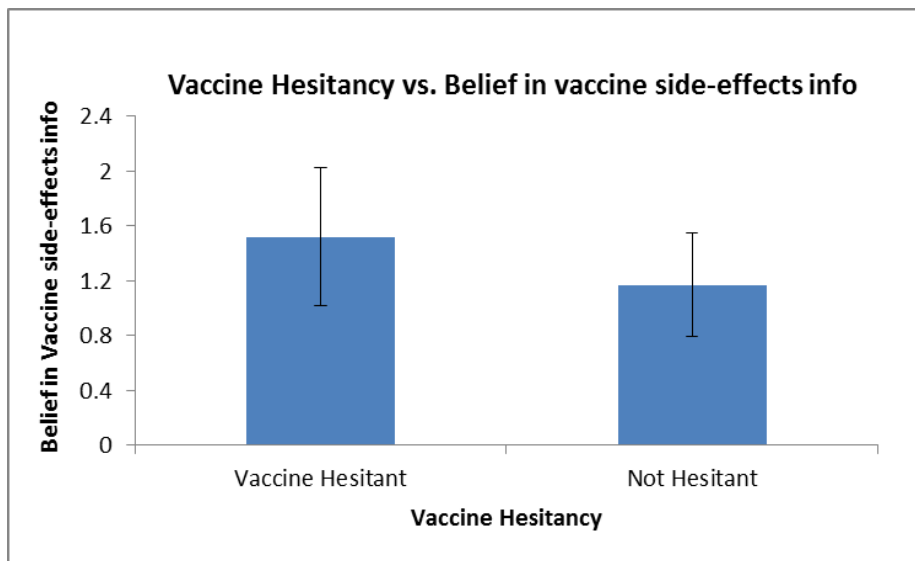


Figure 5: Vaccine Hesitancy vs Belief in COVID-19 vaccine side-effects information (No Belief- 1; Belief- 2)



Other Variables VS. Social Media Practices

Due to large sample size disparities, no clear or accurate impacts of education, economic status, or immunization status on COVID-19-related social media habits could be found. Only 20 of the 128 participants had a high school education or less, 21 had an income of fewer than 2 lakhs and 6 had not or had only partially been vaccinated.

Open To Correction

89% of the participants responded positively to the question, "Are you open to others (e.g., friends, family members, old or young) correcting and counseling you on the accuracy of the information supplied by you?"

Discussion

In our study, age emerged as an important variable in influencing social media practices among Indian online users. People above the age of 45 appeared to be more trusting, practiced poor sharing/forwarding habits, and believed in most information related to the COVID-19 vaccine side effects on social media compared to their younger counterparts. A recent study showed a strong relationship between age and vulnerability to misinformation. Guess⁵ found when examining the habits of Facebook users in sharing false articles from fake domains, people above 65 years of age were 7 times more likely to spread misinformation than the younger population.

There are many factors that make older individuals susceptible to misinformation. Often cognitive decline is thought to be responsible for such susceptibility. However, Brashier & Schacter⁷ argued that cognitive decline cannot be fully responsible for spreading misinformation or becoming victims of fake news. The authors explained that many factors like difficulty detecting lies, less emphasis on accuracy, and most importantly their relative newness to social media contribute to the spread of misinformation. Older adults may have less experience with clickbait and Internet hoaxes, thereby leaving them at a disadvantage in guarding against misinformation.

Our present study also showed that the vaccine-hesitant population was more likely to trust social media and believe in most information related to the COVID-19 vaccine side effects on social media. Many studies have documented an association between misinformation and vaccine hesitancy.^{8,6,9,11} Kricorian & Civen⁶ found that people who were COVID-19 vaccine-hesitant were less willing to receive the vaccine, knew less about the COVID-19 virus and were more likely to believe COVID-19 vaccine myths and misinformation. Additionally, they also found that the people who were vaccine-hesitant and fell for misinformation had lower education and a lower income. The authors emphasized the importance of literacy and clear

communication with people, especially those from disadvantaged socioeconomic and educational backgrounds.

Even though we did not find other demographic variables like economic status or education as significant factors due to sample differences, many studies have shown that these play an important factor in shaping social media habits. Pan⁴ found that people with a higher socioeconomic status and education level were less likely to believe in health misinformation compared to those from lower socioeconomic groups. A study by Seo¹⁰ found high vulnerability to misinformation in low-income African-American older adults, one of the most digitally disadvantaged and underserved populations. They concluded that this group will be able to identify false information better with education.

Raising media literacy awareness and education appears to be a promising path in curbing the spread of misinformation. Guess⁵ showed that media literacy campaigns (education) improved the judgment between mainstream and false news headlines among people from both the United States and India by 26.5 % and 17.5 % respectively. The study further showed encouraging results even with simple, brief and cost-effective media literacy interventions. Moreover, based on this small-scale study and previous studies, it is critical to focus media literacy interventions on socio-demographically disadvantaged groups (e.g, low socio-economic status, low income, seniors) to effectively combat misinformation.

Methods

An anonymous internet-based survey was administered using Google Forms. To ensure that only residents of India participated in the poll, the survey questionnaire link was distributed through email and Whatsapp to our friends and family members who lived in India, who were then asked to share the link strictly with only those who were residents of India and were over the age of 18.

Questions regarding basic demographic information as well as information on participants' online behaviors, opinions towards the COVID-19 vaccine, and other social media habits were included in the survey. The survey took approximately 5 minutes to complete. The data was instantly saved in an online spreadsheet after the participants submitted the form. A total of 133 participants responded, out of which five were discarded due to incomplete survey responses. We report the results of social media practices as reported by 128 participants. The

survey was closed after three weeks of receiving no responses. The survey's response rate could not be calculated because the distribution methods utilized did not allow us to count the number of people who viewed the link. We evaluated the data using statistical techniques like the T-test. The survey study aimed at investigating how socio-demographic factors (age, education, and economic status), COVID-19 vaccine status, and vaccine hesitancy influence social media practices.

We surveyed:

- The purpose of social media use
- Time spent on social media
- Level of trust in social media news
- Level of trust in COVID-19-related rumors in social media
- Level of trust in COVID-19 vaccine-related information on social media
- Open to correction of their behaviors

Statistical analysis (t-tests) was done for the age and vaccine hesitancy variables. We were unable to run the statistical analysis for other demographic variables like education, economic status, and vaccination status due to the high differences in sample sizes. However, the responses will be depicted in percentages.

Conclusion

In this paper, we discuss the factors that contribute to the viral spread of misinformation in India. We created a survey to extract data from a population in India regarding their media literacy habits. We were able to conclude that age and attitudes towards the COVID-19 vaccine likely play an important role in influencing participants' social media habits and their vulnerability to misinformation in general. These findings provide some insight into predicting and mitigating the spread of misinformation.

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Can Data from the Past Predict the Future? By Xianjie Yang

Introduction

In recent years, there has been a growing interest in the use of data to predict future trends and events. With the rapid growth of technology and the abundance of available data, many businesses, organizations, and governments are turning to data-driven predictions to inform decision-making and improve outcomes. From weather forecasting to financial analysis to healthcare, data-driven predictions have the potential to revolutionize the way we approach complex problems and make informed choices. In this essay, we will explore the applications of data prediction and the strengths of this approach.

Predicting the future is something that has always been of interest to humanity. We have developed many tools and techniques to help us make predictions, from tarot cards to complex mathematical models. In this essay, I analyze how data from the past can predict the future through two cases - predictive policing and Apple's business strategies. For predictive policing, I focus on how law enforcement relies on past data to promote community safety and reduce crime. For Apple's business strategies, I focus on how the company relies on data to understand customer behavior and improve its products accordingly.

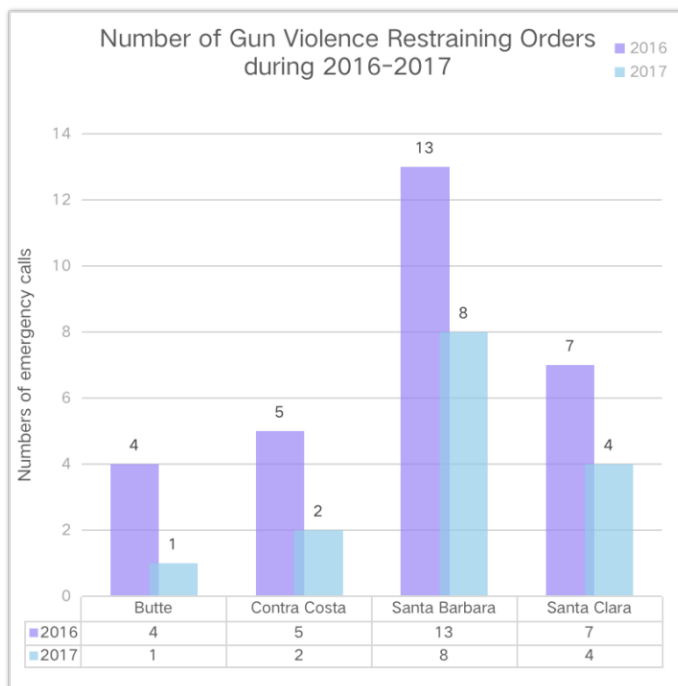
Predicting is particularly important in law enforcement, where predictive policing has emerged as a valuable tool for crime prevention. Predictive policing is based on the idea that data from the past can help predict the future, by identifying patterns and trends that can be used to anticipate criminal activity. The theory behind predictive policing is that it can help police departments be more effective in preventing crime and reduce the likelihood of police violence by focusing on non-confrontational tactics.

Predictive policing uses historical crime data and other relevant information to identify areas where crime is likely to occur. This data can include information about the time of day or week, the type of crime, the location of the crime, and any other relevant factors. By analyzing this data, predictive policing algorithms can identify patterns and trends that can help predict where and when the crime is most likely to occur in the future.

One example of how predictive policing has been used is in the city of Los Angeles. The LAPD has developed a predictive policing program called PredPol, which uses historical crime data to predict where crimes are most likely to occur. The system uses an algorithm to analyze crime data and identify hotspots, which are areas where crime is most likely to occur. Officers are

then dispatched to these hotspots to prevent crimes before they occur. For example, a study conducted by the Los Angeles Police Department found that PredPol was effective in reducing crime in the areas where it was deployed. The success of predictive policing in Los Angeles has been impressive. Since the implementation of PredPol, the city has seen a significant reduction in crime rates. In 2015, the LAPD reported a 13.5% decrease in violent crime and a 10.4% decrease in property crime. These results are a testament to the power of predictive policing and the ability of data from the past to predict the future.

In the following graph below, I aim to show how data from the past is important for the future in predictive policing, by emphasizing the decrease of gun violence restraining orders in the following Californian cities between 2016 - 2017: Santa Barbara, Santa Clara, Butte, and Contra Costa. Pay close attention to how crime rates have decreased in all cities in 2017 when compared to 2016.



One possible reason for the discrepancy in results is that the effectiveness of predictive policing algorithms may depend on how they are implemented. When police departments use predictive policing to inform their decision-making, they may be able to achieve better results. Additionally, proponents of predictive policing argue that these systems can help prevent crime before it occurs, by allowing police departments to allocate resources more effectively. For

instance, if an algorithm predicts that a particular area is at high risk for burglary, police officers can patrol that area more frequently, which may deter potential burglars from committing a crime.

Another example of a potentially positive use of predictive policing is the Beware system. While there are certainly concerns about the potential for Beware and similar systems to perpetuate biases and unfairly target certain communities, the system may also have some benefits.

In addition to Predpol, the Beware system can provide police officers with additional information that may help them make more informed decisions. When an officer responds to a call about a domestic disturbance, the Beware system may be able to provide information about the history of violence at that address, which could help the officer to assess the situation more accurately.

Furthermore, the Beware system can be used to provide police officers with real-time information about potential threats. If the system detects that someone has posted a threat on social media, it can alert police officers in the area to be on the lookout for that person. Of course, it is important to use these systems carefully and responsibly and to ensure that they do not unfairly target certain communities or perpetuate biases in law enforcement. However, when used appropriately, predictive policing algorithms can provide police departments with valuable information that can help them prevent crime and keep communities safe.

While there are certainly concerns about the potential biases and limitations of these algorithms, the success of programs like PredPol in reducing crime rates suggests that predictive policing has the potential to be a powerful tool in crime prevention. Ultimately, it will be up to law enforcement agencies and policymakers to ensure that predictive policing is used fairly and effectively and that the potential risks and limitations are carefully considered. Given the effectiveness of predictive policing in reducing crime, law enforcement greatly benefits from analyzing past data to predict the future for the citizen's safety.

In the fields of business and technology, examining past data is very helpful to increase business competitiveness. Apple is a company that has a long history of using data to predict and drive future growth. One example of this is the company's use of past data to raise revenue. By studying past trends in customer behavior and product performance, Apple was able to identify areas for growth and make strategic decisions that have contributed to its success. Apple has a reputation for having high levels of customer satisfaction. According to the 2021 American

Customer Satisfaction Index (ACSI) report, Apple continues to be the leader in the personal computer industry, with a score of 82 out of 100. This is a one-point increase from the previous year's score of 81, and it marks the 16th consecutive year that Apple has been at the top of the ACSI rankings

In addition, a 2021 survey by Consumer Reports found that Apple is the highest-ranked laptop brand for both reliability and customer satisfaction, with a rating of 89 out of 100. The survey also found that Apple is the second-highest-ranked smartphone brand for customer satisfaction, with a rating of 86 out of 100.

Apple's high levels of customer satisfaction can be attributed to its focus on creating high-quality products with innovative designs and features, as well as its commitment to providing excellent customer service and support. The company also regularly updates its products with new features and improvements, which helps to keep customers satisfied. One way that Apple has used data to raise revenue is through the analysis of historical sales data. By studying past sales trends for specific products, Apple has been able to identify which products are performing well and which are not. This data has been used to inform product development and marketing decisions and to drive sales and revenue growth.

For example, when Apple noticed that sales of the iPhone were beginning to plateau, the company used data to identify new areas for growth. Tim Long, a Barclays analyst and equity researcher in technology, pointed to the popularity of the Apple Watch and AirPods that can help increase iPhone sales. Long's data analysis showed that the wearables market was growing rapidly and that Apple was well-positioned to capitalize on this trend. The company launched new versions of the Apple Watch and AirPods, with improved features and functionality. Apple also introduced new wearables products, such as the AirPods Max headphones and the Apple Watch SE, which offered a more affordable option for consumers. By observing past data on iPhone sales, Apple can improve its product by enhancing the gadgets used alongside the smartphone.

Tim Long predicted that Apple is likely to cut its guidance when it publishes its latest earnings on Feb.1. Long estimates that the company will post revenues of \$39.9 billion in March, 12.4 percent lower than consensus expectations of \$45.57 billion. The analyst made those cuts after predicting that Apple will sell about 9.5 million iPhones less than consensus estimates of 236.5

million. He also believes that revenues and earnings will come under pressure from a lack of new smartphone launches.

Moreover, analyzing past data also helped Apple improve its services to loyal customers. Another area where Long's analysis pointed to potential growth was in services. Apple had already been investing in services such as Apple Music, iCloud, and the App Store, but Long's data analysis suggested that there was even more potential for growth in this area. Long identified opportunities for Apple to expand its services offerings, such as by launching a subscription-based streaming service for original video content. Based on Long's analysis, Apple began to focus more on its service offerings. The company launched several new services, including Apple News+, Apple Arcade, and Apple TV+, a streaming service for original video content. These new services helped to diversify Apple's revenue streams and reduce the company's reliance on iPhone sales.

The success of Apple's wearables and services offerings demonstrates data analysis's power in identifying new growth areas. By analyzing market trends and customer behavior, Tim Long and other analysts were able to provide valuable insights that helped Apple to pivot its business strategy and stay ahead of the curve. Today, Apple continues to use data analysis to inform its decision-making and drive innovation across its product and service offerings.

Another way that Apple has used data to raise revenue is through the analysis of customer behavior. By studying historical data on customer behavior, such as purchasing habits and usage patterns, Apple has been able to identify areas for growth and develop new products and services that cater to those needs. In September 2020, Apple Music introduced personalized playlists, including the "Favorites Mix" and "New Music Mix," which are curated for each user based on their listening history and behavior. The feature was based on data analysis of user listening habits, to increase user engagement and retention. Also, in August 2020, Apple News+ introduced personalized recommendations for each user, based on their reading history and preferences. The feature was developed based on data analysis of user behavior, to increase user engagement and subscription revenue.

