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WOFFORD
## PROGRAM SCHEDULE

16th Annual SC Upstate Research Symposium  
September 26th, 2020 – hosted on the USC Upstate Campus

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| 9:00 – 10:30 | **Welcome and Keynote Address**  
*From Alligators to Astronauts:*  
What we’ve learned and how can we apply it to help human kind?  
Dr. Karen Gaines; Embry-Riddle Aeronautical University |
| 10:45 – 12:00 | **Breakout Sessions 1-6**  
1. Constructing Identity  
2. Business and Economics  
3. Health Sciences  
4. Natural Sciences I: Animal Behavior  
5. Pedagogy in Practice  
6. Service Learning and Community Engagement |
| 12:30 – 1:30 | **Breakout Sessions 7-10**  
7. History and Political Science  
8. Philosophy and Social Sciences  
9. Math and Computer Science  
10. Natural Sciences II: Organism Growth and Distribution |
| 10:45 – 12:30 | **Special Session: Human Cognitive Augmentation**  
(runs concurrently with Breakout Sessions) |
| 1:45 – 3:00 | **Poster Session** |
| 3:15 – 5:00 | **Closing Seminar and Awards Ceremony**  
*Helping students become more T-shaped through undergraduate research.*  
Dr. Korine Wawrzynski, Michigan State University |
Keynote Speaker

Dr. Karen Gaines

From alligators to astronauts: what we’ve learned and how can we apply it to help human kind?

Dr. Karen Gaines has served as Dean of the College of Arts and Sciences at Embry-Riddle Aeronautical University (ERAU), Daytona Beach since 2016. Prior to joining ERAU, Dr. Gaines worked at the US Department of Energy’s (USDOE) Savannah River Site, before joining the faculty of Eastern Illinois University where she served as Department Chair of Biological Sciences and founding Director of the Geographic Information Science Center. Dr. Gaines is an interdisciplinary scientist whose expertise primarily focuses on toxicological exposure pathways for both environmental and human risk assessment, specifically as it pertains to health physics, radiobiology, metals and organics. Dr. Gaines has received numerous research and leadership awards for her work with the USDOE, US Environmental Protection Agency as well as the US Department of Defense. Dr. Gaines continues to serve these agencies, not only as a risk assessor, but also as an expert in spatial data analytics.

Dr. Gaines’ PhD is in Environmental Health from University of South Carolina’s Arnold School of Public Health, where she was awarded the doctoral achievement award for her work in identifying pathway exposures for vulnerable populations living near nuclear waste sites. Dr. Gaines works closely with the Aerospace Medical Society, American Public Health Association, and the Society of Environmental Toxicology and Chemistry in various capacities and is an appointed member of both the Health Physics Society and the International Union of Radioecology. Since joining ERAU, Dr. Gaines has worked closely with NASA researchers looking at how life reacts to extreme environments by applying her knowledge in radioecology.
Closing Seminar

Dr. Korine Wawrzynski

Helping students become more T-shaped through undergraduate research.

Dr. Korine Steinke Wawrzynski is the Assistant Dean for Academic Initiatives and Director for Undergraduate Research in the Provost's Office at Michigan State University (MSU). She also serves as an Adjunct Assistant Professor in the Student Affairs Administration master's degree program.

Dr. Wawrzynski is an active member of the Council on Undergraduate Research, where she served as a councilor and has co-chaired two national conferences. Her research interests include innovative learning opportunities for undergraduate students, the experiences of women leaders in higher education, and collaborative partnerships between Academic Affairs and Student Affairs. She has earned a bachelor's degree in English from Monmouth College, a master's degree in College Student Personnel, and a doctorate in Higher Education Administration, both from Bowling Green State University.

The T–Shaped Professional

![Figure 1](image.png)

*Figure 1.* Figure courtesy of Dr. Phil Gardner, Michigan State University.
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Influence of Social Media Advertisements on Purchase Intentions

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Abstract – The landscape for social media is evolving at such a rapid pace that each day seems to bring about change, especially for marketers. It is critical to understand changing consumer behavior as it relates to social media trends. This research was undertaken to explore the impact of advertisements on social media and if they are successful in promoting purchases. Qualitative research was undertaken to identify the deep links consumers may make with advertisements and identify specific behaviors of consumers and attributes of advertisements that drives intention to purchase. Findings showed that although there may be a lack of knowledge on how companies are targeting them, consumers were not typically concerned with their privacy. The more an advertisement was geared towards their interests, the more likely the consumer was to consider its purchase. Consumers were more confident towards advertisements that included positive reviews and seen as trusted sources. Agreement was not conclusive on the usage of influencers in advertisements or the impact of text versus videos.

Keywords – social media, purchase intentions, digital advertising, consumer behavior

Introduction

Social media has its roots in relationship building among family, friends, acquaintances and others but has now evolved into an essential tool for the same reason between businesses and consumers. Businesses have begun to see the necessity of being on social media for marketing purposes. “As more shoppers are using social media and rely on them for marketing shopping decisions, promotion through these media has become important” (Shankar et al. 2011, p. 32). With 86% of Generation Z on social media multiple times a day (The Manifest, 2019), the potential of product purchase and audience views has moved many companies to see social media as a viable advertising alternative to more traditional outlets. Social media advertising budgets reached $89 billion in 2019 with estimates of over $100 billion for 2020 (Statista, 2020). Over half of companies measure engagement (60.3%) or traffic (51%) as their ROI of social media advertising, but a quarter of them still are uncertain of its effectiveness (Buffer, 2019). Perceived personalization of advertisements have been found to have a positive role in brand engagement on Facebook (Tran & Ho, 2018), therefore this research wanted to further explore how consumer’s react to these ads across different social media platforms. Trust has played an extremely significant role in purchase intentions (Harris & Dennis, 2011; Kim, 2012), but research has been limited in its direct role on social media. Consumers 18-28 have been found to have a more positive attitude to video advertisements online than other age groups (Cox, 2010) so it is important to identify if this has the same impact on social media. With limited research directly in this area, an exploratory methodology was implemented through focus groups for this research in order to get detailed and descriptive insights.

Methodology

Seeing that the most active consumers on social media are Generation Z (The Manifest, 2019), a convenience sampling methodology of college students was selected to garner feedback in terms of their interaction with social media advertisements. Four focus groups were held with a total of 33 respondents. The main objective of the focus groups was to assess if advertisements seen on social media platforms impact consumer’s desire to purchase the product. Factors that were discussed included the amount of time spent on social media, number of advertisements seen, characteristics of advertisements that prompted action, influencer impact, sponsored versus non-sponsored advertisements, posted reviews, visual cues, and trust. Respondents were told to consider their behavior on all social media sites so that all platforms were considered. During the focus groups, respondents were also directed to build a “perfect” advertisement that would encompass all the elements that would be needed to have them click through the advertisement and purchase a product.

Findings

Respondents were first asked to take out their cell phones and identify their average screen time (instructions given by the moderator) per day. Usage varied from 1 hour 26 minutes to 8 hours 47
minutes with the largest majority in the 3-4 hour range. Social Networking was the largest usage category with about three-quarters of the overall screen time spent in this area. Several respondents were surprised by their total – “I never imagined I wasted that much time”, “This truly opened my eyes”. It was important to get a feel for usage to estimate the amount of advertisements that they may view on a day-to-day basis. Much debate has also arisen in the business community as to which social media is most effective to advertise on. Respondents were split between Instagram and Facebook in terms of social media that they are most likely to make a purchase from. Several respondents also discussed that they trusted those social media more than others, especially for shopping.

The most effective time of day to post an advertisement was discussed next. All respondents were on social media at some point between 8 pm and midnight – “This is how I relax”, “I can’t fall asleep without seeing what is going on”. Only a handful were on social media in the morning hours (about 10%). A common belief among Generation Z research is that they are more interested in social responsibility, but our respondents very clearly agreed that a company’s social stance in an advertisement had very little influence on their likelihood of purchase. In order to ascertain a barrier to purchase, respondents were asked about the number of times they had to see an advertisement before they were annoyed with it. By far, the answer was between 2 and 3 – “If the same ad plays again, I more annoyed than interested”. Another view shared during the groups was that some advertisements that were displayed over and over again actually influenced them to make a purchase because they were both geared towards their interests and top of mind – “If it is constantly being put in my head, I am likely to purchase”, “I feel pressure to buy when I see it over and over again and am more likely to buy it on impulse”.

There was little agreement on the impact of sponsored advertisers on trust. Some respondents felt that by placing a sponsored advertisement, a company understood their consumer more. Most did not even realize whether an advertisement was sponsored or not. Ten respondents discussed reviews on sponsored ads as not reliable. Trust was also explored in terms of search history. All respondents agreed that they had seen at least one advertisement appear after they searched for the item (or something similar), mostly through Google – “It happens, but it totally freaks me out”, “I feel violated”. Four respondents even mentioned that advertisements had appeared after using a voice-driven tool such as Alexa. Overall though, respondents were much more likely to click through an advertisement if it was seen as relevant to their interests and did not necessarily make the link to Big Data algorithms or the issue of privacy of their data being used in this matter.

When asked what the most important feature of an advertisement was on their likelihood to purchase, respondents stated they clicked on advertisements because they are “pleasing, interesting, vibrant, and connects to their interests”. Discounts were a good strategy that convinced over half the respondents to click on them. Advertisements that included tools like Apple Pay were also more likely to be clicked on. This could be important as the concept of impulse purchases online has just recently begun to be explored. There was overwhelming agreement that positive reviews were critical in making a purchase and that negative reviews would definitely prevent them from making a purchase. The exception to this was if an influencer posted a positive review since the viewpoint was that they were being paid to do so, although one commented that “If the review feels authentic I feel like I can trust them”.

Each group was also given the task of creating an advertisement to gain insight into the important features it needed to be effective at driving purchases. About a quarter of the respondents created advertisements that included a celebrity using or wearing the product. This was lower than expected in terms of the importance of influencers on whether or not to purchase a product. Most (about 85%) of the advertisements included price, which shows that it may be critical to expose the consumer immediately to the price of the product rather than have the consumer make additional clicks (which they may or may not) in order to ascertain the product’s price – “I don’t want to have to hunt for the price after seeing it”. Several respondents included the picture of the product on a model and several that included 360-degree viewpoints – “I need to see how it would look on me and not just a static picture before I would ever buy”, “I want to see it from all possible angles”. There were only 2 advertisements that were text only and 12 who included a video – “Something that moves catches my eye more easily”. Although some respondents mentioned that video advertisements were too busy, they did indeed grab their attention, but that it would not lead to their purchase of the product.

Conclusions and Future Research

While many make the assumption, this research points to the fact that consumers, Generation Z specifically, spend part of their day on
social media, averaging 3-4 hours. Therefore, companies can focus their marketing through advertisements on social media to reach this target market, but to be successful several considerations must be taken into account. This research identified that although respondents spend several hours a day on social media, they were mostly online between the hours of 8 pm and midnight. Most became disengaged when an advertisement was shown repeatedly. Using algorithms to target specific interests of the consumer also made them more likely to click through and purchase a product. Also, companies should push advertisements on social media that contain discounts or sales because results showed that respondents were more likely to purchase when promotions such as these were included, as well as listing specific prices of products. The use of videos in advertisements must be handled with caution as some were driven to click though and purchase while others were simply annoyed and disregarded it. Reviews play an important role on whether or not a consumer will make a purchase, both in a positive and negative way.

According to this research, brands that actively use social media to engage and advertise build trust and loyalty between them and the customer, but to what extent needs additional data. The use of influencers in advertisements needs further examination as consumers were split on the amount of impact they had on their purchase intention. Although only mentioned briefly, the ability of advertisements to promote impulse purchases could offer valuable insights into its impact through social media marketing tactics. Differences between the use of text and/or videos in advertisements on consumer’s intention to click through also received mixed responses and would be useful to assess in future research.

References

Examining the Concept of Gamified Platform Framing for Entrepreneur Competencies

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Abstract - This study aims to reveal the need to propose a digital network where entrepreneurs can disseminate their skills achieved beyond formal and normative education. The general objective is to design a gamification platform based on entrepreneurial skills. For this, the specific objectives are proposing a Delphi study to experts obtaining a list of priority competencies in the profiles of entrepreneurs, then the second specific objective is integrating the selected competencies within an interface based on the use of game elements, resulting in a platform that displays the 5 priority competencies, learning through experience, motivation, spotting opportunities, working with others and valuing ideas with 5 game elements respectively, experience points, feedback, leaderboards, progress bar and badges. From the results obtained, it can be concluded that the model implemented will serve as a first precedent for the display of competencies, thus providing an alternative traceability to the skills achieved by entrepreneurial initiatives.

Keywords: entrepreneurial skills, gamification, platform, innovation, competencies

Introduction

In the last 20 years there has been growing attention to the issue of entrepreneurship (Castro et al., 2015). The importance given to this aspect does not only refer to educational studies, but also involves other areas of study, such as business studies, social sciences, jurisprudence and communications, among others. With respect to this issue, the main supranational organizations are the Organization for Economic Co-operation and Development or OECD, United Nations Educational, Scientific and Cultural Organization or UNESCO, and Organization of Ibero-American States or OEI. OEI began to address issues related to entrepreneurship, producing numerous policies and frameworks (Reilly, 2018). These frameworks generated by supranational institutions are being regulated and somehow linked to the international scientific debate along with other national experiences and practices. In this sense, a theoretical definition and numerous empirical tools have been gradually produced with reference to the evaluation and planning of competition oriented to entrepreneurship (Ustyuzhina et al., 2019).

Gamification has been defined as the application of game-design elements and game principles in non-game contexts (Huotari, & Hamari, 2012). As organizations are increasingly eager to adopt gamification, entrepreneurs are echoing this technique. Indeed, Patricio (2017) research shows that gamification catalyzes the development of entrepreneurial skills and capabilities, instills team spirit, and shapes the culture of innovation-oriented support. Even more precisely, gamification has its following advantages:

- It tackles challenges in a more structured way: it makes it easy to reach a common conclusion, getting everyone in tune and taking action in the same address.
- Improve, enrich and develop ideas: encourage the contributions of all players, in a more balanced way and gain valuable knowledge even from the most reserved team members.
- Encourage participation: generate results that have been developed by all participants and agree on the actions.
- Develop critical entrepreneurship and innovation skills: promote debate and accept opposing points of view, take risks by explaining things in a different way and collaborating in a more open and committed way.

Gamification is a fixed technology of the productive sector (Rivera & Van der Meulen, 2014), its versatility and adaptation to different contexts means a safe bet for its application in companies of the entrepreneurial ecosystem. In the present study we designed a gamification platform based on priority entrepreneur competencies obtained from the European Commission (2017) that carries out the "EntreComp Conceptual Model" consisting of 3 competence areas and 15 dimensions with 442 indicators in 8 micro levels of proficiency.

Methods

This study is based on the achievement of 2 specific objectives, the first being a list of priority
The second specific objective is integrating the selected competencies within an interface based on the use of game elements. Based on the dimensions, a questionnaire with 15 questions (one per dimension) with the option of an answer on a 10 level Likert scale, the minimum value (1) being "totally dispensable" and the maximum value (10) "totally indispensable" was deployed.

The second objective focuses on selecting from 5 entrepreneurship skills applying different mechanics belonging to gamification in order to provide traceability and visibility of the skills presented by the participants (Torres-Toukoumidis et al., 2018): Playing Elements: levels, challenges, goals, etc, Reward Systems: leaderboards, medals, points (PBL) and Promotion of Competition/Collaboration.

Results

The questionnaire, in pilot test stage (January 2019) was validated through a judgment of experts, taking into consideration its evaluation in appearance, construction, content and criteria. The execution of the pilot test yielded the following results, ordered by competencies:

The results clearly show that, according to experts, there is a priority over entrepreneurial skills, emphasizing learning through experience, motivation, spotting opportunities, working with others and valuing ideas. In short, the 5 entrepreneurial competencies enhance their visualization and traceability through the use of game elements.

Conclusion

This research correctly fulfils 2 specific objectives: the first denoted with the hierarchy glimpsed on the following entrepreneurial competencies: (1) learning through experience, (2) motivation and perseverance, (3) spotting opportunities, (4) working with others, (5) valuing ideas, (6) planning and management, (7) self-awareness and self-efficacy, (8) coping with uncertainty, ambiguity and risk, (9) vision, (10) ethical and sustainable thinking, (11) mobilizing others, (12) creativity, (13) taking the initiative, (14) mobilizing resources and (15) financial and economic literacy. The findings demonstrate that these can be involved in empirical and pedagogical scenarios, as it happens in this case creating a gamified web interface oriented towards alternative skills. Therefore, as it is an exploratory model, a series of obstacles are revealed, such as determining a large pilot sample to test the interface, a more exhaustive analysis of the gamification elements, segmenting between dynamics, mechanics and aesthetics. Gamification of entrepreneurship has the potential to highlight entrepreneurial skills in order to progressively legitimize them in a professional profile.

References


### Table 1
**RATING AVERAGE PER COMPETENCE**

<table>
<thead>
<tr>
<th>Competence</th>
<th>Arithmetic mean</th>
<th>Standard deviation $\sigma$</th>
<th>Variance $\sigma^2$</th>
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<tr>
<td>Spotting opportunities</td>
<td>8.666</td>
<td>1.211</td>
<td>1.466</td>
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<td>Creativity</td>
<td>8.678</td>
<td>1.505</td>
<td>2.266</td>
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<td>Vision</td>
<td>8.500</td>
<td>2.258</td>
<td>5.100</td>
</tr>
<tr>
<td>Valuing ideas</td>
<td>8.166</td>
<td>2.639</td>
<td>6.966</td>
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<tr>
<td>Ethical and sustainable thinking</td>
<td>8.666</td>
<td>2.338</td>
<td>5.466</td>
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<td>Self-awareness and self-efficacy</td>
<td>8.333</td>
<td>2.422</td>
<td>5.866</td>
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<td>Motivation and perseverance</td>
<td>9.839</td>
<td>0.408</td>
<td>0.166</td>
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<td>Mobilizing resources</td>
<td>7.835</td>
<td>1.329</td>
<td>1.766</td>
</tr>
<tr>
<td>Financial and economic literacy</td>
<td>7.500</td>
<td>1.643</td>
<td>2.700</td>
</tr>
<tr>
<td>Mobilizing others</td>
<td>8.500</td>
<td>1.048</td>
<td>1.100</td>
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<tr>
<td>Taking the initiative</td>
<td>7.833</td>
<td>1.834</td>
<td>3.366</td>
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<tr>
<td>Planning and management</td>
<td>9.166</td>
<td>0.752</td>
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<td>Coping with uncertainty, ambiguity and risk</td>
<td>8.664</td>
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<td>1.066</td>
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<tr>
<td>Working with others</td>
<td>8.653</td>
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<tr>
<td>Learning through experience</td>
<td>9.666</td>
<td>0.816</td>
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### Table 2
**PRIORITIZATION OF RESULTS**

<table>
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<tr>
<th>Competence</th>
<th>Ranking</th>
<th>Gamification elements according to Torres-Toukoumidis et al., (2018)</th>
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<tr>
<td>Learning experience</td>
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<td>Experience points (XP)</td>
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<tr>
<td>Motivation and perseverance</td>
<td>2</td>
<td>Feedback</td>
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<tr>
<td>Spotting opportunities</td>
<td>3</td>
<td>Leaderboards</td>
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<td>Working with others</td>
<td>4</td>
<td>Collaboration</td>
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<tr>
<td>Valuing ideas</td>
<td>5</td>
<td>Badges</td>
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An Efficient Portfolio for the Next Stock Market Crash

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Abstract- The U.S. stock market has enjoyed a high return over the last ten years (increase approximately 280% since 3/2009). Both researchers and practitioners believe that there will be a major market correction soon which could be as severe as the 2008 financial crash. While no one knows when it will happen, investors are searching for an investment strategy which still benefits from the current up trend but can limit the downside in case of a foreseeable major crash. Our study identifies a portfolio which satisfies the requirements. In particular, our portfolio of 30 stocks selected from the S&P 500 firms outperformed the S&P 500 index over the last 13 years (11/09/2007-09/30/2019) by 106.8%. More importantly, our portfolio has proven to be better than the S&P 500 over the last three significant downturns. Specifically, its returns were 5.4%, 8.7% and 4% higher than those of the index during the great financial crisis (10/11/2007-3/9/2008); European sovereign debt crisis and a downgrade in credit ratings of the U.S. (4/29/2011-10/3/2011); and the recent market selloffs caused by the acceleration of U.S-China trade war (9/20/2018-12/24/2018). We believe that our portfolio will benefit investors in the bull market and offer necessary protection during the bear market.

Keywords - Investment strategy, defensive stocks, stock market crash, great recession, efficient portfolios

Introduction

According to The Leuthold Group, the U.S. stock market has enjoyed the longest bull run and also the highest stock returns since the World War II. The S&P 500 index has soared 472% from March 2009 to November 2019 which is equivalent to an annualized total return of 17.8% percent. Many researchers and practitioners believe that this long run bull market will end soon and the market will enter a period of significant correction or even a great recession like the financial great recession during 2008-2009. For example, according to Nobel Prize-winning economist Paul Krugman the bond market has signaled a pretty good chance of a recession sometime in the next year or so (Maler and Sprague, 2019). A survey by Bankrate in 9/2019 indicates that the majority of experts believe that the U.S. market will slow down and the odds of having a recession in 2020 are 41% (Foster, 2019). On the other hand, there are other well-known experts who believe the recession threat is not likely and the market will continue its upward movement at least in the short-term. Former Federal Reserve Chairman Alan Greenspan said that despite slowing GDP growth, it’s too soon to worry about a US recession. According to him, the economy has been weakening, but still in a period of deleveraging. No recession in the last half century, at least, began from a period of deleveraging (Winck, 2019). Similarly, Nobel-prize winning economist Robert Shiller believes that the recession can be held off due to the bullish Trump effect which is the strong consumer spending associated with presidency of Donald Trump (Landsman, 2019).

Since it is almost impossible to predict when and how the next recession will be, it is important for investors to design a portfolio which still enjoys the on-going upward trend of the U.S. equity market but also offers some protection in case of a looming recession in the coming years. In this study, our goal is to create a well-diversified and efficient portfolio which meets those requirements.

Methodologies

In this section we discuss our process of creating the TOP30 and its major characteristics. Since our priority is to create a portfolio which can survive a future recession, we decide to choose stocks which performed the best among the 500 stocks in the S&P 500 index during the 2008 great recession (October 11, 2007 – March 9, 2009) which is considered the most severe recession since the Great Depression in the U.S. Specifically, using a Bloomberg Terminal we start by ranking 500 stocks constituting the S&P 500 index during this time frame based on their total period returns. Then we choose the top 30 stocks with the highest returns and called it TOP30. We argue that given the TOP30 performed better than the rest of the stocks in S&P 500 during the most severe financial crisis since the Great Depression, these stocks will be the best candidates for a portfolio which can offer some protections in case of the next recession. Table 1 shows that the majority of the stocks in our TOP30 (66%) are considered defensive stocks including Consumer Staples, Health Care, and Utilities. This is consistent with previous studies which show defensive stocks normally outperform in bad economy (Mahan, 1965; Egan and Peters, 2001). Interestingly, 13.33% of our
stocks in our TOP30 are from Consumer Discretionary which are usually believed to suffer the most in a contractionary economy, especially in the great recession.

**Results**

The returns of the S&P 500 index are widely used as a benchmark in both academic and practice for comparing returns of funds or any proposed investment strategies. Since our TOP30 is a part of the S&P 500 index, it is reasonable to compare the returns of our TOP30 with those of the S&P 500 index. Compare TOP30 and S&P 500 during the 2008 great recession and the sovereign European debt crisis.

The 2008 crisis is considered the great recession in the U.S. since the Great Depression in 1930s. Since our TOP30 is made up of 30 stocks with the highest returns from the S&P 500 index during this specific time frame by design, it is obvious that our TOP30’s return will be larger than the S&P 500's return. In Figure 1, the TOP30 lost -10.35% compared to -54.95% of the index over this period. In the European sovereign debt crisis, countries including Portugal, Italy, Ireland, Greece, and Spain experienced their bonds downgraded to a junk status. The Standard and Poor’s also downgraded the U.S. bonds from AAA (outstanding) to AA+ (excellent) on August 5, 2011. Figure 2 shows that our TOP30 outperformed the index by 8.7%. In particular, the index decreased by -18.64% while our TOP30 only lost -9.94%. Our TOP30 was clearly a better option for investors during this major downturn in the market. Figure 3 indicates that this active return (8.68%) of TOP30 was attributed to our asset allocations (6.94%) and to security selections (2.16%). In particular, the TOP30 outperformed the benchmark due to having more weights in defensive industries such as Health Care, Consumer Staples, and Utilities which showed a better performance than other industries and less weights in cyclical industries such as Financials and Industrials. Compare TOP30 and S&P 500 during the market selloff (9/20/2018 - 12/24/2018) and the entire period (11/09/2007 - 09/30/2019). Similar to the prior tests, Figure 4 shows that the performance of the TOP30 was superior to that of the index. During this market sell-off caused by trade tension between the U.S. and China, the TOP30 lost -15.33% while the index lost -19.36%.

It is possible that the TOP30 might do well in a market downturn but perform extremely poor during a normal or booming market. In Figure 5, we examine the entire period and find that the TOP30 earned a significantly higher return than the index. From a risk-return trade off perspective, one might argue that the excess returns earned by the TOP30 were the direct result of higher risk imbedded in the TOP30. Figure 6 addresses that concern by showing the Sharpe ratio was larger for the TOP30 (0.81) compared to the index (0.48) (Sharpe, 1994). In addition, the TOP30 shows a positive Jensen Alpha of 5.61% per month which is an indication of outperformance on a risk-adjusted return basis (Fama, 1970; Fama and French, 1992; Fama and French, 1993; and Schwert, 2003). In sum, we find that the higher return of the TOP30 is not the result of investing in more risky firms but because of earning higher returns for each unit of risk as indicated by the higher Sharpe ratio and the positive Jensen Alpha.

**Conclusion**

Our analysis has shown the TOP30 portfolio has outperformed the S&P 500 index over the last 13 years (11/09/2007-09/30/2019) by 106.8%. But more importantly, it has proven to be better than the S&P 500 over the last three significant downturns of the U.S. stock market. Even though past performance is no guarantee of future results, the TOP30 is still a great investment strategy for investors who want to ride the bull market but in the meantime are searching for some protection in case of a major pullback in the equity market.

**References**


Winck, B. (2019, October 31). Former Fed Chair Alan Greenspan doesn’t expect a recession to arrive anytime soon and uses one stat to argue his position. *Market Insider.*

### Tables and Figures

Table 1: TOP30 consists of 30 stocks from S&P 500 with the highest returns during the 2008 great recession

<table>
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<tbody>
<tr>
<td>1</td>
<td>AZO UN Equity</td>
<td>AutoZone Inc</td>
<td>US</td>
<td>Specialty Retail</td>
<td>123.34</td>
<td>14.4</td>
<td>8,135.5</td>
<td>21.6</td>
<td>779.4</td>
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<td>2</td>
<td>WMT UN Equity</td>
<td>Walmart Inc</td>
<td>US</td>
<td>Food &amp; Staples Retailing</td>
<td>46.9</td>
<td>15.7</td>
<td>190,799.8</td>
<td>3.5</td>
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<td>GILD UN Equity</td>
<td>Gilead Sciences Inc</td>
<td>US</td>
<td>Biotechnology</td>
<td>42.32</td>
<td>27.0</td>
<td>39,203.5</td>
<td>3.3</td>
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<td>MCD UN Equity</td>
<td>McDonald’s Corp</td>
<td>US</td>
<td>Hotels, Restaurants &amp; Leisure</td>
<td>56.25</td>
<td>21.4</td>
<td>67,037.2</td>
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<td>BAX UN Equity</td>
<td>Baxter International Inc</td>
<td>US</td>
<td>Health Care Equipment &amp; Supplies</td>
<td>56.24</td>
<td>22.1</td>
<td>36,259.6</td>
<td>-7.0</td>
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<td>ABT UN Equity</td>
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<td>Health Care Equipment &amp; Supplies</td>
<td>53.36</td>
<td>20.9</td>
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<td>General Mills Inc</td>
<td>US</td>
<td>Food Products</td>
<td>57.88</td>
<td>17.2</td>
<td>18,715.3</td>
<td>-11.2</td>
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<td>MKC UN Equity</td>
<td>McCormick &amp; Co Inc/MD</td>
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<td>Food Products</td>
<td>35.08</td>
<td>18.6</td>
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<td>Metals &amp; Mining</td>
<td>47.03</td>
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<td>QUALCOMM Inc</td>
<td>US</td>
<td>Semiconductors &amp; Semiconductor Equipment</td>
<td>41.47</td>
<td>24.3</td>
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<td>-18.6</td>
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**Figure 1.** TOP30 vs. S&P 500 during the 2008 great recession

**Figure 2.** TOP30 vs. S&P 500 during the European sovereign debt crisis and the downgrade in the U.S.
Figure 3. Return attribution during the European sovereign debt crisis

Figure 4. The recent market selloff by U.S-China trade war

Figure 5. The TOP30 vs. S&P 500 over the entire period

Figure 6. Risk and Return Analysis over the entire period
FFT Approach for Valuation of Commodity and Futures Options Under a Regime-Switching Model

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Abstract - In this article, we use the fast Fourier transform (FFT) approach to value commodity and futures options price, where the log of the underlying commodity spot price is governed by a regime-switching Ornstein-Uhlenbeck process (RSOU). This article is organized as follows: Section 1 states the motivation, Section 2 presents the model dynamics, Section 3 derives the valuation of commodity options via Fourier transform approach and the value of the futures option price, and Section 4 makes some concluding remarks.