Apple has also used data to raise revenue through the analysis of market trends and competition. By studying trends in the technology industry and monitoring the performance of competitors, Apple has been able to identify areas for growth and make strategic decisions that have contributed to its success. In 2020, Apple introduced a lower-cost Apple Watch SE model,

based on data analysis showing that many consumers were looking for a more affordable smartwatch option. Apple uses data analysis to identify mobile payment market trends and develop partnerships with banks and merchants. In 2020, Apple announced a partnership with Goldman Sachs to launch the Apple Card, a credit card that offers cashback rewards and is integrated with Apple Pay. Apple uses data analysis to identify trends in the music streaming market and expand its Apple Music service to new regions. In 2020, Apple Music launched in 52 new countries, based on data analysis showing that there was a demand for the service in those regions.

All in all, Apple's use of data to raise revenue is a testament to the company's ability to use past trends to predict and drive future growth. By leveraging historical sales data, customer behavior, and market trends, Apple has been able to identify new areas for growth and make strategic decisions that have contributed to its success. While there are always uncertainties and variables that can impact future performance, the use of data provides a valuable tool for companies like Apple to make informed decisions and plan for future growth. Similarly, predictive policing relies on data analysis to predict and prevent crime before it happens.

Conclusion: In conclusion, data prediction has become an increasingly important tool in decision-making across a wide range of industries and fields. As we have seen, predictive policing and Apple's selling approaches are just two examples of how data prediction is being used in practice today. While these applications have shown promise in improving outcomes and informing decision-making, it is important to recognize the limitations and potential biases inherent in data analysis. As we continue to rely on data prediction, it will be important to ensure that these tools are used ethically and responsibly.

Looking to the future, we can expect to see even more advanced applications of data prediction, particularly in areas such as healthcare, climate change, and urban planning. However, it will be crucial to approach these applications with caution and a critical eye, to fully realize the potential benefits of data prediction while minimizing its potential risks. Ultimately, data prediction has the potential to revolutionize the way we approach complex problems and make informed decisions, but it is up to us to ensure that this technology is used responsibly and ethically.

The Impact of Healthcare on the General Public: An Overview of Policies in the United States, India, and the UK By Riya Hari

Abstract

The debate of healthcare being designated a privilege or fundamental human right has never been of greater significance than today, given the circumstances of the COVID-19 pandemic. As a result, the following paper will attempt to analyze the various facets of policy-making in three countries: the USA, India, and the UK, and scrutinize the effectiveness in making healthcare more accessible to its general populace, delving into both the benefits and drawbacks of the legislation passed on a country by country basis. In the US, special focus would be given to Medicare, Medicaid and the Affordable Care Act, in India, a range of government welfare schemes such as the National Health Protection Scheme shall be discussed, while in the UK, the workings of the National Health Service will be analyzed in great detail. The report will then proceed to make comparisons between each country's health policies, articulating both differences and similarities in not only laws but also their impacts on the general public, and conclude by providing recommendations to one country based on the advantageous policies of another.

Introduction

Fundamentally, the realm of economics operates through the model of supply and demand, where buyers (consumers) and sellers (producers) remain the two main market constituents—the consumers being competent enough to judge what they purchase from sellers. In this state of the market economy, whereby decisions are taken by the price mechanism, or the invisible hand, as devised by Adam Smith to allocate resources in the most efficient manner possible, a variety of goods and services are exchanged between consumers and producers in exchange for a price paid by the buyer.

The institution of healthcare in an economy tends to deviate from this model significantly, for third parties such as insurers and governments tend to take an interest in the performance of this sector of the economy. This is primarily because healthcare is a merit good; those goods that are thought to be beneficial to the economy due to the presence of positive externalities, where both consumers and third parties are favorably impacted by the efficient

allocation of such goods but are generally underprovided and under-consumed as a result of information failure. In the case of healthcare, information failure arises when patients are unaware of and unable to evaluate the services they receive. This is closely linked with the idea of asymmetric information, where one party in a market transaction has more substantial knowledge surrounding the good/service being sold relative to the other (Bloomenthal). The establishment of healthcare within the traditional model of the market economy contradicts its primary functions in two essential ways: there is no direct exchange of money between consumers and producers, and private/public insurance sources instead pay healthcare providers. Additionally, market prices do not determine resource allocation. This facet is influenced predominantly by insurers, and therefore, the invisible hand does not come into play here (The Economics of Healthcare 2-7).

Amid the 21st century, there continues to remain a raging debate between efficiency and equity. Must a nation concern itself with matters on how effectively resources are allocated and utilized, or must it focus on how equally these resources are distributed for social welfare? With reference to healthcare, must this service be regarded as something only those who can afford to pay for it gain access to (referring to the idea of excludability) or a fundamental human right? As a result of this debate, the world sees the emergence of a type of market failure associated with the inefficient allocation of healthcare services within an economy: the underprovision and underconsumption of merit goods. To correct such perceived market failure, global governments take differing courses of action. The following report, therefore, purports to analyze the various steps that the governments of the USA, India, and the UK have taken to mitigate such market failure, their benefits and drawbacks respectively, before comparing them with one another and suggesting improvements to each nation as to what they may do to ensure a more efficient allocation of healthcare-related goods and services within their economies.

Overview of the American Healthcare System

The USA does not provide its population of 330 million with universal health insurance coverage (US Healthcare System Overview-Background). As of 2021, 10.2 % of Americans remain uninsured (Drake et al.). The system of healthcare provision in the USA is mixed, where private and public insurers put forth a myriad of schemes to provide common consumers with healthcare pursuits. It is a structure that is undergoing constant change as gradual breakthroughs

continue to be made in ensuring American residents the right to adequate, affordable access to healthcare (Tikkanen).

The two most notable strides that the US government has taken to achieve greater social welfare in the context of healthcare are the provision of the public insurance schemes Medicare and Medicaid, established in 1965. There are stark differences between the two programs. At the surface level, Medicare, funded solely by the federal government, refers to the health insurance services that are provided to those only over the age of 65 years, with the exception of individuals who are under the age of 65 with specific disabilities or permanent illnesses such as end-stage renal disease (US Healthcare System Overview-Background). It focuses predominantly on the provision of medical services such as prescription drugs, hospital stays, doctor check-ups, etc.

There are four parts to Medicare: Medicare ‘A’, ‘B’, ‘C’, and ‘D’. The recipients of parts A and B are generally rewarded with the benefits provided by Traditional Medicare, where the government directly funds one’s healthcare expenditure. Part A concerns in-patient care, while part B concerns a number of other healthcare services such as laboratory tests, general check-ups, outpatient care, etc. Part ‘C’ refers to Medicare Advantage— healthcare plans put forth by private providers and approved by the organization. Medicare Advantage contains not only parts A and B but also part D, which looks into pharmaceuticals and prescription drug coverage (The Parts of Medicare (A, B, C, D)).

On the other hand, Medicaid provides coverage to those individuals who live below the poverty line and is funded by both the federal and state governments. An individual’s eligibility for this scheme is, nevertheless, determined by various factors apart from income, such as pregnancy, visual impairments, and other disabilities; their coverage of medical services is similar to that of Medicare with the exception of Medicaid providing long-term care coverage as well.

The funding of each program is crucial to analyzing their relative accessibility— as Medicare is a federal program, its coverage is standardized across the entirety of the USA, ensuring few discrepancies in costs from state to state. The case is not the same with Medicaid. Due to the fact that the state government also plays a considerable role in conducting this program, eligibility criteria and benefits received vary across states, with certain conservative, states putting forth stricter regulations such as work requirements. The allocation of Medicaid

thereby varies across the USA, and this serves as a critical barrier to widespread access to healthcare; a severe drawback that shall be further delved into (FAQs Category: Medicare and Medicaid).

In addition to both Medicare and Medicaid, the two most prominent public health insurance plans that exist for children are the Children's Health Insurance Program (CHIP), and the IHS, or Indian Health Service for Native Americans. CHIP was created to provide those children born into low-middle income families that make wages too high to be suitable for Medicaid, but earn too little to afford private health insurance schemes (Tikkanen). Concurrently, the IHS serves as the principal source of healthcare for Indian Americans and Alaskan natives (Indian Health Service).

The Affordable Care Act (ACA), more commonly referred to as Obamacare, was a federal law put into legislation in March of 2010. It intended to expand healthcare coverage across the US through the provision of cost-reduction subsidies (CSR) and mandates to enable lower-income families to purchase insurance premiums. In addition to the increased federal funding into Medicaid to incentivize states to improve their access, the ACA also established a range of Health Benefit Exchanges— a 'marketplace' where common consumers can purchase private insurance. To combat asymmetric information, funding was directed into supplying consumers with more information to allow them to choose the insurance plans that most aptly suit their healthcare needs based on their financial situation and the provision of a range of essential health benefits such as ambulatory services, pediatric services, rehabilitative care, etc. were made mandatory by the ACA. Further regulations on private insurance companies, such as prohibiting them from denying individuals health insurance for pre-existing conditions, and an individual mandate requiring all American citizens to purchase insurance by levying a financial penalty on those who did not drastically improve insurance rates within the country (US Healthcare System Overview-Background).

Analysis of the Healthcare Policies Undertaken by the Government of the United States

There remain abundant benefits and drawbacks to the American policies attempting to expand its healthcare services. For instance, expenditure on research and development has increased significantly as a result of the expansion of health insurance policies, which also seek to cover the costs of technological advancements in the healthcare sector (Chandra et al. 2012).

Additionally, the problem of adverse selection almost always stems from the existence of an insurance marketplace. This is where buyers and sellers both have asymmetric information (for example, the buyer may know a pre-existing health condition they have which the seller does not), leading to an unfavorable outcome for one or both parties involved in a transaction. This propels what has been coined a death spiral. As a person's health profile is unknown to insurers, everyone must be charged the same price. Therefore, the healthier individuals may choose to drop out of the insured pool deciding it to be unnecessary. With a greater proportion of sick people in the insured pool relative to healthy individuals, prices would inevitably rise, establishing a firm cycle of the healthier dropping coverage and the health insurance market disappearing altogether. The above-mentioned policies of the ACA, such as insurance mandates and CSRs helped put an end to this phenomenon (The Economics of Healthcare 5-6). Another outcome of government policy is that Medicare Advantage provides common consumers with far more options for healthcare providers relative to other countries such as the UK, whose policies shall go on to be analyzed later on in this report.

The greatest hindrance to universal access to healthcare in the US is that insurance costs continue to remain extremely high and put an immense financial strain on low-income families in the USA, threatening to bankrupt them (Groce et al.). To cite the Kaiser Family Foundation: "In 2021, 69.6% of uninsured nonelderly adults said they were uninsured because coverage is not affordable." Additionally, as touched upon by the earlier paragraphs, there remains too much state variation in access to public insurance schemes such as Medicaid. As of November 2022, only 40 out of the 50 states in the US have adopted ACA Medicaid expansion, leading to a coverage gap in these states where low-middle income families earn too much to be suitable for Medicaid, but earn too little to afford alternative marketplace premiums. As far as subsidized coverage is concerned, undocumented immigrants residing in non-expanding states are outside of the reach of such benefits of the ACA due to their status. Not to mention that several workers are not recipients of employer-sponsored coverage, and despite the integration of Medicare, Medicaid, and the ACA into legislation, people of color face a greater threat of remaining uninsured, with Hispanic, Native Americans, and Alaskan Natives having 2.5 times the rate of uninsured individuals relative to their white counterparts. The uninsured rate of Asians has also risen to 6.4% as of 2022 (Drake et al.).

Overview of the Indian Healthcare System

The Indian healthcare system is a complex culmination of private and public networks of hospitals, clinics, and medical practitioners that function to provide its population of 1.3 billion with access to quality healthcare services. Once again a hybrid system of both private and public insurance systems, the Indian Constitution legally and morally binds the government to safeguard the “right to health” for all its citizens, but there remain significant discrepancies in the quality of healthcare providers, facilities, and equipment between rural and urban India (Mohan et al.). At the state level, the board of directors of the Department of Health and Family Welfare provide not only healthcare services such as pharmacies and hospital care but also supervises a range of other facets such as the training of healthcare providers, food and drug controls, data collection, the promotion of alternative healthcare practices, etc. At a district level, the Panchayati Raj, rural, self-governing bodies are in charge of implementing the aforementioned services (Gupta et al.). To combat this issue, the Indian government has launched a myriad of schemes, one of the most consequential being the National Health Protection Scheme (Ayushman Bharath-Pradhan Mantri Jan Arogya Yojna, or PM-JAY). Targeted at predominantly low-income individuals, the PM-JAY provides cashless treatment, whereby the consumers can avail of costs in secondary (specialized care based on general physician (GP) referrals) and tertiary (highly specialized hospitals) care at private healthcare establishments (Levels of Healthcare). Subsumed under the PM-JAY is the National Health Insurance Program (Rashtriya Swasthya Bhima Yojana, or RSBY) as launched in 2008 to further protect the right to healthcare for those living below the poverty line in India. Although the RSBY was widely regarded as ineffective in reducing out-of-pocket expenditure, where insurance companies do not fully cover healthcare costs, and additional issues involving poor infrastructure and long-waiting times in hospitals, coupled with the PM-JAY, the success of the scheme was boosted, becoming India’s greatest first step in achieving universal healthcare.

To further delve into the availability of public health insurance in India (aside from the RSBY and PM-JAY), in 2013, mine workers were taken into the helm of the RSBY, while the Aam Aadmi Bima Yojana (AABY) was implemented to serve as a social security scheme to provide death and disability coverages for those between the ages of 18 to 59. Lastly, the Central Government Health Scheme, brought forth by the Ministry of Health and Family Welfare (see

below) is another noteworthy scheme, providing coverage for all three types of treatments: allopathic, homeopathic, and alternative medicine. There remain no income eligibility criteria, although, the project is only available for retired central government employees and their families. In just the Indian state of Karnataka, the Vajpayee Arogyashree Scheme (VAS) was rolled out in 2010 and is deemed highly consequential toward India's road to achieving universal healthcare. Its prime subjects were those below the poverty line, coverage to healthcare was offered to these individuals, and tertiary care centers were heavily reimbursed to better the quality of healthcare services in Karnataka.

In addition to the integration of national healthcare schemes, the federal government has spent significantly on R&D pertaining to healthcare services in India. The Ministry of Health and Welfare consists of two primary departments: The Department of Health and Family Welfare which is responsible for the administration of national health programs, and the Department of Health and Research which serves to promote clinical research, ethical healthcare practices, and training for providers. The year 2014 saw the establishment of the Federal Ministry of Ayurveda, Yoga and Naturopathy Unini Siddha and Homeopathy that centralized on R & D concerning alternative medical treatments and practices (Gupta et al.).

Analysis of the Healthcare Policies Undertaken by the Government of India

Healthcare reforms in India have seen considerable success in mitigating barriers to access to healthcare. In terms of the VAS, A study published in the British Medical Journal Reports: "Among VAS ineligible patients, 7.7% reported a post-hospitalization infection and 32.6% reported needing to be re-hospitalized after the initial hospitalization. However, among VAS eligible patients only 0.9% reported infection and 16.8% reported rehospitalization, 88%, and 48% reductions, respectively." (Sood 4). Additionally, the PM-JAY has helped to ease discrepancies in the quality of healthcare in rural India by subsidizing and providing incentives to private sector hospitals to ramp up supply, expand, and fuel the construction of more hospitals. A common criticism of Indian governmental policy surrounding healthcare is that it places too much focus on communities in the below-poverty line category, thereby exempting those families that earn too much to reap the benefits of schemes provided to those within this stratum of individuals, but too little to afford out-of-pocket expenditures from private hospitals. Hence,

the Insurance Regulatory and Development Authority Act of 1999 not only enabled private companies to enter the market but also gave way for those ineligible state-sponsored schemes to easily purchase private ones. This was a significant step in making 4.4 percent of total health consumption through private insurance today. Employer-sponsored insurance schemes in India have also had a profound impact on its population, where the Employees' State Insurance Scheme, now extended to various sectors of the economy such as hospitality, transport, cinema, etc. covers workers and their respective families, accounting for 0.75 percent of their wages. A scheme that possesses over 133 million beneficiaries, the services offered include maternity care and death and disability benefits for injuries that are caused due to their employment circumstances.

Despite the implementation of the policies described above the Indian government has enforced within the nation to mitigate barriers to its populations' access to healthcare, there continue to remain abundant shortcomings. Only 37 percent of the Indian population is insured today, while the remaining 63 percent choose to pay costs out of pocket. Hence, those who cannot generate sufficient income to afford healthcare expenses suffer. The healthcare sector of India also continues to remain underfunded by the government, accounting for only 1.3 % of the nation's GDP. This gives rise to serious inequalities surrounding the quality of healthcare received in the rural and urban parts of India. In addition, 75 percent of the Indian population, all concentrated in rural India, receives healthcare from providers who have not acquired formal training (Mohanani et al.). This highlights yet another important disadvantage, which is the lack of standardization of healthcare schemes, where different states receive different insurance coverage plans, or, only a limited volume of the Indian population is eligible for public health insurance schemes. With special reference to the VAS, a significant drawback of the scheme is that it caters to those only residing below the poverty line. It is a rather difficult task to acquire proof of this status (a BPL card is to be obtained), excluding individuals with serious healthcare needs from this scheme. Not to mention the threat of potential overuse of the VAS (Sood 6). Lastly, mental health care in India continues to remain in a dire state. Resources are available in scant quantities: for every group of 250,000 people there is only one trained psychiatrist, and for every 100,000, there is fewer than one trained mental health professional. The concept of mental health is widely stigmatized in Indian society, giving rise to such issues (Gupta et al.).

Overview of the English Healthcare System

The year 1948 was monumental for the English healthcare system, for the National Health Service (NHS) was established following the enactment of the National Health Service Act of 1946 into legislation, guaranteeing universal health coverage for all (Thorlby et al.). The NHS remains the largest employer in the UK, employing 1.3 million and having a budget of over 90 million GBP. The work of the NHS may be classified into two broad sections; the first concerning social policy, health strategy, and management, and the second dealing with clinical care. Clinical care may be further divided into primary (the first level of treatment acquired by patients, for example, GPs, dentists, etc.), secondary and tertiary care (Levels of Healthcare). What separates the NHS from the Indian and American healthcare systems is the establishment of three other institutions: The Care Quality Commission, The National Institute for Health and Clinical Excellence (NICE), NHS Improvement, and Health Education England. The Care Quality Commission, on one hand, regulates the healthcare services provided throughout England, registering providers to make certain that procedures are carried out safely and are of great quality. NICE, on the other hand, is a regulatory body established in 1999, responsible for setting out guidelines and standards for not only the betterment of clinical care but also research into new health technology to reduce costs associated with healthcare provision (Grosios et al.). NHS improvement licenses healthcare providers and may also investigate probable infringements of NHS corporation and competition rules along with mergers that include NHS trusts, while Health Education England organizes the NHS staff. While the NHS on its own has no eligibility criteria, it has a separate branch known as the NHS Low Income Scheme, which covers transportation costs to and from provider sites for its qualifiers. The NHS also oversees the work of its 199 Clinical Commissioning Groups (CCGs) (Thorlby), created by the Health and Social Care Act in 2012. The CCGs served to replace primary trusts established by the NHS, acting as statutory bodies run by GPs to administer healthcare services within their local area (Miller).

Analysis of the Healthcare Policies Undertaken by the Government of the United Kingdom

Perhaps the greatest triumph of the NHS is that it promises universal coverage for all the citizens of the UK, its comprehensiveness put on full display through the abundant healthcare services that it offers, ranging from hospital care to dental care and prescription medications. As

a result of the abundant variety of healthcare services, all provided free of cost, patients do not bear the mental strains caused by medical bills. Another significant consequence of the NHS is its contribution to higher employment rates within the UK. Just between the years of 1999 to 2009, there was a 35 percent increase in staff employment and an 82% rise in the number of managers, all of which brought increased employment and expanded the scope for the provision of healthcare services in the UK. To further dwell upon this, the Long Term Plan of the NHS seeks to further alleviate poverty rates in the UK and set measurable goals to reduce health inequalities within the region. The scheme has shown staggering success which has enabled it to also shift its focus onto other social issues such as environmental degradation with the NHS as its face (Fenney et al.). The courses of action taken for preventative care is also a noteworthy advantage of the NHS, whereby Predictive, Preventative, and Personalised Medicine (PPPM) in the NHS attempts to spread awareness and spend money on aspects relating to reducing smoking, and improving sexual and mental health. In the long run, the PPPM has the benefit of reducing the risk of medical expenses and interventions.

Nevertheless, there remain barriers to the extent of the workings of the NHS. As the English population continues to increase rapidly along with peoples' life expectancies, records of chronic diseases such as cancer and neurological disorders have skyrocketed. Changing lifestyles and diet patterns have also clogged up healthcare institutions, with the so-called obesity pandemic resulting in an upsurge of cardiovascular disease and diabetes; the treatment of these conditions now accounts for over 16 percent of the NHS's expenditure. There has been an alarming rise in health inequalities, where ethnic minorities and other poverty-stricken communities find themselves at the forefront of the fight against the most serious illnesses, child mortality, premature death, and disabilities. This gap is only increasing— 4 percent for men and 11 percent for women, citing that healthcare services are improving for the rich to a greater extent relative to their poorer counterparts (Grosios et al.). Lastly, poor housing in England has cost the NHS 1.4 billion GBP, as low-income families, who cannot afford adequate housing are forced to reside in homes that expose inhabitants to the cold and other forms of injury, such as those caused by staircases, factory emissions, and even mental health care. Needless to say, this exacerbates health inequalities within the UK and is another shortcoming of the NHS (Bre Report Finds Poor Housing Is Costing NHS £1.4bn a Year: Bre Group).

Comparisons Between the American and Indian Healthcare Systems

The American and Indian healthcare systems are somewhat dissimilar in nature, exempting certain commonalities between the two. Both the American and Indian healthcare systems have both the private and public sectors working simultaneously to provide common consumers with healthcare services, however, it must be noted that in the USA, a greater number of healthcare facilities are owned by the private sector relative to India, where the public sector plays a far more crucial role in resource allocation. Another similarity between the two includes the fact that the healthcare provision schemes, such as Medicare and Medicaid in the USA and the RSBY and the PM-JAY in India have very specific eligibility criteria which result in large populations being exempt from free/affordable access to healthcare. Although, in India, the sole criterion is acquiring a below-poverty line status and this applies to the entire nation, while, in the USA, eligibility for public insurance depends on various facets such as residency status and varies across states. Both the USA and India are also big on R & D expenditure surrounding the realm of healthcare, though Indian government expenditure on this facet is much greater than that of the USA. In India, the role of the Department of Health and Research and a general rise in government investment in the USA cites evidence for this.

However, there remain stark differences between the American and Indian systems of healthcare. On one hand, in India, funding for healthcare services is through both government spending and out-of-pocket expenditures, and most facilities are under public ownership. In the USA, however, healthcare provision is placed predominantly in the hands of the private sector, and the government sponsors schemes such as Medicare and Medicaid, and private insurance companies cover the rest of the healthcare services. Needless to say, the public/private sector ownership of resources in healthcare results in healthcare costs in India being much lower than that in the USA. Additionally, employer-sponsored insurance is prevalent in India with the implementation of the Employees' State Insurance Scheme but not so much in the Americas, where several workers are not recipients of employer-sponsored coverage. There is a greater assertion of alternative medical practices in India with the work of the Department of Health and Research while the USA focuses solely on devoting funds to pharmaceutical services through Medicaid D.

Comparisons Between the American and English Healthcare Systems

Largely, the outcome of healthcare services is alike in both the UK and the USA, where the quality of healthcare services is generally on par with one another. This is a result of R & D spending in technologies focusing on preventative medicine by both countries, with Medicare and Medicaid prompting an increased allocation of resources into the healthcare sector by the American, government and the PPPM working to improve technologies and spread awareness about a myriad of health issues today's generation faces. Moreover, health inequalities are still prevalent in both nations, although attributed to different reasons. In the UK, poor housing causes an upsurge in the demand for healthcare services, while, in the USA, high costs dissuade consumer expenditure on insurance premiums, leading the richer communities to benefit and the poorer ones to suffer from a lack of access to healthcare.

Nevertheless, the English and American healthcare systems differ greatly. The UK has universal health coverage while the USA does not, and as a result, access to healthcare services in the USA is usually insufficient and scattered across different states due to the variances in Medicaid eligibility criteria among states unlike the UK, where healthcare access is standardized throughout all regions. Funding for the healthcare systems also contrasts between the two nations, where, in the UK, it is financed through general taxation, and in the USA, through out-of-pocket expenditures and public/private insurance. Due to this, and the very presence of the NHS, healthcare costs are much lower in the UK, whereby in the USA, there is an increasing reliance on behalf of individuals on the private sector/insurance to access healthcare services. Concurrently, payments for providers vary. In the UK, capitation is the source of income for most clinicians, while in the US, payments in exchange for services are more commonplace. It must also be noted that the NHS goes outside the scope of just healthcare provision with its Long-Term plans, unlike Medicare and Medicaid.

Comparisons Between the Indian and English Healthcare Systems

The workings of the Indian and English healthcare systems also contrast one another to a great extent, with the sole similarity involving investment into technologies and R & D spending to improve the quality of healthcare access and services for both countries. In India, as mentioned earlier, R & D expenditure is covered by the Ministry of Health and Family Welfare which has established the Department of Health and Research, while in the UK, the PPPM

functions to enhance technologies and spread awareness about a series of health concerns hampering the progress made by individuals in contemporary times.

There remain abundant differences between the Indian and English healthcare provision: The UK has a nationalized healthcare system while India has a mixed system, with both the private and public sectors coming into play. As a result of the respective allocation systems of India and the UK, healthcare in the UK is free, although in India, the provision of subsidies only reduces the costs of healthcare services, and rather, consumers still have to resort to out-of-pocket expenditures. The financing of Indian and English healthcare also varies, where, in the UK, healthcare provision is financed solely through taxation, while in India, a culmination of tax revenue, private expenditure, and out-of-pocket payments contribute to the same. Lastly, the English healthcare system is much more standardized than in India, where the rural-urban divide in the quality of healthcare services poses a great challenge to the nation's government today. The aforementioned 'divide' in healthcare provision and quality of services would also revolve around the relative infrastructure of the healthcare facilities of each country, which is far more developed in the UK due to the large budget of the NHS and government investment into the program, relative to India.

Conclusion & Personal Perspectives

To conclude, this literature review vehemently believes that there is great scope for the mitigation of barriers to access to healthcare in the three countries: The USA, India, and the UK should each learn from the workings of one another and integrate certain strengths of each government entities' healthcare policies into their legislation. Generally speaking, there are several ways in which each nation can improve its healthcare services. The USA ought to address the conundrum of high costs, an issue that may be easily sorted by further expanding the provision of Medicaid and ensuring that eligibility criterion is more homogenized among states and is not on the basis of race and ethnicity, to ensure equity for all. India, on the other hand, must focus on eliminating the divide between its rural and urban regions in terms of the quality of healthcare that patients receive, and this may be done through an increase in government investment towards infrastructure projects, training, the subsidization of healthcare services to keep costs low and improve demand, etc. As the UK faces a shortage of workers today, and long wait times for patients, the nation must also amp up funding for the training of workers,

infrastructure, and technologies to improve efficiency and reduce the impact of the aforementioned issues. This report strongly recommends and in order to address the growing issue of health inequalities in each respective nation, social determinants of health, such as poverty, a lack of education, poor housing, etc. ought to be addressed, along with any underlying biases prevalent within the healthcare sector.

As far as what each nation can learn from the other is concerned, the US can learn from India, to lower its costs of healthcare by increasing government expenditure in the healthcare sector and integrating more employer-sponsored coverage schemes such as the Employees' State Insurance Scheme, while India can focus on the provision of pharmaceuticals in more cost-effective manners to improve access, while simultaneously improving the infrastructure and quality of its healthcare facilities like the US. The US must learn from the UK to standardize its access to healthcare by easing eligibility criteria for Medicaid throughout its entire population and lowering costs, while simultaneously increasing funding towards preventative medicine and ways the nation may combat asymmetric information in the market. India too would have to learn the same from the UK with an additional focus on R & D investments, while the UK, from the US, can learn to reduce waiting lines by improving healthcare efficiency in technologies.

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Paradoxes in Quantum Physics By Aiza Ali

Abstract

The rules within quantum mechanics have puzzled physicists for decades, bringing about “paradoxes” which contrast the principles of quantum mechanics and classical mechanics. The Heisenberg uncertainty principle makes it “impossible” to measure certain pairs of observables, such as the system’s position and velocity simultaneously, a basis for some of the following “paradoxes”. Similarly, the Stern-Gerlach experiment quantized the orientation of an electron to merely two possibilities. Schrodinger’s cat thought experiment questions the possibility of superposition within the quantum world. This brings about the EPR paradox, which questions the possibility of quantum physics with respect to the Theory of Relativity and entanglement of multiple systems, while Bell’s Inequality “solves” this question. By looking into these “paradoxes” dealing with the quantum world, it is learned that these are not paradoxes but really experiments that prove quantum mechanics is not fully understood.

Introduction

“It should be possible to explain the laws of physics to a barmaid.” [13] Sources vary on whether this was said by famous physicist Albert Einstein or Ernest Rutherford, yet the idea still remains true. However, if physicists do not understand the laws governing physics, how would they be able to explain such rules to a person with no background on the subject? The rules of quantum mechanics—the study of matter and energy at an atomic scale—are constantly debated due to varying experiments and principles which prove contradicting ideas [5]. Some of these experiments appear to confute one another because they involve the principles of classical mechanics, which do not apply to quantum physics. Phenomena such as Schrodinger’s cat, the Heisenberg uncertainty principle, Bell’s Theorem, and the EPR paradox show the differences between quantum and classical physics regarding superposition and the variables of a system, putting forth the notion that quantum mechanics needs further exploration to fully understand the “paradoxes” and how quantum mechanics works.

Definitions

A **paradox** is a seemingly self-contradictory statement that can actually turn out to be true [7]. It is a common misconception that the rules governing quantum mechanics are paradoxical, as opposed to the case with classical physics, or mechanics. **Quantum mechanics** is the study of particles at an atomic scale while **classical physics** is the study of the motion of bodies under physical forces [11, 6]. Basic background on quantum mechanics includes understanding the common jargon.

A **rigid body** is matter in which all constituent particles have the same motion [8], and a **system** contains multiple rigid bodies or objects [17]. To **observe** a particle or a system means to measure one of its properties through an experiment. Furthermore, a **wavefunction** describes the probability of finding quantum particles in a certain state (specifically, the norm squared of the wavefunction is the probability). This should not be confused with a **wave packet**, in which two or more waves exist simultaneously and travel as a unit [20].

Quantum Physics can be seen as contrary to the **Principle of Locality** which states an object is affected only through its immediate surroundings. Some scientists believe quantum physics to be non-local because many experiments seem to support quantum entanglement. **Entanglement** is another important and recurring concept within quantum physics. It is the idea that discovering the property of one object indirectly reveals a property of another object, regardless of their distance from one another [22].

Superposition is when an object has two or more states due to two or more waves overlapping [21]—this concept is brought up in several experiments, including the ones that follow. The **Heisenberg uncertainty principle** fundamentally proves it is impossible to know a particle's precise position and momentum—examples of incompatible observables. The **Copenhagen interpretation**—opposed by physicists such as John Stewart Bell and Einstein—is the idea that a particle is in an uncertain state until it gets measured.

The **Special Theory of Relativity** was created by Albert Einstein and states that the speed of light is constant, and no matter can move faster than the speed of light, even though time can dilate and length can contract [14]. It will later be seen that this theory may break down at the quantum level. **Schrodinger's Equation** predicts the probability of a result. It's formula is $H\psi = E\psi$, where ψ represents the wavefunction, H represents the Hamiltonian operator, and E represents the energy [16]. Created by physicist Bell, **Bell's Theorem** is $P(X = Y) + P(Y = Z)$

+ $P(Z = X) \geq 1$ [2]. This inequality abides by classical mechanics, specifically locality in which objects with a large distance between one another should not affect one another very much—in other words they should not have a large correlation. When applying this inequality to quantum mechanics, the inequality is violated, proving that non-locality governs quantum mechanics. These terms may seem excessive, but they play a vital role when physicists attempt to decipher the principles of quantum mechanics, and its relation to those of classical mechanics.