Keywords — Commodity Options, Fast Fourier Transform, Future Options, Ornstein-Uhlenbeck Process, Regime-Switching

Introduction

Carr and Madan (1998) pioneered the use of FFT to value a European call option where the underlying asset follows a geometric Brownian motion (GBM). As GBM processes are log normally distributed, they have found the characteristic function of the underlying asset price process analytically. Liu et al. (2006) describe how one can price, very fast and efficiently, European call options where the underlying asset price is governed by a regime-switching GBM using the theory of characteristic functions and FFT. Therefore, the difference between Liu et al. (2006)’s work and Carr and Madan (1998)’s work is that the underlying asset is governed by a regime-switching model in Liu et al. (2006). The regime-switching model is interesting because financial markets often change abruptly. The regime-switching models can match these sudden behaviors. Liu et al. (2006) have developed a solid understanding of the current frameworks for pricing European call options using FFT for regime-switching GBM. The basic idea of regime-switching models is that one set of model parameters is in force at a time depending on the state of the underlying state process at that time. A Markov chain usually describes the state process.

The FFT method is particularly interesting when closed-form solutions for option pricing don’t exist for complex stochastic processes. One of the main features of the FFT method is that one only needs to find the characteristic function of the underlying asset price analytically. This can be considered both an advantage and disadvantage of the FFT method. It’s an advantage since if one wants to switch to another model, only the corresponding characteristic functions needs to be changed and the actual pricing algorithm remains untouched (See Schoutens (2008)). One can also say this only can be applied to the problems for which the characteristic functions of the dynamics of the underlying asset can be obtained analytically. Luckily, it has been recognized that most of the models in literature meet this requirement (See Liu et al. (2006)).

In this article, we wish to find the price of European commodity and futures options where the logarithm of the underlying commodity spot price follows a regime-switching Ornstein-Uhlenbeck model (See Schwartz (1997)). In the proposed model by Schwartz (1998) $\theta$ and $\sigma$ are constant, which seems restrictive. The main feature of our model is that model parameters, the mean-reverting level $\theta$ and the volatility $\sigma$ of the logarithmic commodity spot price, are governed by an observable continuous-time, finite-state, Markov chain. We then discuss the valuation of commodity options and then the valuation of commodity futures options using inverse Fourier transform. In the final section, we provide concluding remarks. All proofs in this article are standard and involve the use of standard mathematical techniques.

The Markovian Regime-switching Ornstein-Uhlenbeck Model

In this section, we consider a RSOU model for the logarithm of the commodity spot price process. We suppose that both the mean-reversion level $\theta$ and the volatility $\sigma$ of the logarithm of the commodity spot price switch over time according to a continuous-time, finite-state Markov chain. We consider our model with a finite time horizon $\tau = [0, T^*]$, where $T^* < \infty$. Let $(\Omega, \mathcal{F}, \mathcal{P})$ be a complete
probability space to be able to describe all uncertainties in the economy, where $\mathcal{P}$ is the real-world probability measure.

Let $X = \{X(t) | t \in \tau\}$ be an observable continuous-time, finite-state Markov chain on $(\Omega, \mathcal{F}, \mathcal{P})$ with state space $\varepsilon = \{e_1, e_2, ..., e_N\}$, where $e_i$ is the unit vector in $\mathbb{R}^N$ with one in the $i$-th position and zero elsewhere. In particular, there could be just two states for $X$, say $X(t) = (1,0)^T$ and $X(t) = (0,1)^T$ for any $t \in \tau$, where $(1,0)^T$ denotes the transpose of $(1,0)$. State 1 and State 2 represent a "good" economy and a "bad" one, respectively. The set $\varepsilon$ is called the canonical state space of $X$.

Elliott and Mamon (2002) in appendix B, with respect to the filtration generated by $\mathcal{F}_t$, provides the following Martingale representation for the chain $X$

$$X(t) = X(0) + \int_0^t A X(u) du + M(t), \quad t \in \tau \quad (1)$$

where $A = [a_{ij}]_{N \times N}$ is a constant rate matrix of the chain $X$ and $(M(t) | t \in \tau)$ is a $\mathbb{R}^N$-valued Martingale with respect to the filtration generated by $X$ under $\mathcal{P}$. The element $a_{ij}$ in $A$ is the constant intensity of the transition of the chain $X$ from state $e_j$ to state $e_i$. The main model feature is mean reversion in commodity prices, indeed mean reversion toward a regime-Switching mean level. All future trajectories of $X$ is assumed to follow the following stochastic differential equation

$$dx(t) = \beta(\theta(t) - x(t))dt + \sigma(t)dW(t) \quad (2)$$

where $W(t)$ is a Wiener process under the risk-neutral probability measure. $\theta(t)$ is the long term mean level. All future trajectories of $x(t)$ will evolve around a mean level $\theta(t)$ in the long run; and let $\beta$ be the parameter controlling the speed of mean reversion for the logarithmic commodity price process, with $\beta > 0$. The instantaneous volatility of the model is $\sigma(t)$. It measures instant by instant the amplitude of randomness entering the system. The solution to the stochastic differential equation (2) is given by the following equation:

$$x(T) = e^{-\beta(T-t)}x(t) + \beta \int_t^T \theta(u)e^{-\beta(T-u)}du + \int_t^T \sigma(u)e^{-\beta(T-u)}dW(u) \quad (3)$$

### Commodity and futures options using FFT scheme

In this section, we determine the price of European commodity and futures options where the logarithmic commodity spot price process is governed by a RSOU. We are going to use the same notation as used in Fan et al. (2015). The difference between our paper and Fan et al. (2015) is that the commodity spot price process $\{S(t) | t \in \tau\}$ and the convenience yield process $\{\delta(t) | t \in \tau\}$ they used follows a Markovian regime-switching Gibson-Schwartz two factor (MRSGS) model. Therefore, in their model, the commodity spot price process follows a regime-switching GBM. However, as we have mentioned earlier, evidence from the stock market shows that the commodity spot price process fits a mean-reverting model better. Therefore, that is why we think it is worthwhile to try with Ornstein-Uhlenbeck model. As we have a different model for the commodity spot price process, hence the expressions of the characteristic functions and the option prices presented here are not exactly the same as those in Fan et al. (2015).

However, the mathematical techniques and proofs are similar to those in Shen and Siu (2013), Kuen Siu (2010), Liu et al. (2006), Fan et al. (2015) and Fan et al. (2016).

**Option pricing via risk-neutral expectation**

Consider a European commodity option written on commodity spot prices $S(t)$ with strike price $K > 0$ and maturity time $0 < T < T^\ast$. By the risk-neutral valuation principle for probability measure $\mathcal{P}$, the European commodity option price at time 0 is given by

$$C(0,T) = \mathbb{E}[e^{-rT}(S(T) - K)^+]] \quad (4)$$

where $\mathbb{E}$ is the expectation with respect to the risk-neutral probability measure $\mathcal{P}$. Following the notation in Liu et al. (2006), the dampened commodity option price is given by

$$c(\kappa) = e^{\alpha \kappa}C(0,T) \quad (5)$$

where $\kappa = \ln(K)$ and $\alpha$ is called the dampening coefficient and assumed to be positive for call options and negative for put options to obtain a square integrable function. Let’s denote the price of a futures contract at time 0 with maturity time $T$ is given by

$$F(0,T) = \mathbb{E}[S(T)] \quad (6)$$
Now let’s consider a European futures option written on futures contracts \( F(T, U) \), where \( F(T, U) \) represents the futures price with maturity time \( T < U < T' \) at time \( T \), with strike price \( K_f \) and maturity time \( U \). Then, the price of the European futures option at time 0 is given by

\[
C_f(0, T, U) = E[e^{-rT}(F(T, U) - K_f)^+] \tag{7}
\]

As seen before, the dampened futures options price is given by:

\[
c_f(\kappa_f) = e^{\kappa_f}C_f(0, T, U) \tag{8}
\]

where \( \kappa_f = \ln(K_f) \). We will derive an explicit formula for the Fourier transform of \( c(\kappa) \) and \( c_f(\kappa_f) \) in the next subsection. Let \( \mathcal{F}_T \) be the \( \sigma \)-algebra generated by \( \{X(t), t \in \tau\} \), that is, \( \mathcal{F}_T = \sigma\{F^X(t), t \in \tau\} \). Let \( f_{x(t)}(x) \) be the conditional density function of \( x(T) \) given \( \mathcal{F}_T \).

**Fourier transform of the option price**

We derive an explicit formula for the Fourier transform of \( c(\kappa) \). The price of the commodity option under a regime-switching Ornstein-Uhlenbeck model is given by

\[
\hat{c}(u) = \frac{\exp(-rt+i\theta e^{-\beta T}x(0))\Phi(\tau, \theta)x(0), 1)}{(\alpha-iu)(1+\alpha-iu)} - (u + i(1+ \alpha)). \tag{9}
\]

Then, with the similar methodology, the dampened commodity futures option Fourier transform is derived to be

\[
\hat{c}_f(u) = \frac{e^{-rT}z(x(T), \theta)\Phi(\tau, \theta)x(0), 3)}{(\alpha-iu)(1+\alpha-iu)}, \quad \theta = (u + i(1+ \alpha)). \tag{10}
\]

**Conclusions**

In this article, we discussed the valuation of European commodity and futures options in a regime-switching Ornstein-Uhlenbeck model. The model parameters were assumed to be modulated by an observable, finite-state Markov chain, whose states represent the states of an economy. The main feature of our study is that our model parameters are under the regime-switching effect, i.e., the structural changes of economy could be incorporated in the model.

We may extend our work to investigate the pricing of European-style commodity options and futures options with a regime-switching Hull-White stochastic interest rate model. The parameters of this model, including the mean-reversion level, the volatility of the stochastic interest rate, and the volatility of the commodity spot price are modulated by an observable, continuous-time, finite-state Markov chain. We may also further our work to investigate the valuation of American-style options under a regime-switching Ornstein-Uhlenbeck model, since as we know, most of the commodity options traded in NYMEX/CME are American-style options.

**References**


American Indian Economic Development: A Primer

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Abstract — Economic Development is at the cornerstone of indigenous peoples’ claims to self-determination. Over the past four decades, Native American nations within the US have experienced significant growth in terms of their development efforts. And while the long-term effects are yet to be truly measured, studies indicate socio-economic gains for Indiana nations as well as local, state, and federal economies. At the same time, many tribes continue to confront serious issues of poverty and in social consequences. Thus an overarching question is why the variation in the levels and rates of economic growth. The paper explores the many dimensions affecting tribal economies, from politics to socio-economic and cultural norms to various legal constraints facing tribal economic development efforts. Similarly, it offers insights on key aspects between Indian economic development, while highlighting linkages between policy supporting self-determination for Native people and improved economic conditions.

Keywords — Economic Development, American Indians, Self-Determination

Introduction

American Indian societies are phenomenally resilient. In the last several centuries, they have faced winds of economic, political, and cultural change that have blown as fiercely over them as over any people in history. These winds have brought military violence and subjugation, epidemics of disease, seizures of land and property, vicious racism, and economic deprivation. Yet hundreds of distinct Indian nations built upon dozens of cultural lineages still persevere and grow, variously bound together by ties of family, language, history, and culture. The lesson from Indian Country is a lesson of strength. This strength is still being tested. Among the most formidable challenges facing native peoples today are those rooted in economic conditions. American Indians living on the nation’s nearly 300 reservations are among the poorest people in the United States. On most reservations, sustained economic development has yet to make a significant dent in a long history of poverty and powerlessness. Despite the many federal programs and the large sums of federal and philanthropic money that have been used over the years, many Indian reservations continue to experience extremely high unemployment rates; high dependency on welfare, government jobs, and other transfer payments; discouraging social problems; and an almost complete absence of sustainable, productive economic activity. At the same time, some reservations have made significant progress.

Creating and Sustaining Tribal Economic Development

Few of the Indian reservations in the United States have functioning economies in which residents can be employed, cash checks, and spend money within the community. This situation means reservation residents have to travel to distant cities to find banks and businesses where they can engage in commerce. A Navajo tribal official estimated that $0.80 of every dollar Navajos received immediately left the reservation, and other studies demonstrate the same problem for other reservations (Jorgenson, 2007). This outflow benefits state economies but impoverishes reservations.

The lack of economic development on reservations is a major factor in creating the extreme poverty, unemployment, and the accompanying social issues that Indian nations face. Tribal governments can help solve this problem by increasing the number of privately and tribally owned businesses on reservations (Dippel, 2014). This outflow benefits state economies but impoverishes reservations.

Tribal governments also need to provide the laws, regulations, and independent court systems that will assist and protect business and property rights; no one, whether tribal citizen or a non-Indian, will locate their business and risk their time and money on a reservation where the odds against being successful are too high (Frye & Parker, 2016). In short, Indian nations must make reservations fair and reasonable locations for businesses to locate if they expect to attract investment and build economies.

Reservation economies rapidly lose the money that residents receive because of the absence of small businesses where people can spend their cash on needed goods and services.
This leads to the loss of an enormous amount of economic activity and employment for Indian country. Ideally, money should circulate about six times within a community, city, or county before it “leaks” away (Dippel, 2014). The only solution to this problem for reservations seems to be for Indian governments to help develop and locate a substantial number of privately owned and tribally owned businesses in their communities.

The importance of having a critical mass of small businesses on reservations is demonstrated by various economic principles. First, every reservation resident has a certain level of disposable income—even the poorest person has some money to spend. If reservation residents had the ability to spend their income at businesses located on their reservations, and that in turn created more reservation-based businesses and jobs, that would create an enormous benefit to the reservation economy.

The second relevant principle is called the “multiplier effect.” This term defines the situation where every dollar that is spent by one person ends up as profit and salary in the hands of another person, whether it is the business owner or an employee of that business. This new person will then also spend that one dollar and pass it on to additional people who will also spend it. In this fashion, one dollar reverberates throughout an economy and becomes pay, profit, and spending money for a greater number of people as long as the dollar stays within the local economy (Anderson et al., 2006).

For a reservation community to benefit from the multiplier effect and to keep dollars circulating through its economy it must create and sustain opportunities for reservation residents and visitors to purchase their needed and discretionary goods and services at reservation-based businesses. The only way to keep dollars on reservations and moving between businesses, employees, and consumers is if there are numerous businesses offering a variety of goods and services.