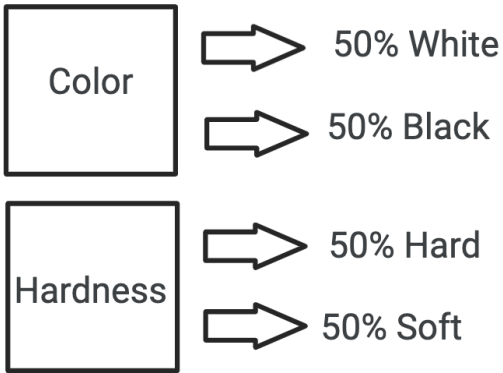


Fig 1: Equal probability for color and hardness qualities when a particle passes through.

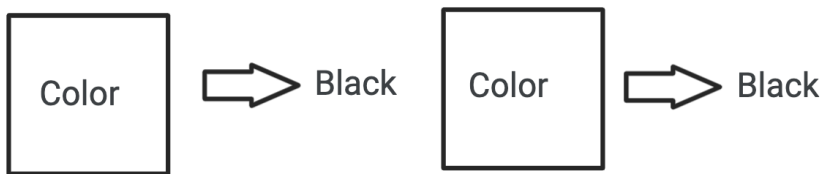


Fig 2: Color property of a particle stays constant when measured successively.



Fig 3: The color property of a particle does not affect another property, such as hardness.



Fig 4: A property of a particle, color, does not have to remain the same when measured non sequentially.

Heisenberg Uncertainty Principle and Stern-Gerlach Experiment

The Heisenberg uncertainty principle makes it “impossible” to measure certain pairs of observables, such as the system’s position and velocity, simultaneously—a basis for some of the following “paradoxes” [18]. Everything in the universe behaves as both a particle (at one exact position 100% of the time) and a wave (disturbances spread throughout space with no defined position, but with a wavelength between two valleys or peaks) simultaneously [1]. To pinpoint an object’s position, for example, more waves are needed to create a wave packet. However, this makes the object’s momentum more uncertain as the greater the amount of waves, the greater the wave frequencies, making more and more momenta possible, and thereby making the momenta more uncertain. These waves can relate to any two incompatible observables.

Although some properties of observables may not be measured precisely at once, it is possible to know one at a time [5]. For example, the Stern-Gerlach experiment quantized the orientation of an electron to merely two possibilities. Regarding the Z component of an electron’s spin, an electron could only spin up or down [23]. However, given this, it is still impossible to know the spin in the perpendicular direction.

In the figures above, color and hardness boxes were used for the sake of explanation, as was done in [1]. In Figure 1, it can be seen that each particle that passes through the box has a 50% probability of either softness and hardness for the hardness box, or black and white for the color box. Additionally, if the particle happens to be black as the result of going through one color box, if it immediately goes into another color box, it will still be black, as shown in Figure 2. However, as shown in Figure 3, knowing that this particle is black, for example, does not give any information regarding its hardness. The principle that two incompatible variables can not be known at once is exemplified through Figure 4, in which a particle that passes through the color box comes out black, then passes through a hardness box and hypothetically comes out soft. At the end it can be noticed that this particle is not necessarily black as it was previously; this is because the color and hardness are two examples of incompatible observables (such as a particle’s spin in the x and z direction).

Schrodinger's Cat

Austrian scientist Erwin Schrodinger once said, "I don't like it, and I'm sorry I ever had anything to do with it" when referring to quantum mechanics. In fact, his upcoming experiment caused him to abandon quantum mechanics because he found the principles of quantum mechanics to be extremely disturbing [12]. Schrodinger's cat thought experiment examines the possibility of superposition within the quantum world. He reasoned that if a cat was put into a box with a button that had a 50% chance of killing it and 50% chance of having no effect, according to the rules of quantum physics, the cat is both dead and alive until the box is opened and the cat's living condition is observed. The cat's wavefunction is in a superposition of states—dead and alive [9]. This superposition of being both dead and alive relates on an atomic scale to atoms and molecules being in different states or positions before they are observed. For example, electrons which "orbit" an atom, do not actually revolve around the atom, but are at a higher chance of being in one position over another [15]. This connection between the cat and the quantum realm can be seen as disturbing as it defies all the common rules to which humans are accustomed. It is important to mention that this is merely a thought experiment meant to provoke other quantum physicists to explore unknown areas of quantum physics, and it would not actually be possible for something as big as a cat to exist in such a quantum state since only quantum scale objects behave in this manner.

EPR Paradox and Bell's Inequality

The above thought experiment brings about the EPR paradox, which questions the possibility of quantum physics with respect to the Theory of Relativity and entanglement of multiple systems. EPR stands for Einstein–Podolsky–Rosen, the three physicists part of this thought experiment. The EPR paradox uses the notion that two objects interact before being separated, therefore sharing a wavefunction at one point [10]. This means, according to the Copenhagen interpretation, the entangled state of a particle becomes known once one particle gets measured. Albert Einstein used the EPR experiment to further his argument against Neils Bohr [19]. Einstein believed that there was a defined way to describe an atom's behavior. He suggested the hidden variables theory to discredit the supposed violation of his theory that nothing can travel faster than light. However, Bohr believed it was meaningless and not possible

to explicitly describe an atom's behavior. The EPR paradox is the reason Albert Einstein believed in the hidden variables theory.

Irish physicist John Stewart Bell's inequality proves that quantum physics is in fact complete, while disproving the possibility of the hidden variables theory. Bell proves that these electrons not only communicate with one another instantaneously, but they do not have set definite values before being measured [3]. He was also able to rule out any possibility of locality. The essence of this inequality is that if locality was true, and one particle's information did not affect another particle, no more than 67% of the results in an experiment can be correlated [4]. However, if entanglement remains true—even for objects a galaxy apart—they will contain a stronger percent correlation.

Conclusion

All the mentioned experiments try to come up with an explanation as to why so little about quantum mechanics is known; the answer that all of them conclude is that quantum principles differ drastically from those of classical physics. The Heisenberg uncertainty principle affirms that velocity and position, for example, can not be known exactly—a stark difference from being able to pinpoint multiple variables of an object in the classical world. This goes hand in hand with the Stern-Gerlach experiment which makes it impossible to know an object's spin in all directions, once again very different from classical physics. The Schrodinger thought experiment is far more puzzling for it endorses the idea that an object's qualities are vague until measured. The EPR paradox tries to make sense of the confusing nature of quantum physics by suggesting it to be incomplete for its violation of certain laws; however the Bell experiment comes back to the main idea that classical and quantum mechanics are drastically different—one's rules can not necessarily be applied to the other's. The nature of quantum mechanics brings about paradoxes, some of which have been “solved”, and others which remain a mystery until further in the future.

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How Aging Works and How to Stop It By Naren Selvam

Introduction

Aging is a concept familiar to all of us. It claims the most lives yearly and weakens us severely as we get older. Aging itself does not “kill” people, rather, it weakens our immune systems until they stop working well enough to protect us from diseases. This is why conditions like Alzheimer’s or dementia become much more deadly at old age. Currently, modern medicine is working on fixing the problems caused by aging, but not aging itself. But by stopping the aging process, many diseases such as Alzheimer’s, cardiovascular disease, and dementia would be solved in the process as well. In addition, staying youthful also has the benefit of being less susceptible to diseases that aren’t related with age, as your body and immune system are overall stronger. With recent scientific breakthroughs, new potential therapies in the fight against aging have been discovered.

How Exactly Do We Age?

Aging is an accumulation of changes over time. Our health mechanisms decline as we get older and as a result we become more susceptible to diseases. Our senses, respiration, digestion, and other bodily functions also deteriorate as the years go on. Studies have shown that activities such as exercise, having a good diet, and restricting calorie intake by a third or a half can all increase life expectancy (Covarrubias et al.). Meanwhile, smoking, stress, or lack of sleep can decrease our life expectancy. This has been shown across most mammals from humans to dogs to mice, and its effects are increased the sooner you start it in your life (Mercken et al.). For example, the effects smoking will have on your life are worse the earlier it begins. The same goes with healthy activities like having a good diet, which also benefit you more the sooner you start. However, the reasons activities like exercise or eating healthy make us live longer is because they produce a certain molecule crucial to many of our cell functions.

The Importance of NAD+ in Aging

NAD+ (Nicotinamide adenine dinucleotide) is a coenzyme used in redox reactions (a chemical reaction where electrons are transported between the 2 reactants in the process), and can influence many key cellular processes like DNA repair, chromatin remodeling (it allows

transcription proteins to access genomic DNA and in turn control gene expression), and immune cell function. NAD⁺ is required for around 500 different enzyme reactions, and is found in the cytoplasm, but can also be in other parts of the cell. NAD⁺ is in a constant state of synthesis, degradation, and recycling, so its levels are never stable, rather it fluctuates up and down (Covarrubias et al.). However, NAD⁺ also has a very important role in aging. The aforementioned activities that make people healthier also increase NAD⁺ levels, hence why people live longer by participating in them (Imai and Guarente). A study has shown that people who are regularly active contain much higher NAD⁺ levels than those who aren't, and shows that more active older adults contain about the same amount of NAD⁺ as active young adults (Okabe et al.). Meanwhile, older adults with the same level of physical activity as the younger adults had a considerable difference in their NAD⁺ levels. NAD⁺ levels also increase when food consumption is reduced by around half and when consuming foods such as milk, vegetables, or grains. That's because those foods contain NMN (nicotinamide mononucleotide) and NR(nicotinamide riboside) in them, which breaks down into NAD⁺ when inside the body (Okabe et al.). Furthermore, all lifeforms tested with NAD⁺ supplementation from mice to worms to yeast benefited. As for restricting food intake, most studies agree that caloric restriction works, however no one seems to know why. But NAD⁺'s main use in aging is to provide fuel for a certain set of proteins that are essential to our life.

Sirtuins and Why They are Important

The first of these proteins are sirtuins. Sirtuins are a class of proteins that regulate our health and lifespan, and use NAD⁺ as a fuel (Imai and Guarente). Studies show that decreases in NAD⁺ also have an accompanying decline of sirtuins along with them. NAD⁺ has its own benefits like energy management and maintaining healthy brain function, but its use as a fuel for SIRT-2 is an important part of why it's beneficial for aging. There are also many other classes of sirtuins that help with general body functions. Decreases in SIRT-1, the most commonly studied sirtuin in mammals, can worsen our circadian rhythm, which controls our internal sense of time (Imai and Guarente). SIRT-3 helps with protection against oxidative stress, and SIRT-6 helps keep the tips of our chromosomes healthy (Verdin). The benefits of NAD⁺ supplementation appear to work because they reactivate sirtuins and allow them to work more. Sirtuins play an

important part in aging, but there are two other NAD⁺ consuming proteins that are crucial as well.

The Role of CD38

CD38 is the second of this dynamic trio. CD38 is a NAD⁺ consuming protein that essentially acts as a flare to bring immune cells to help with problems going on in the body (Covarrubias et al.). CD38 along with sirtuins and PARPs use NAD⁺ as a fuel, but there is one detail that differentiates them from sirtuins. What makes CD38 stand out is that as we get older, we produce more CD38 which in turn lowers our levels of NAD⁺, and is one of the reasons why we age in the first place (Chini et al.). Meanwhile, levels of sirtuins drop as time goes on, and they're also the protein that helps us stay young and healthy (Imai and Guarente). An experiment has shown that CD38 increase in white adipose tissue (WAT), decreased NAD⁺ levels, while inflammation in the tissue caused CD38 levels to rise (Chini et al.). There are theories on why CD38 levels increase over time. One theory is that CD38 increases are most likely a countermeasure to inflammation or stopping other diseases, while another is that the degradation of the thymus over time causes more CD38 to be produced. Although sirtuins also consume NAD⁺, CD38 levels are increased drastically as time goes on while sirtuins levels drop (Wang et al.). Meanwhile, reduction of CD38 does not seem to cause any bad side effects and, along with the addition of more NAD⁺, it protects you people from metabolic inflexibility, diet-induced obesity, and fatty liver and glucose intolerance (Sultani et al.).

PARPS and Their Use in Aging

PARPs (poly ADP-ribose polymerases) are a family of 17 proteins essential for our survival. They have important uses such as repairing DNA and expressing genes. PARP inhibitors (PARPi) are often used in anti-cancer treatment, inhibiting DNA repair while also exploiting a defect in DNA repair to kill the cell (Sachdev et al.). PARPs, like the other proteins mentioned here, use NAD⁺ (Rajman et al.). However, PARPs are similar to another NAD⁺ protein: CD38. As DNA damage accumulates over time, PARP activity increases and it often competes with sirtuins for NAD⁺. As a result, SIRT-2 and the other sirtuin classes have less NAD⁺ to help with keeping ourselves healthy, decreasing the overall pool of NAD⁺ available but still providing a crucial role in our life nonetheless.

What Telomeres Do

However, there is another important piece of aging that indirectly benefits from NAD⁺. Telomeres are the caps at the end of chromosomes. They act like the tips of a shoelace and protect the chromosomes from external damage. Sometimes when the cell replicates itself, a bit of the telomere is lost. When too much is lost, the cell can no longer divide.

One of the ways cancer cells keep replicating is that they keep their telomeres long, so they continue replicating long beyond when a normal cell would have died (Telomerase: Definition, Function, Structure and Cancer | Biology Dictionary). However, telomeres are also important to aging. This shouldn't come as much of a surprise considering that we rely on our cells to live, but when telomere lengths get too short, important parts of DNA are lost through cell division. Calling back to sirtuins, SIRT-6 helps to keep our telomeres healthy by producing a ribonucleoprotein called telomerase, that helps regenerate the ends of our telomeres. NAD⁺ supplementation has increased telomere length and can also be correlated to SIRT-6 being more active (Verdin). However, it should be noted that artificially boosting telomerase with certain substances doesn't have much of an effect, with the only benefits being to people whose telomere lengths were already very short (Telomerase: Definition, Function, Structure and Cancer | Biology Dictionary). Furthermore, having too much or too little telomerase can make you more susceptible to cancer, so it's important to find a sweet spot that we can maintain (Aging: Too Much Telomerase Can Be as Bad as Too Little - Scientific American Blog Network). Telomeres are crucial to the problem of aging because they keep our DNA safe and can also be used as the target in certain anti-aging medications. However, telomere experiments could be controversial, as scientists are unsure whether it could increase or decrease the chances of cancer. While rejuvenated telomeres could protect our DNA from errors in cell replication, in cells that have already mutated from other types of DNA damage, the rejuvenated telomeres might have a damaged cell stay alive when it should have died (Callaway). Overall, their role in the fight against aging is important, and telomeres will be an important factor when considering how to deal with the problem of aging.

The Progress so Far with Experiments Regarding Aging

There have been several successes in recent years concerning aging, most notably David Sinclair's NAD⁺ supplementation on mice in 2020 (Lu et al.). In this experiment, mice that had

previously suffered from poor vision now had their retinas fixed to see clearly again. Sinclair and his team treated mice with NMN, which turns into NAD⁺ when processed inside of the body. The mouse treated with NMN was also much more athletic and overall healthier compared to the one that hadn't been treated with the supplement. Sinclair has also done other studies, including one where his team had successfully aged a newborn twin. Side by side, although both mice were born at the same time, one was old and frail while the other was young and healthy. These studies have shown the importance of NAD⁺ in aging, and is why NAD⁺ is one of the most central components in aging studies. Furthermore, experiments reducing CD38 in mice have proved successful with NAD⁺ levels rising and having other protective roles in cardiac diseases such as ischemia, cardiac hypertrophy, and lipid overload-induced heart injury. However, there are some downsides to these revelations. Currently, anti-aging pills only increase our health span for a few years, so they won't drastically increase your life. The tests with CD38 are also important to know, but there is a big difference between testing on animals rather than humans, so although we have found breakthroughs in mice, it might be decades until we see the results in humans. That being said, current anti-aging experiments are still in early stages, and we've learned so much that it's plausible that our generation might be the first group of people to beat aging.

Conclusion

With experiments surrounding NAD⁺ production already taking place, it seems we could see an end to aging soon. However, current experiments have been limited to mice and what works for them vastly differs for humans. For example, we can treat most cancers in mice but we have yet to find a cure for cancer that works on humans. Furthermore, new medications go through a vigorous process of testing different animals before the first human test can take place. That being said, anti-aging technology has taken off recently and it's likely that in the near future, we will have some way of protecting ourselves from aging. Solving aging also fixes a lot of other diseases humans have been struggling to deal with, such as alzheimers, dementia, and types of cardiac diseases that all become more likely as we get older. Furthermore, anti-aging will also make our immune system, mental, and physical body much healthier and increase our healthspan drastically, giving us the ability to be free of burdens we would carry in our 70's.

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Exploring Marriage in *Pride and Prejudice* By Zheyu Li

Marriage is always important in people's lives; however, the understanding of marriage is also constantly changing. *Pride and Prejudice* (1813) is a masterpiece by Jane Austen, who presents readers with a complex view of marriage in England during the early 19th century. Throughout the novel, ideas of pride and prejudice are developed across settings and scenes, and filtered through the theme of marriage, they work to create a complex plot. Pride, as defined by the renowned Austen scholar Everett Zimmerman, is "a detachment from other human beings in which the self is not seen as involved with others but as superior to them, as unconcerned" (65). And Zimmerman describes prejudice as "the opposite of pride: the self is completely involved with others, and everything is interpreted as it affects the self" (66). He describes pride and prejudice as working in combination, in Austen's novel, as a way of indicating a "limitation of human vision." Using the text, he grounds his analysis in an examination of characters in detail. This paper, by contrast, proposes to analyze the connections between pride, prejudice, and marriage Austen's masterpiece by comparing and contrasting how these ideas are developed in four of the novel's major characters.

Today, the ideas of marriage, pride, and prejudice may seem unrelated, but back in the 19th century, they were closely connected. All three of these ideas were connected to "social status" at that time, and as literature scholar Juliet McMaster explains, "In Jane Austen's world, human worth is to be judged by standards better and more enduring than social status; but social status is always relevant" (9). In her work on class, she discusses the realistic aspect of social ranks and asks how Jane Austen's personal life might have informed characters in her novels. This makes sense since Austen also personally suffered from living under this system. From the perspective afforded by McMaster's biographical analysis, it allows further detailed analysis. The way *Pride and Prejudice* starts gives readers an idea of its general focus. The title itself tells us that the book will focus on the ideas of pride and prejudice. Then, in the first sentence of the book, the narrator states, "It is a truth universally acknowledged, that a single man in possession of a good fortune, must be in want of a wife" (3). Thus, it is quickly evident that the ideas of marriage, pride, and prejudice will appear in the book a lot, and they will have connections between them relating to social status.

Research Method

In order to examine how social status relates to the themes of marriage, pride, and prejudice I am going to analyze the relations between four major characters: Mr. Darcy, Elizabeth, Mrs. Bennet, and Lady Catherine. The central relationship in this story is between Mr. Darcy and Elizabeth, as they grow from initial dislike to deep, lasting love. Their relationship shows how marriage might not solely be based on social status, and how people's views about others might change over time, by overcoming the class-related barriers of pride and prejudice.

To appreciate the changes undergone by Mr. Darcy and Elizabeth, I will compare them with less-central characters that fail to evolve in such character-building ways. As Zimmerman explains, "These static characters provide the background for the maneuverings of the central characters, Elizabeth and Darcy, who, although touched by pride and prejudice, overcome the limitations imposed by these qualities and become equal to the moral challenges presented to them" (65). Although Mr. Darcy's views about Elizabeth eventually change, his aunt Lady Catherine's views about her do not shift at all. By the book's end, Lady Catherine still thinks that because she and her nephew are noble, Elizabeth does not deserve to be married to Mr. Darcy. It is also useful to see that Elizabeth's view about Mr. Darcy changes more completely and earlier than her mother's perspective does. Each character demonstrates certain views on marriage that people possessed in the early 19th century, and my analysis presents a nuanced image of those historical concepts of marriage.

Unlike in many previous studies of how character works in Austen's novels, which tend to focus on the difference between "flat" characters and "deep" or complex characters, my analysis will show how this constellation of four characters sheds complicating light on marriage as a social practice. Many perspectives about marriage are connected with sexes, traditions, families, and ritual or social convention. My analysis in this paper will demonstrate the complex interplay between all these factors and how it both differs from and still resembles modern society.

Comparing Mrs. Bennet with Elizabeth

Mrs. Bennet views marriage in a very realistic way, and like many people of that time, she approaches marriage for its social benefits, with the awareness that it was one of the only ways for women to gain financial independence. As Haiyan Gao explains, "In [the] 19th century,

marriage was dominated by [a] material base in English society. Social relationships and [the] economic mode determined the rule of marriage” (384). Wealth was a determining factor in marriage during Jane Austen’s time, and she uses her characterization of Mrs. Bennet to show that pointedly. A good example of this is Mrs. Bennet’s happiness when she hears her daughters will be marrying into wealthy families. After all, “The business of her life was to get her daughters married,” and marrying into a wealthy family was good business (2). Her exuberance over profit is evident when she exclaims, “Three daughters married! Ten thousand a year! Oh, Lord!” (259). Mrs. Bennet’s tone in this sentence is very excited because her daughters are marrying wealthy husbands, and the wealthier the man is, the better the social status and financial independence the daughter will get.

By contrast, the protagonist of the story, Elizabeth Bennet, has a completely different perspective. We can see this when, early in the novel, she twice rejects marriage proposals that might have secured her financial freedom, despite living in a family where all their property will be taken by a male relative through the process of primogeniture. Elizabeth received her first marriage proposal from Mr. Collins, the male relative who would receive the family’s wealth, but she rejected it because she felt no affection towards him. As she said, “You could not make me happy, and I am convinced that I am the last woman in the world who could make you so” (77). This demonstrates that she wanted to marry someone who could make her happy and whom she actually loves. Not only is that the reason that she rejected Mr. Collins; it is also the reason why she rejects Mr. Darcy the first time.

However, later Elizabeth accepts the marriage proposal from Mr. Darcy after she learns more about his personality. She learns this from a servant, who describes him saying, “If I was to go through the world, I could not meet with a better. But I have always observed, that they who are good-natured when children, are good-natured when they grow up; and he was always the sweetest-tempered, most generous-hearted, boy in the world” (169). A description from a third person’s perspective offers Elizabeth a different point of view, which increases her respect for Mr. Darcy, and eventually they become engaged. At a time when marriage was important to women’s financial security, it was bold and potentially dangerous of Elizabeth to decline the proposals of wealthy men. Her view of marriage is completely different from the one represented by Mrs. Bennet, and Mrs. Bennet’s view reflects the majority perspective during Jane Austen’s time.

Comparison Between Lady Catherine and Mr. Darcy

A comparison between Lady Catherine and Mr. Darcy highlights other 19th century perspectives on marriage by focusing on how social class and pride are connected. Lady Catherine's high social class gives her a lot of pride; she thinks she is superior and so disrespects characters that do not possess the same level of social class. Indeed, McMaster describes Lady Catherine by saying, "We hear of Lady Catherine de Bourgh, one of the most memorable and least likable characters in Jane Austen's novels, that 'she likes to have the distinction of rank preserved'" (1). It is precisely that desire to have her "distinction of rank preserved" which makes her so unlikable. She thinks of herself and Mr. Darcy simply as upper-class people, and believes that lower-class people should not have relationships with them because it would be a disgrace to the class.

So, when she hears rumors about Elizabeth getting engaged to Mr. Darcy, Lady Catherine tries to prevent the engagement by using the dream that she had shared with Mr. Darcy's late mother, who was Lady Catherine's sister, about their children getting married. As she says, "...now, at the moment when the wishes of both sisters would be accomplished, is their marriage, to be prevented by a young woman of inferior birth, of no importance in the world, and wholly unallied to the family" (242). Lady Catherine is referring to Elizabeth as this person of "inferior birth" and "no importance," which is very strong wording that contains a lot of prejudice and vanity.

By comparison, Mr. Darcy, who also possesses social class and wealth, does not behave the same way as Lady Catherine. One key difference between them is that Mr. Darcy slowly reduces his pridefulness through his interactions with Elizabeth. In the beginning, he attends a dance and makes an offensive, proud criticism of Elizabeth to Mr. Bingley, but did not notice she was able to hear him. Mr. Darcy explains that he did not wish to dance with her by saying, "She is tolerable; but not handsome enough to tempt me ... I am in no humour at present to give consequence to young ladies who are slighted by other men" (9). This shows that he viewed himself as superior. Moreover, as Gao points out, "He always has a tendency to judge too hastily and harshly, and his high birth and wealth make him overly proud and overly conscious of his social status" (387). My argument, following Zimmerman, is actually that this changes by the book's end, which is one way Mr. Darcy differs from Lady Catherine. Yet, as Gao points out, in the first proposal Mr. Darcy made to Elizabeth, "...he spends more time emphasizing Elizabeth's

lower rank than actually asking her to marry him” (387). The fact that Mr. Darcy then proposes to Elizabeth a second time demonstrates that his pride and arrogance gradually diminishes, morphing into humility.

Instead of prioritizing the social class of a prospective wife, Mr. Darcy comes to value Elizabeth’s influence on his character. As he said to Elizabeth about her rejection of his first proposal, “You taught me a lesson, hard indeed at first, but most advantageous. By you, I was properly humbled” (252). In turn, Elizabeth observes, “Whenever she did catch a glimpse, she saw an expression of general complaisance, and in all that he said she heard an accent so far removed from hauteur or disdain of his companions, as convinced her that the improvement of manners which she had yesterday witnessed however temporary its existence might prove, had at least outlived one day” (178). These are signs of Mr. Darcy accepting criticisms even from a woman of lower social status.

Conclusion

Jane Austen created a complex plot throughout the book that demonstrates various conflicting ideas of marriage at that time. Back in the 19th century, the idea of marriage was closely connected with social status. When talking about social status, the ideas of pride and prejudice arise quickly, and may even be considered unavoidable. Everyone possesses those traits, and the problem is how they show or hide this. Furthermore, how will they change their views based on outside influences? Jane Austen explores all these aspects. By closely examining these four central characters, this paper has shown how Austen presents her readers with a simple but complex view of 19th century marriage.

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Review of Consumer Sentiment Applications: Specific Goods By Abhishek Bhagat

Abstract

Consumer sentiment determines the likelihood of a consumer to purchase goods depending upon their financial stability. Currently, the literature surrounding consumer sentiment tests the index at a general scope. This study aims to determine the ability of the consumer sentiment index, as defined by the University of Michigan, to test the likelihood of consumers to purchase certain goods. This study finds that one can test the consumer sentiment of specific products, and, by extension, apply a variety of parameters into the index. The implications of this study are that companies can test data which can affect their specific business model and determine which products to sell.

Literature Review–Consumer Sentiment Uses

Consumer sentiment has provided the foundation to determine how consumers react to fluctuations within the American economy. Edoardo Lozza, Professor of Psychology at the Università Cattolica del Sacro Cuore, explains the origins of the consumer sentiment index. George Katona, one of the pioneers of the consumer sentiment index, aimed to “increase the explanatory power of economics” by providing a psychological aspect (Bonanomi). By adding the psychological aspect, the field of economics has allowed for the understanding of how individuals spend their money. Mainly, consumer sentiment serves to provide measurement during times of economic downfall. Currently, due to the aftermath of the COVID-19 pandemic and the Ukrainian War, all-time high inflation has been present. According to The National Bureau of Economic Research (NBER) Business Cycle Dating Committee, an American non-profit organization which conducts objective economic research, defines an economic recession as “a significant decline in economic activity that is spread across the economy and that lasts more than a few months (How Do Economists...).” This has been apparent in recent times, as Philipp Carlsson-Szlezak, Boston Consulting Group's Global Chief Economist, in the Harvard Business Review, write that inflation has been driven up during the COVID-19 pandemic due to the “unusual confluence of extremely high demand, driven by enormous stimulus, and simultaneous supply bottlenecks in product, commodity, and labor markets (Carlsson-Szlezak et al.)” As the spending abilities of consumers tightens as a result of higher

prices and stagnated wages, Americans have drastically changed their consumer behavior ever since the advent of the COVID-19 pandemic.

Review of Previous Economic Recessions

In order to contextualize how consumers have reacted to previous economic recessions, it is imperative to analyze the 2008 Recession. Ivaylo D. Petev, who worked at Stanford University Center on Poverty and Inequality, reported that during the 2008 recession, consumption declined dramatically. As seen in figure 1, in the 2008-2009 period, consumption dropped significantly as disposable income dropped (Petev and Pistaferri). This indicates that consumers are less likely to purchase unnecessary goods and limit their spending in periods of economic downturns. Although this data lacks the specificity of which products consumers cut their spending on; it provides only a generalized view of the economic activity of consumers.

Moreover, spending habits can be drastically different depending on the demographic group being studied. The different spending habits can be attributed to the various types of news and media various demographic groups consume. Maude Toussaint-Comeau, a senior economist at the Federal Reserve Bank of Chicago, and Leslie McGranahan, vice president and director of regional research at the Federal Reserve Bank of Chicago, explore the type of media different demographics consume. Toussaint-Comeau and McGranahan find that “72 percent of college graduates report having heard about business conditions”; however, “only 38 percent of individuals without a high school diploma” have reported hearing that same news (Toussaint-Comeau and McGranahan). This manifests the discussion surrounding what types of news people consider and how it may affect their opinions and viewpoints. In contrast, individuals could be more inclined to weigh their economic situation higher than the opinions they generate from the media they watch. Throughout the literature surrounding consumer sentiment, no study takes into account the spending habits of specific demographics. By extension, it also does not consider the psychological thinking of various groups.

This gap is important to study as it provides insight into the types of purchases different demographics make. Additionally, the gap of specific goods being tested through the consumer sentiment index will provide greater insight into what specific demographics spend their income on. George Borjas, an American economist and Professor of Economics and Social Policy at the Harvard Kennedy School explores the financial aspect of immigrating to the United States and

considers the way immigrants will participate in the economy. More specifically, it explores the various ways in which immigrating to the United States can put a burden on individuals. It compares the prices of staying in the US with the general financial situation of an immigrant (Borjas). Derek Headey is a senior research fellow at International Food Policy Research Institute reporting on the effect of rising food prices on food security. It highlights how families have a more difficult time affording food and how it can cause poverty to erupt. Conversely, it discusses how families become more conservative on their spending as food prices go up and often have to resort to less healthier food items or to cut down on food related expenses (Headey and Martin). Yash Mehra and Elliot Martin, senior economists at the Federal Reserve Bank of Richmond further found that consumer sentiment can depict how household spending fluctuates with the condition of the economy, concluding that consumer spending is dependent on the confidence of a consumer on the stability of the economy. They hypothesize that as consumer sentiment increases, spending also increases (Mehra and Martin). Shun-Chung Yang, an Assistant Professor at the Tainan Theological College and Seminary in Taiwan, explores the ways in which people have to live and spend their money during a recession. More specifically, it compares the times of economic prosperity and focuses on the changes that occur due to an economic recession and the ways people are forced to change their lives (Yang). As the specific spending habits can fluctuate heavily depending on the demographics or products tested, it is important to explore how the consumer sentiment index can be adapted to addressing these gaps.

Within this study there are two main gaps within the scholarly discussion contained in the aforementioned literature that will be addressed in this study. First, the testing on specific products. Instead of calculating the consumer sentiment at a more general level, this study will use more specific parameters to calculate the consumer sentiment index. Then, the values that are calculated will be compared with the national consumer sentiment index value as reported by the University of Michigan in the month that this study was conducted. The second gap will be the location. Due to the limitations of not being able to get a nationally representative sample, this study will concentrate on the Katy/Fulshear area in Texas. It will be important to consider some background surrounding this specific area when discussing the results of this study. As reported by the 2020 United States Census, the median household income in the Katy/Fulshear area is \$87,179 (“United States Census Bureau”). This study aims to address the gaps of specific products and consumer sentiment at the local level.