Governments can play a crucial role in developing free-market economic systems by protecting the public interest, ensuring fair competition, maintaining law and order, and creating laws and judicial systems that help enforce contracts and property rights (Anderson et al., 2006; Jorgenson, 2007). The stability provided by government encourages people to work to create and acquire economic rights and to risk their investments within the jurisdiction of those governments.

Most tribal governments have not yet enacted the kinds of business codes and uniform commercial codes that businesses and banks need before they can locate and operate profitably on reservations. Tribal governments can and should encourage businesses to locate on reservations by adopting such laws and creating stable and fair judiciaries and bureaucracies. Tribal policy makers could also consider enacting “Buy Indian” acts, which encourage the tribal government to patronize tribal-owned businesses. Such acts might direct the expenditure of a certain percentage of tribal revenues, casino revenues for example, on private businesses owned by tribal citizens.

Finally, tribes should consider enacting constitutional or statutory provisions that mimic the United States’ constitutional provision that forbids states from impairing the obligation of contracts. In the past, some tribes have altered the contractual rights of private parties to the great detriment of investment and business operation in all of Indian country. These positive constitutional and statutory mandates would help encourage and support the creation and operation of more privately owned businesses on reservations and assist in creating real economies. In addition, tribes can use taxation and regulatory strategies to attract private investments and new businesses, similar to how states and counties entice new businesses.

Tribal nations can work to remedy some of the reasons for the abysmal rate of private business ownership among Indians. Most private businesses in the United States, for example, are started using family money, bank loans, or by borrowing money against home equity. Most American Indians lack access to these avenues due to dismal poverty and unemployment rates, and rarely have home equity due to the near absence of mortgage home ownership in Indian country and a nearly non-existent housing market on most reservations (Anderson et al., 2006). Consequently, seed money provided by tribal, private, or federal loan funds is crucial to alleviate this funding problem. Several Indian nations are well aware of this situation and are offering their tribal citizens business start-up loans.

American Indian governments must do everything they can to develop the entrepreneurial spirit in reservation residents and to ensure that more businesses are located in Indian country. Such businesses will provide jobs and economic activity that will stimulate the development of even more businesses and more economic activity. Once there are a sufficient number of tribal and privately owned businesses operating on a
reservations, a functioning economy can develop from the effects of money circulating and re-circulating between reservation consumers and businesses, employees and owners (Frye & Parker, 2016). This is a laudable goal. A functioning economy will help native communities create employment, adequate housing, and the needed infrastructure to help escape poverty and to begin to restore their historic communities that were once prosperous, healthy, vibrant societies sustained over thousands of years.

**Conclusions**

While some tribes have experienced a marked change in their socio-economic status in the last few decades, others continue to face exceedingly high rates of poverty and unemployment. Research and experience of tribes support the conclusion that much of tribal economic development depends on a tribe’s sovereignty over such things as resources, regulatory standards, taxation, and the like. Put another way, sustainable economic development is closely linked to tribal self-determination. Despite Federal policy, initiative, and intent, little progress has been made on a national level to assist Native people with meaningful and sustainable economic development.

**Acknowledgements**

The author wishes to recognize the economic development and policy staff with the Lumbee Tribe for North Carolina, the Coharie Tribe, the Haliwa-Saponi, and the Eastern Band of the Cherokee for their invaluable contributions to this work. “Aho Mitakuye Oyasin” – Lakota saying.

**References**


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Queer Abstraction in Contemporary Art

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Abstract - My book project examines the phenomenon of “queer abstraction” that has gained significant critical attention in the field of contemporary art in recent years, as abstraction is increasingly used by artists invested in issues of gender, sexuality, and race. When considering abstraction in the work of minority artists, previous studies read abstract form as the closeted representation of a marginalized body or life. Departing from art historical scholarship that uses queer to define identity, my work aligns with queer theoretical conceptions of what queering can do as an active verb. My book argues that contemporary abstraction queers by recasting the formal language of modernism (such as geometric abstraction, the grid, or the monochrome), demonstrating the affective, sensual, and political queer possibilities therein. My method combines traditional art historical formalism with a queer theoretical approach to offer new models for understanding the queer politics of abstraction in contemporary art.

Keywords – queer abstraction, queer theory, contemporary art, abstract art

Introduction

Abstraction has drawn significant critical attention and scholarly interest in recent years because of its deployment by artists engaged with politics of gender, sexuality, and race. How and why could abstract art—with all of its presumed universalizing and neutralizing tendencies—be politically useful now? My book investigates the recent phenomenon of queer abstraction, a term generally used to describe queer art practices that use abstraction as a tool of resistance against gender and sexuality norms (Doyle & Getsy, 2014; Getsy, 2019). Queer abstraction may seem to be a contradiction in terms, since direct representation and visibility have been central to queer politics and the ongoing battle for LGBTQ rights and recognition in the public sphere. We have come to expect queer art to include overt images of queer bodies, communities, and erotics. When politically driven queer artists use abstraction, their work vexes the foundational understanding of how something called “queer” should look and what we think queering does socially and politically. While “queer” is typically used as a noun or adjective to describe non-normative sexual identity, it is also used as a verb in queer theory to indicate an active challenge to norms of gender and sex. Art historians tend to interpret art as queer when it represents gay or lesbian subject matter, rather than ask how the artwork queers by challenging the stability of representation itself.

Queer abstraction does not have a singular definition or agreed-on “style”; rather, this contested terrain is marked by active tensions between multiple aesthetic and interpretative possibilities. Although abstraction is one way for artists marked as “minor” or nonnormative to avoid the surveillance that accompanies the demands of visibility, there is also a tendency to interpret abstraction in the work of queer artists as a metaphorical closet (a method of hiding nonnormative gender and sexual orientations), particularly when earlier historical conditions seemed to demand it (Katz, 1999, 2011). Abstract form is thought to represent a coded bodily reference (a breast here, a phallus there), and this interpretative model reduces abstraction to a signifying content to demonstrate its queerness (Ledesma, 2019). My book alternatively explores what abstraction can do in excess of reference, shifting attention to this work’s radical formal and material operations and considering how they might resonate socially and politically.

In our current political climate, the stakes of queer visibility are felt acutely in the rising public recognition of violence against queer and trans people, particularly trans women of color. The growing number of murdered women each year, and the frequent refusal of news media to acknowledge the queer and/or trans identities of these women, also points to the limits of visibility politics in the public sphere. But abstraction is not merely a move to safety by closeting. Queer abstraction constitutes a refusal of normative signifying surfaces that have served as a target for anti-queer and trans violence, and at the same time an exploration of what it might do to materialize difference in unexpected ways. By taking abstraction seriously as nonrepresentational and even antirepresentational, my book produces a deeper and more nuanced understanding of how queering operates beyond bodily legibility, along
with richer interpretative models for analyzing the politics of abstraction. These models aim to address the following questions: Why is abstraction useful for queer-feminist politics? How can abstraction address difference in its refusal of bodily legibility? Furthermore, how can formalism—a traditional, seemingly conservative art historical methodology—also serve queer feminist methods?

I argue that abstraction queers through visual and material tactics that defy legibility—abstraction does queer work by refusing direct representation and this is precisely why it is politically relevant for minority artists. My project also traces a queer legacy of modernist form in contemporary art. The artworks central to my project appropriate iconic forms of modernist abstraction, compelling my reinvestigation of these strategies. Exploring how queer abstraction recasts its own art historical legacy, I demonstrate that this current movement reanimates a central tenet of modernism: that form performs and does so historically and politically. Accordingly, I show how abstracting constitutes a process of queering in this work. Each chapter of my book offers a comparative analysis of a particular visual form in the work of a politically-engaged contemporary artist and in the work of modernist artists they are reciting. My analysis shows how the current appropriation of these forms through contemporary queer abstraction alters our understanding of modernism as well as our conceptions of political art, demonstrating the capacities of visual form and media to address queer movements today (most notably by challenging a signifying logic). The following summary of my first chapter illustrates my argument and approach.

Chapter 1: Hard Edges, Queer-Feminist Edging

Ulrike Müller’s small enamel paintings on steel recite familiar elements of modernist painting: hard-edged geometric forms in a craft-based medium that also creates slick, swelling surfaces (Fig. 1). Even as Müller’s objects are taken as a queering of modernist forms (and it certainly is not new to argue that contemporary art recites modernism), this work has been interpreted as “figurative geometry,” merely an abstraction of representation that refers to bodies (Collezione, 2017; D’Souza, 2012). I suggest, instead, that these objects do queer-feminist work precisely by camping or appropriating the loaded visual language of the hard edge; a form that can at once divide or mark and insist on a margin that edges away and opens up to indeterminacy.

These works reanimate a history of geometric abstraction in ways that queerly destabilize processes of signification and yet still speak to the kinds of affiliations on which queer political life depends. Rendered in an aesthetic language that evokes avant-garde geometries and hard-edge abstract painting, how might Ulrike Müller’s objects posit a queer-feminist challenge to the sign, along with readings that attempt to de-code certain forms as legible signifiers of difference? Rather than an outdated utopian aesthetic strategy, geometry’s importance for modernist critiques of representational, pictorial convention is still useful for queer challenges to processes of signification, undermining an iconographic logic by which form is solidified into a bodily sign. If the danger of this iconographic logic is unclear, think of the pink triangle once used during the Holocaust as a sign of stigma to mark gay men for death. A symbol used to mark a subject as an abstraction can do harm, but it has also been redeployed in the service of queer politics by ACT UP, to hold onto that harm while also converting its power for collective action (Fig. 2). My point is that queer abstraction is ambivalent in that it holds onto the difficulty of the forms it redeployes, while re-imagining them in service of alternative futures (Muñoz, 2009). This example demonstrates the political stakes of abstraction, which is never really a neutral or transcendental gesture.

The hard edge has historically worked as an essential design element in early twentieth-century art: the line was both a primary means of mark-making and an industrial, democratic aesthetic strategy. Seemingly neutral and objective, the hardened borders of geometric form could speak to modern forms of social organization, uniting craft with industrial design (in the work of Bauhaus artists, for example) (Blazwick, 2015, pp. 15-19). The hard-edge geometric painting and sculpture of the 1960s were similarly preoccupied with the mechanical and seemingly impersonal manufacture of objects, the systematic structuring of space, clean lines and surfaces that were undisrupted by expressive mark-making (Alloway, 1960). Müller’s craft-based practice and geometric compositions draw in part on Bauhaus aesthetics: crisp lines and stark geometric shapes that interact to produce abstract designs. Müller’s enamels recall the enamel “constructions” of László Moholy-Nagy. Their compositions are quite different: the colors and curves of Müller’s are distinct from the straight lines and primary color palette of Moholy-Nagy’s. And yet, they share a similar scale and surface facture, and playful tensions between the handmade and mechanical. In 1923, Moholy-Nagy exhibited a series of five enamel pictures on steel
that were manufactured by a porcelain-enamel sign factory (Fig. 3). Moholy-Nagy described his vision of painting according to “objective standards” achieved through “neutral geometric forms” (Doherty, 2009, p. 130). This removal of the artist’s hand from the facture of the work was achieved through an impersonal production process: Moholy-Nagy claimed to have ordered his compositions by telephone from a sign factory, dictating his compositions using readymade coordinate systems. Pursuing these objective standards to exceed the human was also an effort to produce a universally communicable art: the idea of an image as transferable data rendered accessible through the democratic promise of modern technology. In a conceptual performance of the artist as generator of ideas rather than craftsperson, Moholy-Nagy’s radical move to exhibit these industrial products-as-paintings distanced the work from the artist’s subjectivity in both their production and their abstraction.

Three of Moholy-Nagy’s enamel works share the same simple composition of straight lines and primary colors: the lines are oriented vertically and horizontally, so that it is apparent they were composed on a standard grid, their colors selected from the company’s chart. This standardized, mechanical production and appearance aimed to make art more utilitarian, in line with modern life. The precision of this work is presumably the opposite of ornament; straight lines, no decorative excess, no expressive marks. Müller’s enamel objects take on a similar surface facture, but their seemingly “objective” medium or “neutral” lines are rendered through an emphatically hand-crafted process. Rather than the industrial porcelain enamel applied uniformly across the surface by machine, the vitreous enamel of Müller’s objects is sifted across the surface by hand, producing varying thicknesses and degrees of imprecision (they blur at the edges). Rather than the coded logic of color charts and standard grids used to dictate a composition, Müller’s compositions are more playful. They utilize the hard line differently, producing an interplay between straight and curved edges.

In one example from the series Franza (2010) (Fig. 4), a thick vertical red line appears to bisect a field of monochrome beige, and yet it curves down to the left at the bottom of the composition, the “ground” giving way to a triangular area of white fanning out at the base of the support. While it may at first seem that the neutral monochrome beige color produces the ground against which the “figure” of the red line emerges, this curvature confuses that relationship. If the white seems to emerge as if from behind curtains, its lack of distinction from the beige, the edge between them produced by the fusion of enamel, further confuses figure and ground. In Moholy-Nagy’s work, figure-ground relations are not complicated—it appears as if the black, red, and yellow lines are set as figures against the larger white field. Müller’s works are more ambiguous. The edges of their forms fuse together, so that even in the boundary between colors that distinguish shapes, the line is deployed as both a visual division and also a material contact and connection. This produces a sharp boundary that is nevertheless melding, a uniform material surface that is nevertheless inconsistent.

Lifting off from the strict vertical-horizontal orientation of Moholy-Nagy’s work, Müller’s use of line often diverges in multiple directions, suggesting breaks as well as continuities. Their lines create both sharp divisions and slippery curves, they merge and conjoin and depart in arcs that suggest intimate touch, a bristling or brushing up against. They suggest a multiplicity, both in their near (but not exactly) symmetrical compositions, and in the mirroring that occurs within as well as beyond their surfaces: the shining reflective surface of colored glass literally creates a mirror onto the viewer’s space. But their surfaces are never really flat, they undulate and ripple so they may reflect light and shadow but never a duplicate picture. That rippling surface also creates a sense of depth, even as these are thin, flat objects. Their surfaces seem to be at once hardened dry and still liquid, a protective coating and a fragile glassy substance. That material ambiguity, along with the play between sharp cuts and arced lines, refuses the precision of a Bauhaus construction or an industrial product, insisting on a more intimate spectatorship. At the same time, they gesture to this modernist work by showing the expressive potential of even the most mechanical aesthetic—but that refusal of singular authorial mastery or intention remains useful for rejecting the burden of self-representation so often placed on minority artists.

Conclusions

Overall, my book pushes our use of “queer” (within art historical discourses) beyond the representational content or the context of the artist’s life. My book makes a significant methodological intervention in combining traditional art historical formalism with queer theory. While formalism is normally taken to be an outdated, universalizing or necessarily conservative art historical methodology that excludes the external factors contributing to the work, I demonstrate that formalism can actually contribute
to queer theoretical methods by exploring what these formal visual techniques do rather than what they might signify. My book shows how traditional methods of formal analysis that consider the facture and material condition of artworks resonate in illuminating ways with queer theoretical concerns, such as the “over-the-top” aesthetics of camp or the affective (emotional) capacities of materials that invite more intimate forms of spectatorship by suggesting or producing a sensory experience.