Method

Consumer sentiment is often measured through surveying individuals. There are a variety of study methods that have been utilized for consumer sentiment research such as actor analytic methods, multidimensional scaling of similarity matrices, multivariate methods, cross-section studies, time-series data, econometric methods (Rao). For this survey, econometrics will be used along with a survey and use economic theory and statistics to back up the data that will be collected. The University of Michigan pioneered the consumer sentiment index (CSI) and calculates it every month in order to track consumer behavior. The CSI will be utilized throughout the remainder of the study in order to serve as the foundation of comparison.

Design

The goal of this research is to discover how peoples' spending habits change based on the economic situation ensuing in the nation. More specifically, this study will analyze consumer sentiment pertaining to specific products and demographics, and then compare it to nationwide consumer sentiment index value as reported by the University of Michigan. The method used by the University of Michigan has been replicated to the greatest extent in order to ensure comparability of the data received through this study. A survey and comparative analysis has been conducted. Results will be compared to the literature surrounding consumer sentiment. It will be gauged how individuals will change their spending habits depending on the current economic situation of their household. They will be asked questions pertaining to their economic situation, as well as, how they will react when it regards purchasing specific goods.

Variables

The variables that will be utilized through this study will change depending on which demographic or product that is being tested. In all cases, the dependent variable will be the consumer sentiment index value that is calculated. The independent variables will fluctuate as they could be a specific demographic or product that is being tested in order to determine how consumer sentiment varies by specific variables.

Survey

This study will collect quantitative data. The primary tool used in this study will be a consumer sentiment Google form testing peoples' decisions to purchase specific goods. People will be required to rank their desire to buy five different goods that have been defined below in figure 2.

Specific Goods Tested
Media, books, and movies (\$1.99-59.99)
New Clothes (\$35.00)
Gym Membership (\$49.99 per month)
Car (\$35,000)
Lottery Tickets (\$10.00)

Figure 2. List of Goods Tested

Richard Curtin, Professor of Economics and Director of Consumer Sentiment Surveys at the University of Michigan, provides the exact method and formula utilized each month by the University of Michigan. Figure 3 below is the formula utilized in order to calculate the consumer sentiment index. The same formula was used in this study in order to ensure comparability with the University of Michigan's data.

Each value of "X" represents the percentage of respondents who answered favorably to each question. Figure 4 below contains each question asked within the survey that was calculated into the formula shown in figure 3. The data from each of the following questions was utilized and plugged into the formula shown. This allowed for the index of consumer sentiment to be calculated accurately.

In addition to the questions asked to calculate the consumer sentiment index, numerous questions regarding demographics were asked within the survey. The following demographics were collected as represented in figure 5, along with the possible answer choices.

Demographics Collected

Age

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

Yearly Family Income

- \$1 to \$9 999
- \$10 000 to \$24 999
- \$25 000 to 49 999
- \$50 000 to 74 999
- \$75 000 to 99 999
- \$100 000 to 149 999
- \$150 000 and greater

Highest Level of Education

- Some high school, no diploma
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Associate degree
- Bachelor's degree
- Master's degree
- Professional degree
- Doctorate degree

Race

- White

- Black, African American
- American Indian or Alaska native
- Asian Indian
- Asian

Figure 5. Demographic Questions

Then, respondents would rank the likelihood that they are to purchase each specific product defined in figure 2. The question was worded: “Considering my current economic situation, I would make the purchase of ___.” The likert scale was used for people to rank their decisions. They can answer with the following ratings: highly disagree (1), slightly disagree (2), neutral (3), slightly agree (4), highly agree (5). For the purpose of this study, a rating of 1 or 2 will be considered as a non-favorable response; a rating of 4 or 5 will be considered favorable. A rating of 3 will be voided as the respondent did not have an opinion regarding the question. The questions represented by X_5 will be changed depending on the product being tested, as aforementioned. The remainder of the variables will remain constant throughout this study.

Subject of Study

The subjects of this study were primarily individuals who were given out QR codes in a nearby grocery store in Katy/Fulshear, Texas area to allow for convenience and geographical proximity for collecting data and the survey was advertised on Nextdoor to local residents. Additionally, these individuals were all over the age of 18 and all had a source of income. They were instructed to complete the survey truthfully. Each participant had to consent to their data being utilized in order for their data to be contained within this study. Additionally, the method of this study was presented in front of an Institutional Review Board in order to ensure the ethical treatment of all respondents.

Results

In total, there were 48 respondents, however, 1 person did not consent to their data being used; therefore, they will be left out in this evaluation.

Demographic Data

76.6% of the respondents identified themselves as Indian American, 17% identified as White, and 6.4% identified as Asian. The data findings within this data will be geared towards the Asian community and how they react to the purchase of certain goods as the majority of respondents can be put into a general group. 57.8% of respondents were of the age group 35-44, 28.9% were ages 45-54, 6.7% were ages 55-64, 2.2% were ages 65-74, and 4.4% were ages 25-34. Although the ages of the respondents were skewed to one group, the inclusiveness of each group allows for a sufficient range of age in respondents. As per the education level of the respondents, 48.9% had a bachelors degree, this is the most common within the data. 40.4% had a masters degree. Each of the following accounted for 2.2% of respondents: associates degree, doctorate degree, and high school diploma. 4.3% had professional degrees. Lastly, family income was collected in order to determine any disparities between income and consumer sentiment. 51.1% of respondents had an income of \$150,000 or greater. 27.7% had an income of \$100,000 to 149,999. 12.8% of respondents had an income of \$75,000 to \$99,999. 6.4% had an income of \$50,000 to \$74,999. 2.1% had an income of \$25,000 to \$49,999. Overall, data was collected of a variety of demographics when considering age, income, and education. Figure 6 below represents the demographic data.

Consumer Sentiment Data

For the purposes of this study, we will be separating the consumer sentiment of consumers who are worse off than before the pandemic compared to those that are not worse off. 74.5% of respondents reported that their economic situation did not change since the pandemic in March 2020. 25.5% reported that their economic situation was worse off than before the pandemic began. In total, 46.8% of respondents would make the purchase of books, media, and movies, while 27.6% would not. As per new clothes, 53.4% of respondents reported that they would make the purchase while 31.9% would not make the purchase. Most respondents claimed they would not purchase a gym membership at 48.9% while 23.4% of respondents would make the purchase of a \$49.99 gym membership per month. 48.9% of respondents would not make the purchase of a new car while 24% would make the purchase. Lastly, the biggest disparity was seen when considering the purchase of lottery tickets with 72.4% claiming they would not make the purchase, while 21.3% would. Figure 7 below represents the Likert scale ratings provided by

each response.

As an integral part of this study, it will be important to analyze the consumer sentiment disparities between people who are financially worse off and those who are not. Across all of the products, those who responded by saying they were worse off reported an average Likert Scale score of 2.833. On the contrary, those who were not worse off reported an average Likert Scale score of 3.02. This shows a disparity between those who were well off during the pandemic and those who were not. Figure 8 below represents the average Likert rating for each product depending on the financial status of each respondent. The specific consumer index ratings will be presented in the discussion section of this paper and will be separated and analyzed by the ts.

Analysis

This discussion will evaluate the discrepancies between consumer sentiment of specific products, income, and education level by comparing it to the national average as defined by the University of Michigan. Additionally, this analysis will compare consumer sentiment across the board to determine how it can be utilized in terms of what people spend on.

For the purpose of this study, we will be utilizing the consumer sentiment index number for January 2023 as defined by the University of Michigan since that is the time period in which the responses of this study were collected. The consumer sentiment index is 64.9 (“Surveys of Consumers”). This ensures the comparability as the basic economic conditions were the same nationwide. Throughout this section, discrepancies will be analyzed between this index and how it compares to the index of specific products, furthered by an evaluation of the index of those certain products under the parameters of income and education.

Specific Products

Consistently, the consumer sentiment index (CSI) showed a lower index number than the national average of 64.9. In its more specific form, it can be determined that consumer sentiment can vary greatly depending on the parameters under which it is defined. When analyzing the CSI of media, books, and movies, it can be seen that it deviates a minor amount than the national CSI, likely due to the low cost of the product. Furthermore, there is also a minor deviation when considering the purchase of new clothes. However, as the items get more expensive, such as a gym membership, new car or lottery tickets, there is a drastic drop in the CSI of those products. This is due to the nature of the products. Media, books, movies, and clothes can be considered

both a necessity and a splurge, leading to a range in response to buying these products. By extension, the latter three products are largely deemed unnecessary, explaining the larger drop in consumer sentiment. Within the scope of the entire data, it can be seen that 100% of the time, consumer sentiment of specific unnecessary products drops below the national consumer sentiment. Figure 9 below represents the consumer sentiment index value of each product. Each value is lower than the national average. This can likely be attributed to two things: the non-essential nature of each product and the specificity contained in this survey. Additionally, the consumer sentiment index varies depending on the product which contends that specific parameters such as products can be used in the consumer sentiment index as created by the University of Michigan. This shows the adaptable nature that the consumer sentiment index has. In the remainder of this discussion, the consumer sentiment index will be broken down into numerous demographic groups.

Review By Education Level

Below, figure 10 contains the consumer sentiment index of each product depending on the education level. Due to minimal responses for the other degree types, it was statistically irrelevant to include data as it would not be representative of the population. As the level of education increases, consumer sentiment also increases. Additionally, all of these values are statistically higher than the values given across the entire study contained in figure 9, given that a lower education level equates to a lower income on average. Again, this alludes to the hypothesis that the vast disparities that can exist when separated by various parameters. Through analyzing the bachelor's degree CSI, it can be concluded that it varies greatly from the national CSI of 64.9. As the products become more expensive, the CSI falls. Contrastingly, when analyzing the master's degree CSI, it can be determined that, although consumer sentiment does drop, the discrepancy between the national CSI is minimal compared to the CSI of those with bachelor's degrees. In fact, for the products "media, books, and movies" and "new clothes" the consumer sentiment index value represented by those holding a master's degree is higher than the national CSI. The consumer sentiment of specific products would be influenced by a multitude of factors, such as need, potentially altering the data depending on the population that is surveyed. This furthers the need to explore the variability of the CSI in future studies.

Review by Income Range

Figure 11 below details the consumer sentiment when considering different income ranges for consumers. Contrary to education, income provides a more specific scope, as it can be analyzed how consumer sentiment deflects depending upon the amount of income one makes. For the purpose of this study, any income range with minimal data was not considered to provide a representative sample. Although this provides a limitation, there are still large discrepancies to be discussed in the scopes of calculated data. As seen in the data, the consumer sentiment increased along with incomes in essentially all products. There are minor discrepancies between the consumer sentiment of the two largest income ranges; however, they deviate quite close to each other. This furthers the notion of the income cushion relating to how likely consumers are to spend furthered by Ivaylo Petev in his discussion of disposable income and consumer spending (Petev and Pistaferri). As seen in other studies that analyze consumer sentiment depending on different parameters, there was always a significant change in consumer sentiment when separated by specific demographics (Toussaint-Comeau and McGranahan). The higher income ranges provide a larger spending cushion, thus corroborating the trend of higher consumer sentiment depending on income. Since those earning \$75,000 to \$99,999 have a consumer sentiment that is lower than the other two income categories, it can be concluded that consumer sentiment can vary heavily when different parameters are applied.

Implications, Limitations, and Future Directions

Through the aforementioned results, it can be concluded that the consumer sentiment index of the University of Michigan has a multi-faceted and adaptable nature that can be critical to future consumer behavior and sentiment studies. Future researchers can include other variables into the consumer sentiment index. The United States Center of Commerce quantifies the negative effects of inflation on small businesses: 90% of small businesses report being affected by high inflation (U.S. Chamber Staff). This is important to consider as small businesses provide the foundation for the American economy. As put by the University of Minnesota, small businesses provide the most innovation and opportunities to the American people. Over a four-year period, small businesses produced 26.5 patents per hundred employees whereas larger

firms only produced 1.7 patents per hundred employees. Additionally, small businesses are critical for giving opportunities to minorities and women, both historically underrepresented groups. As shown in figure 12, minorities and women own a large proportion of small businesses in the United States. Most importantly, the “nearly twenty-seven million small businesses in the United States generate about 50 percent of [the United State’s] GDP (University of Minnesota).” Thus, as small businesses are affected by high inflation and economic downturn, the consumer sentiment index can provide small businesses with a unique opportunity to gauge how they will perform in coming months. As small businesses usually have a specific niche in which they sell products within, the adaptability of the consumer sentiment index can allow small businesses to evaluate the extent to which consumers are likely to purchase their products. Additionally, due to the versatility of the consumer sentiment index, larger firms can also utilize it to foreshadow consumer behavior. The index could be used towards a specific industry as larger firms will have a wider variety of products they market to consumers. Overall, the consumer sentiment index provides a variety of usages to businesses across the country that can influence their business decisions and model. Thus, the versatile characteristics of the consumer sentiment index provide a unique ability to businesses and corporations to test favorability towards products, demographics, and markets.

It is imperative to consider some of the limitations to properly acknowledge the findings of this study. This study was only conducted at the local level that had drastically different demographics than did the remainder of the country, these uncontrollable variables could provide a shifted perspective of the results. Nevertheless, the largest finding under this study is the versatility of the consumer sentiment index, which implores future studies to explore different variables within the index.

In the future, the findings of this study can give way to more consumer behavior studies and comparisons that will be crucial to our understanding of economics. In this study, the products tested can be characterized as unnecessary, especially to individuals who have limited spending power as limited by the specific economic conditions in which they reside. Thus, in the future, studies could consider products that will be more essential to consumers such as food and household supplies. It can consider how consumers will adapt to the economic conditions and by how much they will cut down their spending. This can also be separated by various demographic groups in order to gain further insight into how specific groups adapt to economic conditions.

Overall, the consumer sentiment index spearheaded by the University of Michigan can provide crucial insight into a variety of different variables that can alter consumer sentiment. The findings of this study give way to a variety of avenues of study that consider consumer sentiment or behavior. The consumer sentiment index can therefore be utilized as a measure of customer behavior when relating to any specific products and can be narrowed down by a multitude of parameters, specifically income, race, and education.

Conclusion

This discussion evaluated the discrepancies between consumer sentiment of specific products, income, and education level by comparing it to the national average as defined by the University of Michigan. It was found that a variety of parameters can be set to determine the consumer sentiment of certain products and vary the consumer sentiment depending on demographic. This study proves the multi-faceted nature of the consumer sentiment index and the applications it can provide to the fields of business and finance.

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Artificial Intelligence and the Human Work Force: Review of the Capabilities, Limitations, Ethics, and Future of AI in the United States By Dimitris Kyprianou

Abstract

Artificial intelligence (AI) has permeated our daily lives, from voice assistants to recommendation algorithms, transforming the way we live and work. As this transformative technology continues to advance, the question of its place in the American workforce looms large, stirring contrasting views and impassioned debates. The decisions we make regarding the implementation of AI have profound implications for employment, productivity, and the very fabric of our society. This review article details a journey through the diverse landscape of opinions and research from leading experts in engineering, business, and education, seeking to paint a full picture of the options we have in shaping the future of AI for our collective benefit. By exploring the capabilities, limitations, ethics, and future implications of AI in the United States, we navigate the complex intersections between human potential and technological advancement. In doing so, we unveil the challenges and opportunities that lie ahead, fostering informed dialogue and guiding strategic decisions in the ever-evolving relationship between artificial intelligence and the human workforce.

Introduction

The fear that intelligent technology will disrupt the workforce has been felt through centuries, and with rapidly developing technology, that fear of disruption is more justified than ever. However, disruption is not always adversity. The development of artificial intelligence technology will not halt progress anytime in the near future, and its place in the workplace is unignorable. Expert engineers agree that AI belongs in the human workforce, but the debate lies in the superior form of AI to implement into the educated white-collar workforce.

Computer science professor at the University of Belgrade Vladan Devedžić envisions a future wherein complex organizational systems collect data and conduct scholarly research autonomously, assisting experts in a potentially complicated human task. But as Chief Data and Research Scientist at West Point, Nathaniel Bastian, suggests: artificial intelligence software can increase workforce efficiency to such a magnitude that prioritizing it over humans might be the best implementation. This relatively new world of artificial intelligence is at a vital time in the

engineering design process. Where should scientists target development? In AI that serves to work alongside humans? Or perhaps in fully autonomous programs for the sake of robotic efficiency. How exactly should AI be implemented within corporations in the United States to benefit educated white-collar workers the most?

AI and American Workers

Scholar for the National Academies of Sciences, Engineering, and Medicine Stuart W Elliot admits that AI has made tremendous strides in its ability to complete increasingly complex tasks in the workplace. Assembly line and factory setting responsibilities can be efficiently done by artificial workers. Elliot furthers that these tasks are almost entirely routine, and the future can see a world with repetitive low-skill tasks becoming obsolete. Blue-collar jobs would be outperformed by AI, while white-collar jobs would have to restructure how a job works (Elliot). Corporate America analyzes enormous amounts of data daily, ranging from consumer information to profit projections. So, white-collar jobs that process this data would be revolutionized by utilizing data processing and organizational AI (Elliot). While Elliot attributes the potential success of corporations using AI to their data management, researchers such as Andy Way disagree.

Andy Way has over 30 years of experience teaching computer science at Dublin City University, specializing in computing linguistics. In the peer-reviewed journal he co-founded, *Machine Translation*, Way reasons; communication within a white-collar workspace is paramount, and AI that assists in this should receive priority. Compared to Elliot's research finding corporate analytical data as the integral factor that AI could process, Way found through his extensive research that AI could have even more application through corporate communication.

Programs such as Google Translate use AI to decipher human language through software. This technology has astounding global applications and does not have to be limited to simple language translation. Computational linguistics could blur the lines between what is possible to communicate and what is not throughout a company. Complex instructions and data sets could be transferred through intelligent programs and converted into comprehensible information for any worker. Deaf and non-English speaking employees would all have their place in the office workforce revolutionized. Way suggests that workers of any disability or disadvantage could

efficiently be communicated with through communicative AI. An even playing field is attained with the help of AI which could genuinely compute and alter human language. This form of artificial intelligence used in the white-collar workplace would eliminate previous barriers and create new jobs, contrasting the fear that AI will destroy jobs (Way). These new jobs would be one of many that coming AI technology will bring, and new jobs mean changes to education for even highly skilled workers.

AI and Education

According to Michael Spencer, even a high schooler educated properly about AI and its capabilities in the workforce could acquire a job as soon as "six months after graduation" specifically due to specialized education regarding artificial intelligence. Equipped with a Doctoral and Master's degree in Engineering from Cornell University, Michael Spencer has researched mechanical and software engineering for 36 years. Spencer is a respected mind in the field who believes the key to the best possible AI-based workforce is education. AI, as he claims, is an unstoppable force of innovation. Yes, jobs will be lost, but fighting this progress is futile. Offering workers modern education on how AI will affect them and function will see the most career success. Current office employees will need intensive reeducation due to the landscape of the workforce changing so drastically (Spencer).

Dr. Julie McLeod has a Master's degree in historical education and specializes in her research on the history of education and the possible future of schools for children and working and non-working adults. Julie introduces the idea of organizational AI that can identify quality information and organize it to aid researchers in and outside academia. She defines what 'quality' information is in the context of research and uses that definition to exemplify how abstract that very idea is. Using exaggeration of how catastrophic the prospect of low-quality information is, McLeod proposes an autonomous system of organizing research information that could automatically analyze the quality of a source and properly present it to a user. This form of education for researchers would revolutionize how efficient education is in this country. For white-collar workers today, McLeod's perspective is also unique. McLeod's research concluded with another proposal of the most efficient program in the workplace: A network of information that any stakeholder who requires intelligence, such as students, employees, and researchers,

could utilize. The autonomous program McLeod proposes would analyze sources and distribute them to researchers, autonomously presenting them to a user who requires them at any time.

Ethical & Efficient Implementation of AI

Ambitious theories regarding artificial intelligence such as those proposed by McLeod and Way could have significant implications for white-collar workers in industries ranging from offices to the military and even educational institutions. Researchers such as Nathaniel Bastian believe that the only way to truly understand which method of implementation is the most effective is to simply implement them. To elaborate, he reasons that no simulation could predict the implications of an experimental artificial intelligence program in the real world; the only way to observe these implications is to implement an experimental program directly into the workforce and observe its consequences. Bastian believes that the development of artificial intelligence is to be prioritized over human workers to reap more benefits and actualize more development.

This is a belief among engineers and experts in the field, shared by Dr. Michael Spencer. However, experts such as Bastian and Spencer may be too ambitious in their expectations of artificial intelligence. Implementing it into workplaces in the United States workforce directly could introduce great risks due to the unstable and relatively young nature of AI. Dr. Yuna Huh Wong has vast experience researching technology, serving as Special Meeting Chair of artificial intelligence and autonomy for the board of directors of the Military Operations Research Society. When consulted by the US Department of Defense for her research regarding AI and its future within the United States, Wong did not deny the future that artificial intelligence had for the United States but rather suggested it was not ready to be relied on and implemented on a massive scale. Wong proposes a safe solution for implementing it in workplaces.

Through simulating real-life scenarios within intelligent programs, it can be understood how exactly a specific AI will complete certain tasks in the workplace, leading to less error and drastically less severe consequences. Teaching about artificial intelligence at Georgetown University, Wong has key experience in how AI interacts with students and workers. As she puts it, in its current state, AI is still within its 'narrow' phase. This terminology defines AI's current stage as in its infancy, unable to think for itself genuinely, and remaining superficial in its capabilities. It hasn't nearly reached human intelligence, and cannot be without error, therefore

simulating and experimenting in *specific* scenarios to *specific* institutions is key to reaching its maximum current potential (Wong).

Conclusion

There is massive conflict in the technological landscape regarding what direction should be taken regarding AI and the United States workforce. The conflicting views on the role of artificial intelligence in the United States workforce underscore the uncertainty surrounding its future direction. Some advocate for prioritizing AI over human workers, while others emphasize the need for further development and careful implementation. Debates also arise regarding which aspects of AI should be prioritized, such as communication, education, or organizational systems.

Ultimately, the true benefits and downsides of different AI propositions will unfold through their implementation and public reaction in the coming years. As AI technologies continue to evolve, it is crucial to navigate the challenges thoughtfully and ensure that the ethical, societal, and economic implications are carefully considered. In this dynamic landscape, open and inclusive discussions among stakeholders, including researchers, policymakers, industry leaders, and the public, are essential. These conversations should focus not only on technological advancements but also on the broader societal impact, ensuring that the future of AI aligns with our values, safeguards individual rights, and promotes the well-being of all.

The path forward demands a delicate balance between embracing the potential benefits of AI and being mindful of its potential pitfalls. By fostering collaboration and informed decision-making, we can shape a future that harnesses the transformative power of AI while safeguarding the interests of workers, preserving human dignity, and promoting a more equitable and inclusive society.

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The Portrayal of Women Over Time in Children’s Media: Scooby-Doo’s Daphne Blake By Aysha Lamis Vattoth

Using Feminist Theory to Explain the Role of Women

There is a large conversation amongst feminist authors regarding the appropriate theoretical approach that should be taken when examining the patriarchy, though they seldom diverge from the basic concept that “...activities traditionally thought of as masculine are also traditionally thought of as human...” (DiQuinzio 3). As such, feminist theory is predominantly centered around the notion that femininity is thought of as being ‘less human’ from a societal standpoint. There are three primary approaches taken when conducting feminist research, and of these are positivism, which aims to discover natural laws so people can predict and control events, interpretive social science, which aims to describe and explain meaningful social action, and critical social science, which aims to invalidate myths and empower people to create radical changes in society (Kiguwa 229). One example of interpretive social science is when Collins posits that “women are the subordinate class in a system of sexual stratification” (5). This is seen in life by women merely taking orders from and not giving orders to men; thereby, when men take orders from another individual, it is always another man, and women only give orders to other women (Collins 5). This sexual stratification is attributed to men’s physical dominance over women, and the power they attain from being able to coerce women to fulfill their desires (Collins 7). Chafetz, in her overview of underutilized positions for feminist theory, validates Collins’ theory and considers its significance by commenting on how “...[he] is alone in making male coercive power central to such a theory by linking it to a typology of political structure” (108).

The Applications of Theory in Real Life

In applying Collins’ theory of sexual stratification to prior literature regarding the sociopolitical state of women in certain decades, these aforementioned ‘states’ can then be standardized. Davis & Robinson found, in their analyses of class identification of men and women in the 1970s and 1980s, that women predominantly tended to follow a “borrowing model” in the 1970s—or, the importance of their spouse’s characteristics was generally placed above their own; in the 1980s, however, there seemed to be a shift, and more women began to

follow the “sharing model”, which means their characteristics were placed at equal importance to that of their spouse (103). It is hypothesized that this shift to more women exhibiting individuality came as a result of society’s status quo shifting from the husband being the only breadwinner in the family to working women becoming a norm (Davis & Robinson 110). This idea is expanded upon by Moen’s study of women’s work and family roles in the 1970s, in which it was found that “fundamental changes in social attitudes and dispositions regarding fertility and labor force participation... effectively [began] to broaden the opportunities available to women” (147). This implies that women were set back by their societal responsibility to remain in the private sector and fulfill the role of the homemaker. Women garnering a greater sense of independence as a result of having more connections to the labor market makes sense when viewing the situation through Collins’ theory—in creating their own capital, women were partially freed from the ease with which men could coerce them, due to money being a means of power. Money being a gateway to female individuality is exemplified in the 1990s as well, in which it was found that women valued autonomy more than their male counterparts (Xiao 793). Xiao posits that women had to have more determination and independence than men did in order to gain footing in the workplace due to historically being taught to be submissive and obedient (793). As a result of the preexistence of a male power structure, women over time began exhibiting greater senses of autonomy in order to compensate for being disadvantaged in the labor market. Furthermore, over time, as more women have entered the workforce, their focuses have turned away from reproduction, and the overall attitudes of both men and women in regards to gender equality have begun to converge (Carter et. al 210). In observing these trends, it can be expected that women would only continue freeing themselves of the rigidity of the sexual stratification model imposed on them, but, though a significant increase was observed in the number of women joining the workforce over the later time period, it must also be noted that there was a plateau in the shift of gender role attitudes in the mid-1990s that continued into the 2000s (Cotter, David, et al. 259). This can be attributed to a number of factors, though a large one is the rise of antifeminist backlash in pop culture around the time; primarily, it was people bringing to light that women couldn’t have it all—balancing family and work was posed as not being genuinely possible (Cotter, David, et al. 266).

Female Roles as Illustrated in Media

The role of women is emphasized via more means than just real life, however. Media is one of the main ways in which large-scale audiences receive information regarding the past, and as such, content analysis of media is a good way of evaluating the real historical context surrounding it at the time of its creation (Deshpande 4455). It must be considered, however, when using media as a means of examining history, that “history [is] spun, adapted, and adjusted to accommodate audiences and the times” (Weinstein 30). When considering this, it is made clear that the intended audiences of a work are to be taken into heavy consideration when deducing the genuine impact that history has on a particular iteration of media. Art and visual media are often used to further ideas that are considered, in their infancy, to be radical—as was the case with female political cartoonists creating art as their means of supporting the push for women’s suffrage (Sheppard 39). Klein details the same idea fervently; though visual media once depicted women in a stereotypical and one-dimensional light, the evolution of comics in America has reflected its history, which includes changing images of women (60-61). Furthermore, though social constructs are not created by artwork, they are heavily enforced by them, as seen in how the status of women is revealed by their bodies and general appearances in artwork; the “ideal” woman is one that emphasizes availability and passiveness, with the male viewer being what is prioritized (Klein 61). The male gaze represents longing and desire, in contrast to the female gaze, which is coy, empty, and non-confrontational; they’re objectified as desirable, but themselves cannot be the ones doing the desiring, and are conveyed as sugared coated versions of what strong women could be, rather than what they are (Klein 61). Moving past still artwork meant for adults, however, sex differences are also seen in media intended for children; Brownlow & Durham found that, when it comes to the use of science and technology in children’s cartoons, men are depicted as being aggressive and being more likely to use technology for destruction, whereas women were more likely to use science and technology for the greater good (103). Men, in both visual art and cartoons intended for children, are portrayed as beings of great physical power, which, when applying Collins’ theory, keeps women subservient to them.

The Case for Scooby-Doo

One notable example of media that has changed significantly over time is the Scooby-Doo franchise. The show follows a group of characters that remain consistent in their basic archetypes from iteration to iteration. The group, called Mystery Incorporated, is comprised of Fred (the dimwitted leader), Daphne (the fashion-conscious damsel in distress), Velma (the smart one), Shaggy (the easily-frightened slacker), and Scooby-Doo (the dog); typical storylines including Daphne being kidnapped/endangered in some way, Fred devising a plan, Velma solving the case, and the Shaggy-Scooby duo using their dumb luck to help solve the mystery (Orr 1). Though the archetypes used throughout the show remain the same, its longevity has lent itself to having to portray these archetypes in different manners throughout the course of its runtime—from iteration to iteration, characters display changes, and as such, are not prisoners of their initial eras. This idea is amplified by the voice actors in the show, who stated in an interview that the reason for Scooby-Doo’s longevity is the way that it adapts to changing times—just because things that didn’t exist while it aired now do, it doesn’t confine itself to the time period of its release (“Speaking With the Crew of the New Scooby-Doo! ‘Return to Zombie Island’”).

The Characterization of Daphne Blake

Since her creation, Daphne has been the typical “girly girl” of the Scooby-Doo franchise. She is also considered the second quasi-adult of the group, after Fred (Orr 1); this is imperative to take into account when considering her role in the group because, in certain instances, she must adopt a motherly role—a role that women have stereotypically been reduced to over the course of history, and, as referenced earlier by Cotter, David, et al., a role which has had its importance reiterated as a means of antifeminism (266). Grey Griffin, who has voiced Daphne for twenty-one years (or over a third of Scooby-Doo’s runtime), in response to the question “How have you seen the evolution of your characters over the past 50 years?” responded that Daphne has gone from being “Fred’s girlfriend” to having taken control of her own life—doing expositions and talking about how mysteries are solved—overall, she claims that Daphne has changed entirely (“Speaking With the Crew of the New Scooby-Doo! ‘Return to Zombie Island’”). Despite her changing character, however, Scooby-Doo remains formulaic in its structure; even as Daphne becomes more of her own person, she will always fulfill the

underlying archetype of the “girly girl.” Though Velma is also a girl in the group, she fulfills the archetype of the “brainiac,” and thereby the evolution of her character lends itself to being influenced by more factors than real-world feminism, especially in comparison to Daphne.

The Gap

Based on the literature, it can be seen that feminism has changed not only the roles of women, but the way women have been perceived from the periods 1970 to the modern day, with the media being a large variable in this perception. What has not been examined, however, is the inverse of this—or, the ways in which the perception of real women contributes to the way women are portrayed in media, especially that which is targeted at child-based audiences. The former research that has been conducted in this field regards how the media’s portrayal of women has impacted real people’s perceptions of them over decades of time, however more research must be done to determine if the media portrays the roles that women fulfill in a realistic light, or if audiences merely believe women to behave in certain ways as a result of what they’ve seen in the media. Due to Scooby-Doo’s longevity and popularity, it becomes a suitable means of studying the way portrayals of characters differ over time, with Daphne—being the archetypal feminine figure of the group—offering a means of viewing characterization through the lens of direct feminism. The show is notable in that it has kept its characters very consistent throughout its iterations; Fred has always been the leader, Daphne has always been the girly girl, Velma has always been the smart one, and Shaggy and Scooby Doo have always been the cowardly duo. Due to the characters consistently sticking to their predetermined roles in the group, the way characters are portrayed remains consistent enough that changes in their behavior can be attributed to the context surrounding the time period the iteration of the show was released, and not as a result of severe character change over years after being released. Through this, the question can be answered: how has the sociopolitical state of women in the United States contributed to the evolution of Daphne Blake’s characterization throughout iterations of Scooby Doo’s 53-year runtime? For the purpose of the study, “sociopolitical states of women” were operationally defined as the roles of women outlined in the literature review, because all of the roles were described through social and political lenses. In order to fill the gap in the literature, iterations of Scooby-Doo over time were watched and analyzed.