Acknowledgements

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References


Figures

Figure 1. Ulrike Müller, *Bauhaus Boat*, 2014

Figure 2. ACT UP, *Silence=Death*, 1986

Figure 3. László Moholy-Nagy, *EM 1; EM 2; EM 3 (Telephone Pictures)*, 1923

Figure 4. Ulrike Müller, *Franza*, 2010
Assessing Transgender and Non-Binary Microaggressions
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Abstract — Transgender microaggressions are generally subtle, often unconscious and unintentional forms of behavior that communicate derogatory messages to transgender or non-binary individuals (TNB). Using a qualitative analysis, Nadal, Skolnik, and Wong (2012) created a taxonomy of microaggression themes that apply to transgender individuals. The purpose of this project was to replicate and extend Nadal et al.’s (2012) analysis by assessing whether TNB individuals recruited from online transgender-focused communities experience the behavior described in the study. Specifically, the purpose of this study was to assess how these individuals experienced each theme and how the behavior affected them. We found that the new themes presented by Nadal et al. (2012) were experienced at a greater than or equal rate to the previously identified themes in Nadal et al. (2012) and that they had equal or greater negative emotional impact. Results show that familial microaggressions are the most common form and have the most negative impact. Future studies should be vigilant with creating examples that don’t create bias and selecting a more varied sample.

Keywords — Transgender, Non-Binary, LGBTQ+, Microaggression

Introduction

Transgender and non-binary individuals (TNB) are persons who identify differently from their gender assigned at birth or who identify outside of the gender binary of male and female. Microaggressions are generally subtle, often unconscious and unintentional forms of behavior that communicate derogatory messages, and transgender microaggressions specifically targeted at TNB individuals. Research that has investigated transgender microaggressions has often considered them in the context of lesbian, gay, bisexual, transgender, and queer/questioning (LGBTQ+) individuals and although these microaggressions are often not recognized by the perpetrator and in fact may be viewed as innocuous, research looking at microaggressions directed toward LGBTQ+ individuals suggests that they do have a significant impact on the emotional health of the recipient in domains such as the work place, friendship relationships, and college experiences (Kulick et al. 2017).

Nadal, Skolnik, and Wong (2012) presented a taxonomy of themes of transgender microaggressions, based on previous research (e.g., Capodilupo et al. 2010) and asked transgender individuals in two focus groups (nine in one, six in the other) to discuss their experiences as transgender individuals. Based on these discussions, Nadal et al. (2012) confirmed eight of the previously identified themes and identified four new themes that would be unique to transgender individuals and some examples of these themes. One of the issues surrounding the concept of microaggressions is how to determine if they actually exist. Often when a person makes a statement, there are not only the actual words said, there is the assumed underlying message. The concept of microaggressions comes in when we try to figure out what the underlying message is. If a person is the one doing the communicating, they may think they had the best of intentions, whereas, the one on the receiving end of the statement might feel as if a slight has occurred. From the receiver's perspective, it appears as if there are two criteria that could be used to determine if a new theme is, in fact, a microaggression. First, the new-theme behaviors have to be experienced by a large number of participants (i.e., have an equal or higher prevalence than the previously identified themes) and second, they have to have a negative impact on participants (i.e., have an equal or greater negative emotional impact than the previously identified themes). The purpose of the current research was first, to determine if Nadal et al.’s (2012) new themes empirically met the two criteria for being a microaggression (it was hypothesized that they would do so), and second to use a transgender/non-binary population to assess the impact of the presented microaggression behaviors. Previous research has often not made a distinction between sexual orientation and gender orientation, combining these two groups as LGBTQ+ participants. Finally, we wanted to assess our participants’ reactions to the microaggression theme behaviors.

Method

In constructing our Transgender Microaggression Questionnaire (TMQ-TNB Version), we selected our example behaviors to go along with the themes in one of two ways. First, we
used examples presented in Nadal et al.’s (2012) article for themes 1, 2, and 6. However, because we felt all examples identified in Nadal et al. (2012) were not completely applicable, we introduced our own examples for the other seven themes. We also decided not to include two themes in our questionnaire: “Denial of Individual Transphobia” as we found it difficult to define and “Environmental Microaggressions” considering the state of the current political climate and current legislation on a national and state level. Therefore, our final questionnaire was comprised of ten themes of microaggressions toward transgender individuals, seven that were previously identified with other taxonomies of microaggressions: Themes 1-7; and three that were new themes suggested by Nadal et al. (2012): Themes 8-10 (see Figure 1). Participants (N = 55; 53% trans-female; 18% trans-male, 29% non-binary) from online transgender-focused communities completed a questionnaire that included a definition and example of ten themes of transgender microaggressions and were asked to identify if they had experienced each one, and if yes, using modified 5-point Likert scales, evaluated how insulting (1 = Not Insulting, 5 = Very Insulting), easy it was to shrug off (1 = Easily, 5 = Not at all Easily), and how much it undermined their confidence (1 = Not at all, 5 = Heavily).

Results
Results indicated that 98% of our participants had experienced at least one of the microaggressions. The hypothesis was supported. As can be seen in Figure 2, the average percent of participants who said they had experienced one of the previously identified microaggressions (themes 1-7) was 52%, compared to 65% for the new types of microaggressions (themes 8-10) and the frequencies of occurrences of the individual new theme behaviors were equal to or greater than the previously identified themes.

Conclusions
This is the first research that has measured the frequency of occurrence of transgender microaggressions by a TNB population and simultaneously measured the impact of those microaggressions. Our results supported our hypotheses that these new themes would have equal or higher prevalence than the previously identified themes and that they would have an equal or greater negative emotional impact. We were also able to assess the general negative emotional impact of these microaggressions and found plenty of surprising and interesting results. Most notably, familial microaggressions had the highest rate of experience as well as being the highest rated on negative emotional impact. Studies have emphasized the importance of familial support for LGBTQ+ individuals (McConnell et al., 2016). Thus, this finding that familial microaggressions were both the most encountered and most negatively impactful, makes it very important that families become aware of potential microaggression use. While the use of transphobic terminology was not significantly high in negative emotional impact, the rate of experience was immensely common. This shows that use of this transphobic terminology is common and is something that everyone, especially for those who have relationships or encounter LGBTQ+ individuals, should be made aware of and work on removing this terminology from use. As this is, to our knowledge, the first research to measure the frequency and impact of microaggression on TNB individuals, there were plenty of limitations to our study. First, creating and finding clear and easily understood examples of microaggression themes was difficult. Along with this, it was difficult to create examples that would not prompt an implicit emotional response. For example, Theme 2’s example stating that “all transgender people are prostitutes” could potentially skew ratings to more insulting. Second, the demographics of our sample were most likely very similar, as they were all recruited from very similar sources. Finally, our sample had a significant percent of trans-female responders and a lower percent of trans-male responses. Future research should recruit a broader sample of responders from various and different sources. In the future, researchers should be vigilant about providing examples that would not prompt an undue emotional reaction.

References
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bisexual, and transgender youth. The Journal of Adolescent Health: Official Publication of The Society For Adolescent Medicine, 59(6), 674-680.


Figures

| THEME 1: Transphobic or Incorrectly Gendered Terminology—“Oh, so you’re a shemale?” |
| THEME 2: Assumption of Universal Transgender Experience —“It’s just that usually transgender people are prostitutes.” |
| THEME 3: Exoticization—“OMG, I always wanted a transgender friend!” |
| THEME 4: Discomfort Disapproval—“I’m just not comfortable being seen in public with a transgender person.” |
| THEME 5: Gender/Binary Norms—“I just think you being transgender makes you not suited to be a den mother for our cub scouts.” |
| THEME 6: Denial of the Existence of Transphobia —“It’s not because you’re transgender, I just don’t like sharing that stuff on social media” |
| THEME 7: Sexual Promiscuous—“Transgender people are always so sexual.” |
| THEME 8: Harassment—“Your shoulders are just too broad for a woman.” |
| THEME 9: Denial of Body Privacy—“Oh, you’re a transgender woman? Do you still have your penis?” |
| THEME 10: Familial—“No son of mine will wear a dress.” |

Figure 1. Taxonomy of ten themes of transgender microaggressions.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Total %</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transphobic Terminology</td>
<td>76%</td>
<td>3.57 (2.18)</td>
</tr>
<tr>
<td>Universal Experience</td>
<td>44%</td>
<td>4.17 (1.88)</td>
</tr>
<tr>
<td>Exoticization</td>
<td>40%</td>
<td>3.00 (2.00)</td>
</tr>
<tr>
<td>Discomfort Disapproval</td>
<td>58%</td>
<td>4.06 (2.33)</td>
</tr>
<tr>
<td>Gender Norms</td>
<td>58%</td>
<td>4.00 (1.94)</td>
</tr>
<tr>
<td>Denial of Transphobia</td>
<td>42%</td>
<td>4.13 (1.84)</td>
</tr>
<tr>
<td>Sexual</td>
<td>45%</td>
<td>4.08 (1.94)</td>
</tr>
<tr>
<td>1-7</td>
<td>52%</td>
<td>3.88 (2.16)</td>
</tr>
<tr>
<td>Harassment</td>
<td>45%</td>
<td>3.20 (2.28)</td>
</tr>
<tr>
<td>8</td>
<td>42</td>
<td>4.48 (1.65)</td>
</tr>
<tr>
<td>Denial of Body Privacy</td>
<td>73%</td>
<td>3.10 (2.28)</td>
</tr>
<tr>
<td>9</td>
<td>40</td>
<td>2.67 (2.41)</td>
</tr>
<tr>
<td>Familial</td>
<td>76%</td>
<td>3.14 (2.51)</td>
</tr>
<tr>
<td>10</td>
<td>107</td>
<td>2.09 (2.00)</td>
</tr>
</tbody>
</table>

The most frequently experienced themes are represented in green and the least frequently experienced theme are represented in blue.

Figure 2. Frequency and Percent for Experiencing Microaggressions and Mean (SD) for Impact. Figure 2 indicates that the new theme behaviors were viewed as just as insulting, difficult to shrug off, and harmful to confidence as the previously identified theme behaviors. The most frequently experienced themes were familial (76%; $M_{ave. impact} = 4.25, SD_{ave. impact} =1.95$) and transphobic and/or incorrectly gendered terminology (76%; $M_{ave. impact} = 3.27, SD_{ave. impact} =2.32$). The least frequently experienced was exoticization (40%; $M_{ave. impact} = 4.25, SD_{ave. impact} =1.95$).
Race, Gender, and Violence in 90s Rap-Metal Music

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Abstract — Rap-metal music, a genre popular during the 1990s, presents a case study in the intersection of race, gender, and sexuality in American cultural politics. When rap-metal artists Limp Bizkit, Korn, and Kid Rock gained popularity they sparked a moral panic similar to those that had erupted over earlier genres like heavy-metal and gangsta-rap. However, 1990s rap-metal bands pushed the boundaries of mainstream moral propriety by linking their music to the depictions of violence and sex in professional wrestling and hardcore pornography, and the violent acts during Limp Bizkit’s performance at the Woodstock ’99 festival provided a tragic commentary on this. In this paper I argue that there was more at stake in the debate over rap-metal in the 90s: through musical analysis I demonstrate that “Nookie” by Limp Bizkit depict a problematic power dynamic of white male entitlement and misogyny. Through musical genre analysis, this paper details how rap-metal bands appropriated a means of cultural protest developed by African American artists—hip-hop—and used it to construct a model of white male subjectivity that directed sonic violence towards female characters.

Keywords — rap, metal, heavy metal, music, limp bizkit

Introduction

American rap-metal artists like Korn and Limp Bizkit rose to national popularity in the late 1990s with a blend of heavy metal sounds and gangsta-rap lyrical flow. Not only did rap-metal represent a blending of traditionally black and white musical genres, it also sat at the intersection of the mainstream media, sports-entertainment, and the sex industry, as rap-metal songs became simultaneously ubiquitous on mainstream rock radio, professional wrestling, and in legions of strip clubs around the country. (Smith, p. 38; Daly, p. 32) As this amalgam of media outlets indicates, rap-metal music wasembroiled in representations of race, sex, and violence, tapping into fundamental tensions in American society. What I want to do in my time with you today is consider rap metal’s origins and then examine how one representative rap-metal song musically constructed a subject position that negotiated tensions of white male identity. At its most benign, the volume and aggressive timbres of rap-metal music provided a pressure valve to help alleviate adolescent anxieties surrounding race, gender, and sex. Yet it also had a malignant side, rife with homophobia, misogyny, and violence, that resolved straight, cis-gendered white male anxiety at the expense of anyone not in that category. By understanding that music does exert rhetorical force—and therefore is susceptible to discussions of ethics and morality—we can examine how the musical decisions made by artists like Limp Bizkit interacted with the web of power relations that imbue issues of identity in American life.