Method

Six different iterations of Scooby Doo—Scooby Doo, Where Are You? (1969-1970), The 13 Ghosts of Scooby Doo (1985-1987), What's New, Scooby Doo? (2002-2006), Scooby Doo! Mystery Incorporated (2010-2013), Be Cool, Scooby Doo (2015-2018), and Scooby-Doo and Guess Who (2019-2021)—were watched. These particular shows were chosen because they align with the years outlined in the literature review (the 1970s, 1980s, 1990s, and 2000s onward). Scooby Doo, Where Are You? was chosen to represent the 70s due to its notability in that it was the first iteration of Scooby-Doo to ever be released. The 13 Ghosts of Scooby Doo was chosen as the representation for the 80s because it aired in the middle of the era and for a longer period of time, as opposed to The New Scooby and Scrappy-Doo Show which aired in 1983 and ended in 1984. Furthermore, A Pup Named Scooby-Doo, which aired from 1988-1991, was excluded from the list of shows to be watched due to the characters all being aged down to child-age; the entire reason the Scooby-Doo franchise was picked is lost if examining this particular show because the characters are not remaining wholly true to the archetypes expected of them. Due to the showrunners' attempt to create character personas different from their adult counterparts, Daphne is not portrayed in the same manner as she is in the rest of the chosen Scooby-Doo iterations, and thereby, the data collected would be skewed as a result. There was no Scooby-Doo show released in the 1990s, and as such, What's New, Scooby Doo? was watched to look for Daphne exhibiting the traits expected of women at the time, because numerous Scooby-Doo shows were released during the 2000s, and What's New, Scooby Doo? was released closest to the 90s. Scooby Doo! Mystery Incorporated, Be Cool, Scooby Doo, and Scooby-Doo and Guess Who are, as of 2023, the most recently aired complete Scooby-Doo series, and as such, were all included in the study because they have the most relevant implications in the modern era; the portrayals of Daphne in the three most recent iterations are the most vital to study due to there being opportunity for improving her portrayal in the next iterations that are released in the future, if need be. Scooby-Doo movies were excluded from the study completely because, when watching the first and last episodes of a show, there has been room for characters to develop in between the runtime of said show. However, if a movie were to be analyzed, the character would only have the course of under two hours to develop fully.

The first and last episodes of each chosen iteration were rewatched, with the timestamps of moments where Daphne's behavior matched the expected role of women described in the

literature review in the particular era being written down on a Google Doc. The reason the first and last episodes, specifically, were watched, was because these two episodes would convey the overall feel of the particular show over its entire runtime, as opposed to only specific instances. When viewing *Scooby Doo, Where Are You?* examples of her exhibiting the borrowing model were noted, in *The 13 Ghosts of Scooby Doo* examples of the sharing model were noted, in *What's New, Scooby Doo?* examples of her showing personal autonomy were noted, and in *Scooby Doo! Mystery Incorporated*, *Be Cool, Scooby Doo*, and *Scooby-Doo and Guess Who?* instances where there was no significant shift in gender roles were noted. Deductive codes were used to determine which moments were noteworthy and which were not; in the 70s, codes were made using the criteria of Davis & Robinson's borrowing model, in which the importance of other people's characteristics were placed above a woman's own. Using this criteria, four deductive codes were made: moments when Daphne verbally placed men's importance above her own, moments when other characters verbally placed Daphne's value as lower than (making fun of her, not acknowledging her, or giving her orders), moments when Daphne was visually depicted as dependent on a man (in which she was either showcased with men or showcased clinging to them), and instances of her being "danger prone." For the 80s, codes were made using the criteria of Davis & Robinson's sharing model, in which the importance of others' characteristics were placed at equal importance to a woman's own. Using this criteria, three deductive codes were made: moments where Daphne refused to follow someone's orders, moments where she took control of the group's actions, and moments where she visually asserted her power (showcased through her stances and solo scenes). All of the deductive codes under the sharing model were made with the group's intent in mind because it was in the 90s when the roles of women shifted towards independence. For the 90s, codes were made using the criteria of Xiao's female autonomy, in which women had the freedom to make their own decisions in regard to their own lives. Using this criteria, three deductive codes were made: moments where Daphne made her own decisions, moments where she said no to other characters, and moments when she was visually independent (showcased through her being relied on by others, or self-reliant). The same deductive codes used for the 90s were used when collecting data for the 2000s and onwards, to account for the plateau in gender roles observed by Cotter, David, et al.. Furthermore, in every era, instances of the borrowing model were looked for in order to account for regression back to older eras of the roles expected of women. The reason the borrowing

model was used as the standardized era of “regression” is because, from the sharing model onwards, women tended to take more agency in their behaviors. The sharing model is an intermediary stage between autonomy and a lack thereof, and that is not a reversion back to the original gender roles expected of women.

The noted timestamps were revisited and a transcript was made of the moments Daphne exhibited the traits that were expected of her in the particular era. The goal of making the transcript was to collect all of the instances where Daphne exhibited one of the models expected of her in the particular era being examined (or, in some cases, if she was exhibiting reversions in gender roles). It must be considered however that some characteristics are not objective when it comes to what they portray; the context must also be examined. For example, Daphne may be shown standing with Fred in one scene, but that would not necessarily be an example of “visual dependency”—however, if she is only ever depicted with Fred in an episode and never once given a solo scene, then the scenes where she is only ever depicted with Fred are grounds to be considered scenes where she showcased visual dependency.

Once the data was collected, a qualitative content analysis was conducted to see if Daphne’s behaviors matched those observed of real women in particular eras. Data tables were made that separated the noted examples under the deductive codes that they were collected and categorized under, with explanations for why the particular instance fits under the code being italicized and in red under the example. The goal of the study was to see if Daphne generally followed the models expected of real women at the time of a specific airing of a Scooby-Doo iteration, and if so, then it would be accepted that the perception of real women’s sociopolitical status contributes to the way women are portrayed in media. In order for it to be accepted that Daphne generally followed a particular model, then the data collected from the two episodes viewed from the particular iteration had to, at minimum, include either instances of her exhibiting every deductive code once, or two or more examples of her following half of the deductive codes derived from the foundational text for that particular time period.

Data

The first and last episodes of Scooby Doo, *Where Are You?* were watched when collecting data for Daphne’s portrayal in the 70s—“What a Night for a Knight” and “Don’t Fool with a Phantom.” It was found that generally, in the 70s, Daphne largely followed the borrowing

model that was expected of her to follow. In *Scooby Doo, Where Are You?* there are numerous examples of her verbally placing men's importance above her own, such as when the first time she ever speaks in the show she says:

Daphne: You're right, Shaggy. This sure is strange.

The first time Daphne speaks in the show, it is to agree with a male figure. Furthermore, numerous times she is put down by others verbally, as is the case in this particular scene in "What a Night for a Knight".

Daphne: Let's take this back way out!

(Door slides open to reveal the Black Knight standing in the doorway, growling)

Shaggy: Leave it to Daphne to pick the wrong door!

In this instance, not only is it being implied that Daphne chose the wrong door as a result of her disposition ("Leave it to Daphne..."), but she is also being made the object of the joke—Shaggy's line is followed by a laugh track; in the two episodes of the show observed, no other character was put down by another character in a demeaning way, especially not in the presence of a laughtrack. Furthermore, she showcases numerous instances of only ever being showcased with Fred, and clinging to him in situations where no other character clings to another person (visual dependency), and there are also numerous instances where she is depicted as danger prone. The data table created based on the notable data from this time period is included in the appendix.

80s

The first and last episodes of *The 13 Ghosts of Scooby Doo* were watched when collecting data for her portrayal in the 80s—“To All the Ghouls I’ve Loved Before” and “Horrorscope Scoob.” Daphne also generally follows the model expected of her, the sharing model, in the 80s. There are instances where she refuses to follow other characters’ orders, instances where she takes control of the group’s actions, and instances where she visually asserts her power through her stance and solo scenes. In direct contrast to *Scooby Doo, Where Are You?*, *The 13 Ghosts of Scooby Doo* gives Daphne numerous scenes in which not only is she the focus of the screen, but at times, the only person on it at all. The data table created based on the notable data from this time period is included in the appendix.

90s

The first and last episodes of *What’s New, Scooby Doo* were watched when collecting data for her portrayal in the 90s—“There’s No Creature Like Snow Creature” and “E-Scream.” In the 90s, Daphne exhibited a great sense of the autonomy outlined by Xiao. She makes her own decisions numerous times, says no to other characters, and there are also instances where other characters depend on her visually. Furthermore, *What’s New, Scooby Doo* continues the trend set by *The 13 Ghosts of Scooby Doo* in that it showcases numerous solo shots of Daphne. In one instance, in “There’s No Creature Like Snow Creature”, as Daphne fights off the monster in the episode (which is incredibly notable because this is the first time where she has ever been depicted carrying on with an investigation on her own), she blasts the monster with a blowdryer. This is imperative to note because not only is she fighting the monster, but she is doing so in a way that many would consider to be very feminine. In fighting the monster, she is not shedding her femininity. The data table created based on the notable data from this time period is included in the appendix.

2000s and Onwards

From the 2000s and onwards, Daphne does not exhibit too many instances of the autonomy outlined in Xiao’s research on the roles of women, thereby indicating that her behavior does not follow the plateau in gender roles that was outlined by Cotter, David, et al.. The first

and last episodes of Scooby Doo! Mystery Incorporated— “Beware the Beast from Below” and “Come Undone”—the first and last episodes of Be Cool, Scooby Doo—“Mystery 101” and “The Curse of Half Beard’s Booty”—and the first and last episodes of Scooby-Doo and Guess Who?— “Revenge of the Swamp Monster!” and “The Movieland Monsters!”—were watched when collecting data for the way Daphne was portrayed from the 2000s and onwards. In Scooby Doo! Mystery Incorporated, only three instances of her following the autonomy model were observed. However, when applying the four deductive codes under the borrowing model, however, numerous examples of Daphne exhibiting the model were collected. One notable instance of Daphne’s following of the borrowing model was in “Beware the Beast from Below” in which Daphne is knocked to the floor by the monster in the episode.



“Beware the Beast from Below”

In this moment, she is depicted as danger prone. The moment is particularly notable, however, in that she is not just shown as being knocked to the ground as a result of circumstance, but in staying on the ground and opting to crawl away from the monster—an action no other Scooby Doo character has taken in the context of the Scooby Doo, Mystery Incorporated—Daphne is depicted as weak. In the first episode of the show, she is the only character to be shown one on one with the monster, and the moment is one of sheer terror and fear. In instances where Fred, Velma, or Shaggy were faced with the monster, they found means of escape, whereas Daphne had to depend on the others to save her from the face of danger.

In Be Cool, Scooby Doo only one instance of Daphne exhibiting the deductive codes under autonomy was collected. However, when applying the borrowing model to the show, it was seen that Daphne exhibited numerous instances of the model that would have been expected of her in the 1970s—however, in contrast to Scooby Doo! Mystery Incorporated, in which

Daphne exhibited every code under the borrowing model, in *Be Cool, Scooby Doo* only moments of other characters verbally placing Daphne's value as lesser than others, as well as examples of her being danger prone, were exhibited.

When viewing the first and last episodes of *Scooby-Doo* and *Guess Who?* the same trend that persisted thus far throughout the 2000s and onwards was exhibited—Daphne showcased barely any instances of following the autonomy model. In terms of the borrowing model, however, holistically there were also not many examples of Daphne following the model expected of her in the 1970s. When applying the criteria for analysis (that every notable instance of Daphne following a particular model must be in context), it can be seen that the reason Daphne barely follows any model of female roles is because she, as a whole, has become a background character in the show. She rarely appears in scenes alone, and even when she is present in a scene with other characters, the amount of dialogue she delivers is minimal. This becomes especially clear when comparing her portrayal in *Scooby-Doo* and *Guess Who?* to *Scooby Doo, Mystery Incorporated* and *Be Cool, Scooby Doo*, in which there are instances of her—at least in some way—contributing to the overall storyline of the episode, even if, in those episodes, her contributions involved being danger prone. The data tables created based on the notable data from all three of these shows (with comparisons between the minimal extent to which they follow the autonomy models and the varying extents to which they follow the borrowing model both included) are included in the appendix.

Conclusion

To answer what extent the sociopolitical states of real women have contributed to Daphne Blake's characterization over the 53-year runtime *Scooby-Doo* has had, the data analysis shows that from the 1970s to the 1990s, Daphne followed the borrowing and sharing models expected of her, but from the 2000s and onwards, there was not a strong correlation between the autonomous model expected of her and her characterization. This conclusion was drawn because data analyzed from *Scooby Doo, Where Are You?* (1969-1970) showcased Daphne following all four deductive codes derived from the criteria of Davis & Robinson's borrowing model that represented women in the 1970s, *The 13 Ghosts of Scooby Doo* (1985-1987) showcased Daphne following the three deductive codes derived from the criteria of Davis & Robinson's sharing model that represented women in the 1980s, and *What's New, Scooby Doo?* (2002-2006)

showcased Daphne following all four deductive codes derived from the criteria of Xiao's autonomy model that represented women in the 1990s. Data analyzed from *Scooby Doo! Mystery Incorporated* conveys that, from 2010-2013 (when the show aired), Daphne exhibited a complete reversion to the roles expected of her in the 1970s; as shown by how holistically, she barely followed the deductive codes derived from the criteria of Xiao's autonomous model, but strongly followed the codes derived from the borrowing model. Data analyzed from *Be Cool, Scooby Doo* (2015-2018) conveys that, from 2015-2018, though Daphne did not exhibit a complete reversion to the borrowing model, she was heavily belittled and demeaned. This was shown in how she did not follow every deductive code derived from Xiao's autonomy model at least once, but was consistently depicted as being verbally placed, by other characters, as lesser than, as well as dangerprone (two deductive codes derived from the criteria of Davis & Robinson's borrowing model that represented women in the 1970s). Data analyzed from *Scooby-Doo and Guess Who* (the most recent version of *Scooby-Doo* that has been aired to completion) conveys that from 2019-2021 (the years it aired), Daphne was reduced to a background character in the show. This conclusion was reached because, in the context of the two episodes viewed, Daphne's actions or dialogue never once furthered the progression of the overall plot of the episode. The final conclusion is that, though Daphne's characterization adhered to the sociopolitical roles of real women from the 1970s to the 1990s, from the 2000s and onwards, she exhibited a decrease in autonomy—completely reverting to the role expected of her in 70s, followed by being consistently belittled, to eventually, being made into a background character in the show.

Discussion

The implications of the conclusion are vast—due to the aforementioned popularity of *Scooby-Doo*, Daphne's portrayal is vital to the way young girls form their views on their own roles in the world. As stated in the method section, the reason three shows were chosen to analyze the 2000s and onwards is because this era has the most relevant implications to modern audiences, and in the data analysis showing that Daphne has not recently been portrayed fulfilling the autonomous model that real women do, young girls, in turn, are losing a strong female role model to look up to. Portrayals in media matter because "...associations in media may mislead girls' and women's perspectives about female role identity" (Lin & Jin-Tsann 62).

In constantly seeing a feminine woman in children's media be portrayed the same way as she was expected to behave in the 1970s, belittled and demeaned, or made into a background character, children may begin to believe that the sociopolitical state of modern women is not autonomy, but rather, one of subservience. Furthermore, connecting back to Sheppard's assertion that visual media has been used in the past to push radical ideas, it becomes clear that the media does have an impact on the real world as well (39). If the media can improve the sociopolitical state of women by pushing for radical change, then shows, such as Scooby-Doo can take this into consideration and portray characters like Daphne in ways that are more positive than the pre-existing role expected of her.

Despite the findings, there were still numerous limitations to the study. Firstly, in only the first and last episodes of each show being watched, it is likely that there were more examples of Daphne following the models expected of her in a particular era than the recorded data conveyed. Furthermore, Daphne is not the only hyperfeminine character in every iteration of Scooby-Doo, but she is the only character of this nature that appears in every iteration of the show. As such, no other characters could be considered, because then their portrayals over time could not have been studied. Future researchers can use the conclusions found in this study and analyze either more episodes of Scooby-Doo (to account for one of the limitations of this study), or apply the outlined methodology to other pieces of children's media to determine if the conclusions found in this study remain consistent to other shows.

Using the conclusions found in this study, showrunners of Scooby-Doo can see that Daphne's modern characterization does not accurately portray the roles of modern women, and, due to the interconnected nature of female portrayals in media and young girls' perspectives on the roles of women, that this is an issue that must be addressed going forward.

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