 Appropriation and Erasure of Blackness

True to its name, rap-metal music was a novel fusion of heavy metal and hip-hop, two genres that had both inspired moral-panic responses when they became popular in the mainstream media. The heavy metal genre originated in the industrial north of England in the late 1960s, growing out of the British blues-rock scene and tapping into the occult imagery and guitar heroics young British men found in African American blues music. Yet by the late 1980s the genre of heavy-metal and its cousin hard-rock had become so thoroughly identified with the white male demographic that black musicians found themselves squeezed out of the genre. (Mahon, pp. 146-7; Waksman, pp. 141-3)

Rap music originated in the predominantly working-class African American community of the Bronx, New York, in the 1970s. Initially associated with festive themes and block parties, by the early 1980s black artists had begun using the medium of rap music to comment on the economic blight facing working-class communities of color during the Regan era, as exemplified by Grandmaster Flash and the Furious Five’s 1982 song “The Message.” As hip-hop historian Murray Forman argues, this was an innovation that forever changed hip-hop, making the portrayal of reality and allegiance to one’s community or neighborhood signal elements of the genre. (Forman, p. 87) As the explosive growth of hip-hop spawned numerous sub-genres in the late 1980s, the one that arguably hewed the closest to this aesthetic of hood and realness was gangsta-rap, which originated amidst the working class African American neighborhoods of South Los Angeles. In songs such as “Fan Tha Police” by N.W.A., and “I’m Your Pusher” by Ice-T, gangsta-rap artists used the language of the street—offensive as it may have sounded to mainstream listeners—to protest problems such as racially biased policing, gun
violence, and the crack epidemic that were negatively affecting their communities. (Adler, Foote, & Sawhill) While the initial moral panic that erupted over gangsta-rap may have been overblown, recalling white America’s initial panic over jazz music and rock ‘n’ roll, the question of offensiveness is of particular centrality to the rap-metal genre. Michael Dyson, writing in 1991, argued that the “offensiveness” of rap music to mainstream white audiences was an aesthetic choice intended to critique the “...poverty, racism, sexism, classism, and violence...” in American society. (Dyson, p. 24) Feminist and intersectional scholars such as Kyra Gaunt have rightly problematized the use of sexist and homophobic language in hip-hop. (Gaunt, 2002) But for the purpose of this argument I need to place such language within the larger context of black social protest in the 1990s, a context that does not excuse the sexism and homophobia but, as scholar Robin Kelley argues, places it within the black linguistic folk tradition of badman or trickster narratives. (Kelley, p. 187)

This is a context that is entirely absent in the case of rap-metal artists of the later 1990s. The earliest rap-rock or rap-metal hybrids were collaborations between white metal or hardcore and black hip-hop artists, such as Run-D.M.C. and Aerosmith’s 1986 remake of “Walk This Way” or the Ice-T / Slayer song “Disorder” from the 1993 Judgment Night movie soundtrack. Yet when rap-metal came into its own, the almost exclusively white bands that became popular in the genre—such as Korn and Limp Bizkit—had taken over the rapping themselves and no longer collaborated with African American artists. And for these bands, the explicating context of racial protest politics did not exist. As New York Times writer R.J. Smith argued in a 2000 article, “...what white artists have taken from hip-hop is a towering sense of resentment. Rap today has a well of aggrievement, and when a black artist is sloppy about his rage, race relations have a way of focusing the issues for him... But when white kids start talking that talk, the rage often comes out inchoate... And the easiest targets get flayed the worst: women, of course, and gays.” (Smith, p. 38) White appropriation of African American cultural capital is of course a consistent subtext to the history of popular music (see also Ragtime, Jazz, and Rock ‘n’ Roll) but the offensiveness—the sexism and homophobia that rap-metal took from gangsta-rap—is especially problematic in light of the way that rap-metal songs used them to mediate sexual and gender anxiety for their predominantly white male audience.

**Rage Against the Feminine**

Many genres of youth culture are concerned with sexual attraction and gender identity formation in adolescence, and both of rap-metal’s precursor genres have a tendency to mediate these issues by creating worlds in which women and femininity are portrayed as dangerous and then symbolically contained. Robert Walser has argued that dealing with the “threat of women” has been one of the central themes of the heavy metal genre. (Walser, Running with the Devil: Power, Gender, and Madness in Heavy Metal Music, p. 110) Rap-metal artists put a novel twist on this strategy by using pornography as a topos to contain femininity in an exaggerated and male-centered caricature. Jonathan Davis of Korn went on record as being a supporter and collector of pornography, Kid Rock used starlets from porn production company Vivid Video in his music videos, and Fred Durst of Limp Bizkit appeared in the second of L.A. porn maverick Matt Zane’s Backstage Sluts movie franchise. (Dunn) With these two factors in mind—the appropriation of gangsta-rap’s misogyny without the mediating factor of racial protest, and the addition of a construction of female sexuality taken directly from heterosexual pornography—I want to consider the song “Nookie” by the band Limp Bizkit.

Limp Bizkit’s second album, Significant Other, debuted at #1 on the Billboard 200 album chart on June 22, 1999, dislodging the Backstreet Boys and selling 635,000 copies in its first week, largely on the strength of its lead single, “Nookie.” The song was an enormous radio hit, and it’s easy to hear why: it begins with a catchy, repetitive guitar hook, which quickly yields to a bombastic chorus (minus the vocals) before settling back down into a mellower verse. The rest of the song’s form relies on highly contrasting verse and chorus sections that are mapped onto alternating affective states by the vocals: the song’s overall topic is a male subject who has been hurt by an unfaithful lover, yet he ping-pongs between depressive self-pity during the verses and explosive, righteous anger during the choruses. Throughout, the lyrics remind the listener that both of these emotional states—abject and wrathful—are causally connected to the external feminine figure.

The song begins with a hip-hop drum sample and an ambiguous guitar riff, both at a relatively quiet dynamic, before exploding into what will turn out to be the chorus of the song, minus the vocals. Harmonically, both sections use the phrygian mode on F#, a mode that, as heavy metal scholar Robert Walser points out, creates an affect of claustrophobia or instability owing to its distinctive flattened second degree. (Walser, p. 47) The dynamic level then comes down again for the verse,
which is based upon the same hip-hop sample and looped guitar riff as the introduction. These two introductory sections set the template for the rest of the song, which is based on the dramatic tension between quiet, hip-hop inspired verse and loud, bombastic, heavy-metal chorus. During the song’s verses lead singer Fred Durst delivers lyrics that express pain and self pity; in the first verse, for example, he sings “I came into this world as a reject,” and later laments “I can’t believe I could be deceived.” The rhythmic groove of the verse is playfully polyrhythmic while maintaining empty space between the different instrumental parts—in short, it is using the kind of loop-based polyrhythmic construction common in hip-hop of the late 80s and early 90s, right down to its use of a sampled drum ostinato. Against that ostinato, the other musicians play at a relatively quiet dynamic: the bass plays in a higher than normal pitch register, and the guitarist typically associated with heavy metal music. All of this underscores the lyrics, delivered by rapper and front-man Fred Durst, that portray the character as a reject with a painful past, the proximate source of which is a girlfriend who was unfaithful and then left him. Durst uses a thin, brittle vocal timbre that is treated with a stereo chorus effect, which adds to the overall affect of destabilization or discomfort.

By contrast, the chorus features lyrics that express rage and vengefulness directed at the female object of the song, characterized by a sing-along chant of “stick it up your...”. The timbral space fills up with the entry of live drums, the descent of the bass guitar to its lowest pitch range, overwhelming guitar distortion, and the rapper’s switch to a louder and more aggressive vocal timbre. Rhythmically, the hip-hop polyrhythm of the verses is flattened to a strict two-four rock accent pattern. The guitar and bass reinforce the heavy-metal quality of this rhythm by playing an on-beat riff in unison with each other. Even the vocals support the straight on-beat rhythm by switching away from the playful off-beat phrasing of the verse to a string of straight, on-the-beat sixteenth- and eight-notes delivered in a gravelly shouting voice.

Conclusions

What I hope to communicate in this cursory analysis of “Nookie” is the problematic dynamics of race, gender, and violence that inhere at a sonic level in this rap-metal song. The sharp contrast between verse to chorus reads as an erasure of race. Whereas the sampled drums and polyrhythmic interplay of the verses recalled the African American origins of the hip-hop genre, the pounding refusal of rhythmic play that is enacted during the chorus marks the moment when metal appropriates rap from black people (as it arguably took the blues several generations prior). In terms of the timbral contrast, the use of aggressive distortion in vocals and guitars reads as an externalization of anger and force. As Robert Walser has argued, timbral distortion—the gravelly shouting voice and the buzzy, overdriven guitar—signifies force or power because it literally overdrives the mechanism that produces it (the vocal cords and the acoustic vibration of the string, respectively), thus acting out a transgression of boundaries or symbolic violence, which is, in the case of this song, unambiguously aimed at women.

The question I want to raise in closing, then, is whether the moral responsibility of a song, or a genre? To say that any music or any art causes a behavior would be untenable and unconscionable. However, debates over the moral power of music are as old as Plato, and such debates evince our unspoken belief that music has power; and with power comes responsibility. This debate became very real for the band Limp Bizkit when horrific riots broke out during their performance at the ill-fated Woodstock ‘99 festival: as Rolling Stone reported, two of that festival’s five reported acts of sexual assault “...allegedly took place in front of the stage during Limp Bizkit’s performance,” not to mention countless acts of looting, arson, and vandalism across the festival grounds (Hendrickson, p. 35) Without a doubt there were many factors that contributed to the ugly mood of the crowd, from the extortionary food prices to the uncollected trash, to the overflowing sewage; but among those factors we must consider the rhetorical power of music, which in the case of Limp Bizkit involved symbolic erasure of black identity and violence towards women.

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References

Birds of Prey (And the Conceptual Metaphors that Shape its Characters)

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Abstract - This paper explores the idea of conceptual metaphors and how they can be used to analyze the 2020 film Birds of Prey (And The Fantabulous Emancipation of One Harley Quinn). I will explore how the women characters are shaped by metaphor and by both internal and external forces, and how socio-cultural perceptions can create these conceptual metaphors. I will also explore how experiences and interactions with external forces can alter the way that socio-cultural metaphors are perceived by the characters which those metaphors describe.

Keywords — Birds of Prey, Metaphor, Gender

Introduction

In George Lakoff and Mark Johnson’s influential work Metaphors We Live By, they argue that our lives are shaped by conceptual metaphors, which are metaphors that are so pervasive that they shape cultural thought and action. The pervasiveness of these metaphors does not necessarily equate to the truthfulness of these metaphors. Lakoff and Johnson argue there is no such thing as absolute truth, but that “truth is always relative to understanding” (Lakoff, 1981). Traditionally, a metaphor has been seen as a figure-of-speech, often found in poetry, in which an idea is explained through comparison with an unrelated idea for instance, love is war. However, cognitive linguists have found that many of the ideas that govern these poetic metaphors can be found in everyday conversational language and these metaphors do not originate in figurative language, but in thought. A result of this research is that metaphor has evolved to mean “a cross-domain mapping in the conceptual system” this cross-domain mapping results in metaphorical expressions (Lakoff, 1992).

For instance, the expressions “she fled from his advances” or “he won her attention” are common expressions that are derived from the metaphor love is war, in which the concept of the domain “war” is applied to the domain “love”. Other people may see love less combatively and use expressions derived from the metaphor love is a journey (“This relationship is going nowhere!”) or love is a transaction (“What is she getting out of that relationship?”). All of these love metaphors seem true to the people who are living them, but none of them can be objectively proven; furthermore, a person’s personal truth can evolve over time as they gain experience and understanding. One of the ideas that has risen from this idea of conceptual metaphors is the idea of socio-cultural metaphors, these metaphors explore socio-cultural interpretations that apply to the domains that create metaphors (Takada et al., 2000). These socio-cultural metaphors explore metaphors concerning gender, race, or other identifying classifications of humanity that are shaped by the social perception and norms. This essay will explore some of the gendered metaphors that shape the lives of the characters of the 2020 film Birds of Prey (And The Fantabulous Emancipation of One Harley Quinn) and the implications those metaphors hold for the women of Gotham.

Metaphor in the Film

Women are Harlequins

“Do you know what a harlequin is? A harlequin’s role is to serve.” explains the titular Harley Quinn (Kroll et al., 2020). Harlequins, according to Harley Quinn’s definition, are supporting characters; they are the “badass broad” behind “every successful man” (Kroll et al., 2020). In the world of Gotham, and our own world, women are often seen as support structures. They are the glue that holds families together; the anchor that keeps men from floating adrift; the mother that coddles and encourages. Support is generally a good thing and there is nothing inherently wrong with trying to uplift your partner or loved ones; however, the problem arises when the metaphor becomes so ingrained in a culture that women cannot be seen as anything other than support. Harley Quinn has embodied her role as a harlequin so thoroughly that she has no outside identity, in her own estimation, she’s “nothing without a master” (Kroll et al., 2020).

The men in Birds of Prey are shown to have accepted this metaphor as well, which results in several consequences for the women characters. Most obviously, it results in a loss of anatomy. For instance, late in the film the antagonist Roman Sionis, Black Mask, a collector of things with a need to be the center of attention and a penchant of
misogyny, is compelled to humiliate a woman for – he believes - laughing at him. Roman's objectification is not limited to women--about fifty-percent of his screen time is devoted to him ranting about owning different people and factions of Gotham regardless of gender--however, his choice of punishment for the woman in question shows that he has internalized the idea that women are harlequins; he places the woman in what he seems to think is her appropriate role as entertainment. In the same scene, visibly upset Dinah Lance, Black Canary, attempts to leave the bar, but Sionis pulls her to him and informs her that she must stay because "you comfort me, little bird" offering another example of how women are meant to serve (Kroll et al., 2020).

Another consequence of the societal acceptance of the metaphor that women are harlequins is shown in Birds of Prey more subtly. Women as entertainment and supporting figures are shown to result in women’s contributions and ideas to their objects of support to be implemented without the women being credited for these contributions. For instance, in Harley Quinn’s opening monologue she explains she “was the brains behind some of Mr. J’s greatest stunts. Not that he let anyone know about it.” (Kroll et al., 2020). This phenomenon also makes up most of the back story of Detective Renee Montoya, whose contributions to a big case early in her career were co-opted by her male partner and leveraged for his promotion. Women’s actions and ideas are offered to their objects of support, and because women’s identities are formed by the idea that they are meant to serve, women accept it when they are ultimately not credited for their work. This results in an invisible contribution of women and perpetuates the idea that women do not actively do anything other than serve. In Birds of Prey, the repeated assumption that “the crossbow killer” - Helena Bertinelli, or the “Huntress” - is male is a side effect of the idea that women are passive entertainment; however, as Huntress is a shadowy assassin, this assumption arguably plays in her favor.

This societal training to be support also plays in the women characters’ favor late in the movie when they have to team up to fight Sionis and his gang. Throughout the fight scene, the women are shown offering support to each other in various ways, one notable example is Harley Quinn rollerskating over to Black Canary and offering her a hair tie between swings of a mallet. This showing of mutual support exposes how they’ve allowed society to take advantage of them but also gives them the strength they need to move to a new phase of their lives. 

**Women are Birds**

Late in the film, henchman Victor Zsasz delivers a villainous monologue to an incapacitated Harley Quinn. He shows her a collection of scars on his chest and informs her “I’ve got one for all the little birds I’ve helped fly away from this world” (Kroll et al., 2020). For most of the film the correlation between women and birds comes from the antagonists who imply that like birds, women are fragile and delicate creatures, unable to protect themselves and capable of being caged. This metaphor is commonly seen in the real world, “bird” is common slang for women in England, “chick” is another bird-related slang term that is occasionally applied toward women in English speaking countries (thank you to an anonymous reviewer for reminding us of this). This idea also exists outside of English speaking countries, for instance in Japanese there are gendered metaphors such as “kago-no tori” (a bird in a cage) for “a woman kept in a house or a room by her husband or employer” or “uguisu-joo” (nightingale-girl) for “a female announcer whose voice is beautiful” (Takada et al., 2000). In the real world, the concept behind the women are birds metaphors generally mirrors that of Victor Zsasz, women are decorative pets meant for the enjoyment of men.

One of the ways the film presents this perspective of the metaphor can be seen by the treatment of Harley Quinn as a figure who needs protection. At the beginning of the movie, Harley’s relationship with the Joker as his pet protects her from retaliation or general harm from the other villains of Gotham. However, when she announces that she and the Joker have parted ways by blowing up their “Eiffel Tower,” the Ace Chemical Plant, she effectively declares open season on herself. Every enemy that she has made comes after her, seeing her as a person who is no longer protected, without considering that she may be capable of protecting herself. Interestingly, Harley’s surprise when she is attacked by an onslaught of enemies implies that unlike the metaphor women are harlequins, Harley doesn’t accept the metaphor women are birds as a personal truth, or, at least, she doesn’t accept it in the form that Zsasz and Sionis accept it.

What makes the metaphor women are birds interesting is that it illustrates the arbitrary nature of words. Words have meaning because we give them meaning, just as different subcultures may live by different metaphors, different subcultures may define the same word in different ways or they may reappropriate words to lessen those words’ power. The women in Birds of Prey, think of birds not as the weak, domesticated pets but as fierce and graceful hunters, which is why they ultimately decide to use
the word when deciding on a name for their crime-fighting syndicate, The Birds of Prey.

**Conclusion**

One of the core ideas of Lakoff and Johnson’s Metaphors We Live By is the importance of taking an experientialist approach to knowledge, which is the idea that “understanding emerges from interaction with the environment and other people” (1981). This approach allows the metaphors that shape our lives to evolve over time as we grow and experience more of the world. Birds of Prey (And The Fantabulous Emancipation of One Harley Quinn) shows how experiences can alter the way people perceive themselves and the world around them through the evolution of its women characters. Exploring how metaphors shape the lives of fictional characters, such as Harley Quinn, can help us develop an awareness of the metaphors that we live by in our day-to-day lives and the broader positive and negative consequences that those conceptual metaphors entail.

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**References**


“Goonies Never Say Die”: An Analysis of Disability and Economic Anxieties in The Goonies

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Abstract - Out of feminist literary critique arises the necessity for critical cultural overhaul, an investigation into the ideologies making up and represented in works of literature from those of the distant past and into current pop culture. In this essay, I take up tools provided by modern scholarship in the field of feminist disability studies to dissect that which makes up the beloved 80s film The Goonies and the ways in which it takes up ableist logic as it represents disability, both literally and metaphorically as a device to express cultural fears of emasculation and of the displacing effects of capitalism.

Keywords- The Goonies, disability, feminism, capitalism, masculinity

Introduction

Representations of disability in The Goonies (1985) occur across multiple characters and levels of plot. In this paper, I analyze three sites of disability in this popular 1980s boys-on-bikes film, starting with (1) the ogre-like character of Sloth, moving next into (2) protagonist Mikey's (straight white male and middle-class) experience of asthma and the film's appropriation of disability as thematic emasculation, and addressing in more detail (3) the plot itself, which is motivated by anxieties of class immobility that indirectly reference broader cultural fears of the disabling and displacing forces of capitalism. “Goonies never say die”, and as the characters that make up the misfit group push back against thematically emasculating threats of disability and economic unease, The Goonies itself consents to an ableist system of thought that can be illuminated by scholarship in feminist disability studies on anomalous bodies (Garland-Thomson, 2009), the intersectionality of invisible disabilities (Mollow, 2017), and the relationship between disability and economic insecurity (Kafer, 2013).

Analysis of Characters and Plot

Analyzing the Character of Sloth

The most glaring representation of disability in The Goonies is that of Sloth, the third brother and social outcast of the criminal Fratelli family that serve as the film's antagonists. Even without taking a deep look at Sloth’s cognitive and social skills, the character’s anomalous body and even his name itself calls forth a baggage of narrative; in her book Staring, feminist disability scholar Rosmarie Garland-Thompson (2009) postures the stares and looks that “people who look like dwarfs, giants, and monsters” garner as the result of being "unfamiliar as flesh and too familiar as narrative” (p.167). In Staring, Garland-Thompson (2009) details a handful of the lives of anomalous-bodied people, and drawing here on Garland-Thomson's work on giants, I read Sloth as a character who “lived within stares because [he] had no other place to live,” and someone “called... from the mundane world into a hyper-visible space where actual people cannot live out ordinary lives” (p.171). Garland-Thomson illuminates ableist responses to the physical appearance of giants; in The Goonies, ableism rears itself when Sloth’s visible difference from his surrounding characters is used to disrupt the audience’s empathetic understanding of him.

The film, however, does not abandon Sloth here; in fact, it attempts to rehabilitate Sloth by giving him agency and a heroic conclusion to his character arc. Rather than show a reversal of ableist attitudes and save Sloth from a sad fate, I argue that the film’s super-heroic rehabilitation works instead to constrain Sloth in a binary, ableist representation of disability. In Feminist Queer Crip, feminist disability scholar Alison Kafer (2013) analyzes the notion of the ‘supercrip’ within the context of billionaire Philip Anschutz’s Foundation for a Better Life (FBL) campaign, a pull-yourself-up-by-the-bootstraps multimedia offensive pushing for “an individual adherence to ‘community-accepted values’” (p.89), and her insight into the cultural phenomenon of the disabled or anomalous body as superhuman recalls much of Sloth’s arc in The Goonies. Understanding the broader cultural tendency towards the mythologization and fetishization of non-conforming bodies, Kafer (2013) argues that “disability appears as an individual physical problem that can best be overcome (and should be overcome) through strength of character and adherence to an established set of community values” (p.89). It takes no stretch of the imagination
to see that Sloth’s arc illustrates this tendency Kafer traces: during the scene of his rescue of the Goonies, Sloth tears off his pirate garb to reveal a Superman shirt underneath, tightly fitted to his muscular frame, and his heroics towards the Goonies are what make him redeemable. As Kafer (2013) would frame it, Sloth’s “disability is depoliticized, presented as a fact of life requiring determination and courage, not as a system marking [him]... as deviant and unworthy” (p. 89). While Sloth is not emasculated in the traditional sense (rather the opposite, showing off his physical and figurative macho during the film’s climax) or in the thematic sense I will discuss later, the film positions Sloth as a ‘supercrip,’ elevates his character above that of humanity and subsequently removing his relevance as a disabled character and representation of such.

Analyzing Mikey’s Asthma

A more subtle display of disability in the film is embodied (or not) in the protagonist Mikey and his use of an inhaler. The film is consistently ambivalent about whether or not Mikey, despite the use of his inhaler, actually has asthma: his mother wonders in passing if Mikey might “be coming down with asthma,” language which characterizes the chronic respiratory disease as akin to something like the common cold that you can catch and shrug off. Additionally, Mikey’s use of his inhaler typically comes at times when his masculinity is threatened, or when he has to buck up his courage for the good of himself and his fellow goonies. Moreover, in the conclusion of the film, as Mikey sees his brother Brand kiss love interest Andy, Mikey pulls out his inhaler, briefly contemplates it, then throws it behind him into the surf, posing the rhetorical question “Who needs it?” to no one in particular.

Yet perhaps this is quite the particular move by the filmmakers. Mikey’s character, Mikey’s use of his inhaler and supposed disability, and his masculinity are all inextricably connected within the film: the young protagonist’s first appearance in the film finds him gazing meditatively out of his bedroom window, and the following shot shows him taking a puff from his inhaler, backgrounded by his brother lifting weights. Shortly thereafter, the brothers share a bittersweet but sentimental moment, regretting that the house they’ve grown up in will be foreclosed and then eaten up by hungry land developers for a country club golf course (more on this later). This moment of tenderness is undercut almost immediately, however, with Brand’s line “Adopted wuss”, reasserting his own emotionally-hardened masculinity after a temporary slip. Moreover, the next scene in which Mikey’s inhaler appears finds fellow Goonie Chunk picking up Mikey’s mother’s miniature statue of David off of the ground after dropping it - the damage to the statue? It’s lost its genitalia.

It is key here to note that Mikey’s experience, both as a character and as a person with asthma, is a straight, white, middle-class experience of asthma and the film’s concluding commentary about the nominal nature of Mikey’s disease go even farther to suggest that the film’s representation of asthma are both inconclusive and resistant to intersectionality. We know from scholar Anna Mollow (2017), however, this is not the case. In “Unvictimizable: Toward a Fat Black Disability Studies,” Mollow first historicizes environmental racism, writing that “people of color are far more likely than whites to have little choice but to live near landfills, hazardous waste facilities, coal-fired plants, and chemical factories” (p. 115). Mollow notably cites the life of Eric Garner, killed by police who blamed his death on his suspected criminal activity (selling single cigarettes without tax stamps), his disability, asthma, and his physical size. Mollow reminds readers that “the pollution that proliferates in African American neighborhoods likely does increase the risk of acquiring these disabilities” (p. 115), and thus, viewers cannot take real pleasure in Mikey’s “triumph” over asthma; even if one could simply overcome asthma as Mikey apparently does (“Goonies never say die”), Mikey’s story is not representative of the way that asthma affects the majority of people and cases. In other words, Mikey’s story not only assumes notions of heteronormative masculinity and disability, a move that excludes most people, Mikey’s story especially excludes people of color.

Analyzing the Plot

Stories like The Goonies that capture the anxieties of the trickle-down theory and other Reaganomics are not uncommon and not inherently ableist, discriminatory, or otherwise oppressive, and this film fits nicely into the rest of the canon of boys-on-bikes 1980s original stories and retellings. The ways in which The Goonies chooses to address these issues of economic anxieties and the effects of class displacement, however, moves the film further into ableist territory, picking up disability for its rhetorical and thematic destabilizing potential. Throughout the film, disability serves as both a sign and catalyst for economic instability; if Mikey cannot “overcome” his asthma, it could threaten both his upward class mobility and one’s once-believed secure position in the middle class. Mikey’s inhaler use is interwoven with his masculinity and courage, or lack thereof, and until Mikey feels that he has defeated his
The threat of homelessness Mikey’s family faces in *The Goonies* works to further illuminate the ties between economic anxieties and disability: I return to Alison Kafer’s (2013) analysis of the FBL campaign in her book *Feminist Queer Crip* for a guide in understanding homelessness as a disability issue. In her analysis, Kafer describes a personal experience seeing one of the FBL billboards in Austin, Texas. The billboard in question is positioned “directly over a clothes donation box and a bus shelter -- two sites marked by poverty and homelessness -- at an intersection with panhandlers on each corner” and features Liz Murray photographed in a classroom, captioned “AMBITION” and subtitled “From homeless to Harvard” (p. 96). Here the FBL deploys the disabled body for its own purposes, reproducing the neoliberal idea that the homelessness seen on the streets can be avoided if only one has ambition. Kafer reminds readers that “not only are many homeless people disabled, homelessness is a threat all-too-real for many disabled people; homelessness is a disability issue” (p. 96). Kafer (2013) further contextualizes disability and homelessness together when she calls to her readers’ attention that the subject of the billboard in question, Murray, grew up surrounded by disability: it was Murray’s parents’ drug “addiction that caused them to lose their housing. Her mother eventually died of AIDS, and Murray nursed her father through a long illness” (p. 96). Reading *The Goonies* through the lens of modern discourse within feminist disability studies should help to unravel some of the ableist logic at play within the film, and analysis within the context of this discourse can be used to investigate the ableist claims that operate within other forms of pop culture to further critique our understanding of disability issues.

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Heat Shock Protein 90β Plays a Leading Role in Promoting Lipopolysaccharide (LPS)-induced Inflammation in Microglial Cells

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Abstract – Heat shock protein 90 (Hsp90) is a family of chaperone proteins that consists of 4 isoforms, (Hsp90α, Hsp90β, glucose-regulated protein 94 (Grp94), and tumor necrosis factor type 1 receptor-associated protein (TRAP1). They play a critical role to regulate numerous intracellular signaling pathways, such as inflammatory and pain signaling and modulating the folding, maturation and activation of their client proteins. Previous studies demonstrated that non-selective Hsp90 inhibitors, such as 17-N-allylamino-17-demethoxygeldanamycin (17-AAG), inhibited the inflammatory signaling pathways resulting in a reduction of inflammation and pain. However, the role of Hsp90 isoforms and co-chaperones in inflammation remains poorly understood. This study aimed to determine the molecular isoforms and co-chaperones by which Hsp90 promotes LPS-induced inflammation in microglial cells. BV-2, a murine microglial cell line, were treated with 17-AAG or Hsp90 isoform/co-chaperone-specific inhibitors for testing the generation of inflammatory mediators such as nitric oxide (NO) and the activation of NF-κB. We found that Hsp90β showed comparable inhibition as 17-AAG on NO production and NF-κB activation over a 24 hour treatment period. These findings suggest that Hsp90β is the key player in the LPS-induced neuroinflammation.

Keywords – Heat shock protein 90, microglial cell, inflammation, pain

Introduction

Pain, particularly chronic pain, has a substantial clinical and economic impact worldwide for nearly one-third of the world’s population each year (Henschke et al., 2015). Inflammation and pain are highly related, as inflammatory signaling can initiate pain through tissue damage and pain sensitization. A family of chaperone proteins known as heat shock proteins (HSP) are upregulated in response to cellular stress, such as heat shock, in order to maintain cellular functioning. During recent years, a subclass of HSP known as Hsp90 has gained interest as novel drug target due to its role in inflammatory signaling (Costa et al., 2020; Hoter et al., 2018). Due to its anti-inflammatory properties, Hsp90 inhibitors have become an increasingly popular target in scientific research and clinical trials for cancer and proliferative diseases.

As chaperone proteins, Hsp90 assists in the folding of proteins to maintain structure and function. During cellular proliferation, such as tissue regeneration or tumor growth, excess proteins are synthesized to sustain cellular growth. Upregulation of HSP occurs in response to the increased need for protein synthesis. Hsp90 consists of 4 isoforms: Hsp90α, Hsp90β, GRP94 and TRAP1. Hsp90α and Hsp90β are the major isoforms, expressed predominantly within the cytoplasm, while GRP94 is expressed in the endoplasmic reticulum and TRAP1 in the mitochondria (Hoter et al., 2018; Lei et al., 2019). Co-chaperones also play an extensive role in the regulation of Hsp90 activity, particularly in the cytosolic isoforms (Xu et al., 2019). These co-chaperones assist in the function of Hsp90, and many play a role in carcinogenesis.

Upregulation of HSP is associated with pain and inflammatory disease states. In neuroinflammation, HSP function plays an important role within microglial cells. Activation of both microglial cells and astrocytes occur in response to chronic pain, while microglial cells are more responsive to acute pain stimuli (Ji et al., 2018). This microglial reaction within the central nervous system (CNS) demonstrates the role of microglial cells in pain regulation. Focusing on the role of Hsp90 within CNS cells that modulate pain response illustrates the relationship between the Hsp90 drug target and pain recognition.

A variety of previous studies have examined the effects Hsp90 on various signaling pathways through in vitro and in vivo models. In in vitro models, activation of pro-inflammatory pathways such as ERK, JAK2 and STAT3 are associated with upregulation of Hsp90. Likewise, increased expression produced an increase in production of inflammatory mediators and cytokines, such as IL-
6, IL-1β, TNF-α and nitric oxide (NO) (He et al., 2019). Decreased ERK signaling due to treatment with Hsp90 inhibitors was identified in mouse models (Lei et al., 2017).

This study aims to examine the roles of individual isoforms and co-chaperones in inflammatory signaling pathways. By comparing the effects of a single isoform or co-chaperone to the effects of the entire protein class, a deeper understanding of their function may identify potential drug target that are more specific than current therapies. By narrowing the drug target for these compounds, unintended impacts on auxiliary cellular functions. In clinical trials, Hsp90 inhibitors have had limited application due to toxicities and adverse effects. Selective drug targets can reduce side effects compared to their non-selective counterparts by limiting off-target binding that can interfere with additional cellular pathways and functions. This study assesses Hsp90α, Hsp90β, GRP94 and co-chaperone Aha-1 for cytokine production and inflammatory activation compared to baseline, non-specific effects.

Methods and Results

A murine microglial cell line, BV-2, was cultured using Dulbecco’s Modified Eagle Medium (DMEM). The cells were cultured at 37°C with 5% CO₂. 17-N-allylamino-17-demethoxygeldanamycin (17-AAG), was used as a non-specific Hsp90 inhibitor treatment. The inhibitors for specific Hsp90 isoforms and co-chaperones Aha-1, KUNA115 (Hsp90α), KUNB10 (Hsp90β), KUNG65 (GRP94), and KU117 (Aha-1), were synthesized by the laboratory of Dr. Brain Blagg at the University of Notre Dame. Lipopolysaccharide (LPS) was used as positive control. NO assays were performed to measure NO production. Activation of NF-κB inflammatory signaling pathway was detected using a Luciferase assay.

The results of the NO assay showed a dose-dependent reduction in NO production with 17-AAG treatment after a 24 hour treatment period. These results are consistent with similar findings from previous studies. NO inhibition from the isoform-specific inhibitors were compared with the 17-AAG treatment in order to identify the isoforms responsible. Hsp90β showed a comparable NO inhibition pattern to 17-AAG, as shown in Figure 1. Hsp90α and co-chaperone Aha-1 also showed a weak response, although Grp94 had minimal impact on NO production. Furthermore, we found that expression of inducible nitric oxide synthase (iNOS) was reduced with Hsp90β inhibition. This confirms our findings and indicates that mechanism of decreased NO production is through iNOS inhibition.

The Luciferase assay results showed dose-dependent reduction in NF-κB activation with 17-AAG treatment, shown in Figure 2A. Hsp90β showed similar results to 17-AAG, while all other isoforms and co-chaperones showed NF-κB activation (Figure 2B). This suggests that Hsp90β plays a key role in decreased NF-κB with Hsp90 inhibition. However, we found that ERK activation was not impacted by 17-AAG treatment or by Hsp90β inhibition.
Our findings suggest that ERK is not a key player in decreased NF-κB activation by Hsp90 inhibition. Therefore, future studies will explore the role of alternate factors. Also, quantitative polymerase chain reaction (qPCR) will be used to examine production of additional cytokines and inflammatory mediators such as IL-6, IL-1β and TNF-α.

**Conclusions**

Identifying the isoforms and components that account for the anti-inflammatory effects of Hsp90 inhibition provides insight to the mechanisms of signaling pathways that play a role in these effects. By determining that Hsp90β inhibition has similar effects as 17-AAG on NO production and NF-κB production, this suggests that Hsp90β inhibition has potential as a more specific drug target. Clinically, this could reduce potential side effects and expand the utility of the drug class.

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Mental Health and Chiropractic: A Brief History
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Abstract —The chiropractic profession has a long history of acknowledging the relationship between nervous system function and mental health. Review articles are seen as a form of research/scholarship in the health sciences. This paper reviews the history of chiropractic involvement in mental health issues, chiropractic institutions specializing in the care of mental health problems, and the current research status of mental health and chiropractic.

Keywords — Chiropractic, mental health, vertebral subluxation carver

Introduction

Many chiropractors and those they serve tend to focus on how altered nerve function influences the physical body. However, abnormal nervous system function may also compromise emotional and psychological health. The scope of chiropractic is as broad as the scope of influence of the nervous system. The author completed an expanded paper including history and putative neurobiological mechanisms. Review articles are seen as a form of research/scholarship in the health sciences. This paper is a brief historical overview of chiropractic and mental health. (Kent, 2018)

Early Days—1895-1920s

D.D. Palmer founded the chiropractic profession in 1895. He described vertebral subluxations as "slightly displaced vertebrae which press against nerves causing impingements, the result being too much or not enough functioning" (Palmer, 2010, p. 280) The chiropractic profession has been actively involved in the field of mental health since Palmer described a postulated mechanism for "insanity." According to his son, B.J. Palmer, “D.D. Palmer was the first man to discover that insanity was caused by displaced cervical vertebrae, that by replacing them the patient could be restored to normal condition.” (Palmer, 1951, p. 20) B.J. Palmer himself wrote, “If an atlas is subluxated it makes abnormal the functions of the brain . . .What is to be done in insanity? Go back to cause? Adjust that and return that brain to its normal capacity and capability. Interpretation then will be normal and expression follows likewise, then what have you? Coordination—health, in all that the word implies.” (Palmer, 1920, p. 41) (Figure 1; Figure 2).

Willard Carver, an attorney and chiropractor, authored several books exploring the relationship of psychology to physiology and chiropractic. Carver wrote, “Between the Psychology and the Physiology I have built the Biologic bridge that scientifically connects these two very important departments of human experience.” (Carver, 1920, p. 3) Carver was a controversial figure, as he advocated utilizing adjunctive therapies to supplement the adjustment of vertebral subluxations.

1920’s—1960s

In the era from the 1920s to the 1960s, several chiropractic inpatient facilities operated catering to patients suffering from “Nervous and mental disorders.” Two of these were located in Davenport, Iowa. In 1922, the Chiropractic Psychopathic Sanitarium was established. (Figure 3) The facility was later known as Forest Park Sanitarium. North Dakota Judge A. W. Ponath noted that at the North Dakota state mental hospital, the “cure and discharge rate” ranged from 18%-27%, compared to 65% at Forest Park. (The Times, 1936) Clear View Sanitarium was an inpatient chiropractic psychiatric facility that operated in Davenport, IA, from 1926 to 1961. The second facility, Clearview Sanitarium, was established in 1926. (Figure 4) In 1951, Clearview was acquired by the Palmer School of Chiropractic. Chiropractor W. Heath Quigley, who directed the sanitarium, described his clinical protocol: "Each day, each patient was examined with the neurocalometer (NCM). If the clinician interpreted the NCM to indicate nerve impingement, the patient was adjusted." Quigley reported that the rooms were "sunny and bright," and that meals included "large servings of fresh vegetables...from a garden." (Quigley, 1990)

Unfortunately, both institutions closed, (Forest Park in 1959 and Clearview in 1961) in large measure because of third party pay issues. Insurance companies often refused to pay the costs of care. Iowa statutes at the time did not provide for licensing specialized hospitals; only full service medical hospitals could be licensed. Clearview was
not licensed as a hospital, and functioned legally as a nursing home. (Quigley, 1992)

**1970s—Now**

The 1970s saw a renewed interest in chiropractic care and mental health issues. In 1973, Herman S. Schwartz, a chiropractor, published a book titled "Mental Health and Chiropractic: A Multidisciplinary Approach." This remarkable book included contributions from two Nobel Laureates, (Schwartz, 1973) (Figure 5) In 1949, Schwartz had published a preliminary report of 350 patients afflicted with a "nervous or mental disorder" and reported that the majority of them showed improvement under chiropractic care. (Schwartz 1949) Schwartz was active in the ACA Council on Mental Health (formerly Council on Psychotherapy), which survived through the '70s, but no longer exists.

In the 1980s, Quigley (1983) published an article describing a four decades period where "treatment of the mentally ill was a highly motivated discipline within the chiropractic profession." Goff (1988) published a review of the theory and practice of "chiropractic treatment for mental illness." Interest in this field continues.

Blanks, Schuster and Dobson (1997) published the results of a retrospective assessment of subluxation based chiropractic care on self related health, wellness and quality of life. This is, to my knowledge, the largest study of its kind ever undertaken regarding a chiropractic population. After surveying 2,818 respondents in 156 practices, a strong connection was found between persons receiving Network care and self reported improvement in health, wellness and quality of life. Genthner et al (2005) reported on a series of 15 patients with a history of depression. The Beck Depression Inventory II was used to measure the baseline level of depression and any post care changes following orthospinology care. A paired t test demonstrated significant improvement in depression test scores. A systematic review of psychological outcomes in randomized controlled trials (RCTs) described the results of 12 RCTs of spinal manipulation which had adequately reported psychological outcomes. The authors concluded that there was some evidence that spinal manipulation improved psychological outcomes compared with verbal interventions. (Williams et al., 2007)

Other small articles ranging from single case reports to randomized clinical trials have reported favorable outcomes in persons with behavioral and mental health issues following chiropractic care. These include cancer-related traumatic stress syndrome (Monti et al., 2007), attention deficit hyperactivity disorder (ADHD) (Lovett & Blum, 2006), general health status measured using the RAND-36 and Global Well-Being Scale (Blanks & Dobson, 1999), addiction treatment (Holder et al., 2001), autism (Khorshid et al., 2006), learning disabilities (Pauli, 2007), anxiety (Russell & Glucina, 2019), cancer-related traumatic stress symptoms (Monti et al., 2007), and health related quality of life among public safety personnel (McAllister & Boone, 2007).

**Conclusions**

Chiropractic care is concerned with the totality of the human experience. Vertebral subluxations may result in autonomic dysregulation, compromising the adaptive capacity of the organism. By analyzing and correcting vertebral subluxations, a patient is placed on a more optimum physiological path, potentially increasing resilience and adaptability. Further research into the effects of vertebral subluxations on mental health, the neurobiological mechanisms involved, and the use of reliable and valid outcomes assessments should be undertaken.

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Barriers and Facilitators to Elementary School-Based Interventions Targeting Physical Activity and Nutritional Intake Behaviors to Address Childhood Obesity: An Integrative Review

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Abstract – The World Health Organization identifies childhood obesity as one of the 21st century’s most serious public health challenges. Some school-based weight management interventions have successfully targeted physical activity and nutritional intake behaviors; however, there is lack of synthesis on the barriers and facilitators to implementing these interventions. The purpose of this integrative review was to critically appraise the literature using the Social Ecological Model to investigate and synthesize the barriers and facilitators related to implementation of obesity-related interventions in elementary schools. Electronic databases of EBSCOhost, PubMed, and Scopus, along with reference lists of applicable studies, were searched for appropriate publications. Initial searches yielded 395 citations. Of these, 24 studies met criteria for inclusion in the study. Most commonly reported barriers involved teachers’ lack of time and insufficient resources to provide interventions. Main facilitators to successful implementation included adequate training and support for school officials. Understanding the barriers and facilitators to elementary school-based interventions addressing physical activity and nutritional intake behaviors is critical for intervention implementation. Although studies have described existing barriers and facilitators, more research is warranted on strategies to aid intervention implementation.

Keywords – childhood obesity, school-based interventions, barriers, facilitators, integrative review

Introduction

The World Health Organization identifies childhood obesity as one of the 21st century’s most serious public health challenges, with approximately 340 million children and adolescents considered overweight or obese globally (World Health Organization, 2018). Behaviors that lead to excess weight gain include inadequate participation in physical activity (PA) and consumption of high-calorie, low-nutrient foods. Negative health outcomes are associated with obesity, including increased rates of chronic illnesses, diminished quality of life, and shorter life span (Centers for Disease Control and Prevention, 2016). Childhood obesity is primarily treated in the clinical setting. Numerous challenges exist with this approach, including time and resource constraints, inability to attend appointments, and misinterpretation of medical orders (Shreve et al., 2017). School-based weight management interventions have improved PA and nutritional intake behaviors (Calvert et al., 2019; Hecht et al., 2019). Schools have ready access to children and serve as excellent venues for teaching healthy lifestyles. The purpose of this integrative review (IR) was to critically appraise the literature using the Social Ecological Model (SEM) to investigate and synthesize the barriers and facilitators to elementary school-based interventions targeting PA and nutritional intake behaviors. The SEM addresses the interrelations of the social, cultural, and physical environments; human health; and health behaviors. Components of this model are intrapersonal (students), interpersonal (student relationships), institutional (schools), community (school relationships), and social/policy (school programs/policies) levels (Sallis & Owen, 2015).

Methods

Whittemore and Knafl’s (2005) methodological framework guided this IR to synthesize knowledge and evaluate the applicability of research findings to inform school health initiatives. In September 2019, the electronic databases of EBSCOhost, PubMed, and Scopus, along with reference lists of studies, were searched for appropriate publications. The primary goal was to identify studies that described implementation factors of elementary school-based interventions targeting PA and nutritional intake behaviors to address childhood obesity. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram directed the process for
screening and selection of studies. Studies were included if they were scholarly, peer reviewed, primary research on school-based interventions targeting PA and nutritional intake and if barriers or facilitators to implementation were discussed. Articles were excluded if they were not in English, were review articles, or were published prior to 2009. Initial searches yielded 395 citations. Of these, 24 studies met inclusion criteria (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Centis et al., 2012; Chan et al., 2018; Cunningham-Sabo et al., 2016; Day et al., 2019; Donnelly et al., 2009; Elder et al., 2011; Fung et al., 2012; Gorely et al., 2009; Gutuskey et al., 2016; Hayes et al., 2019; Hoelscher et al., 2010; Koch et al., 2019; Magnusson et al., 2011; Piana et al., 2017; Scherr et al., 2014; Schetzina et al., 2009; Schroeder & Smaldone, 2017; Stines et al., 2011; Toruner & Savaser, 2010; Turner et al., 2013; Wright et al., 2013). Two studies (Burke et al., 2014; Scherr et al., 2014) have commentaries published regarding questionable statistical analyses and interpretation of results (Lucan, 2018; Scherr et al., 2018; Skinner et al., 2015; Wood et al., 2018). Because the primary focus was not intervention results, these articles were included in the IR. Studies were evaluated for methodological quality using the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018).

**Results**

All studies discussed the effect of barriers and facilitators on intervention implementation and how identified concepts hindered or supported intervention efforts. The interventions in all of the studies advocated increasing PA and improving nutritional intake. There was a mixture of methodological designs among the studies: randomized controlled, non-randomized, qualitative, descriptive, and mixed methods. Studies were conducted in the United States, England, Italy, Canada, Iceland, Ireland, Malaysia, and Turkey. Seventeen involved all SEM levels (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Chan et al., 2018; Cunningham-Sabo et al., 2016; Day et al., 2019; Donnelly et al., 2009; Fung et al., 2012; Gorely et al., 2009; Hayes et al., 2019; Hoelscher et al., 2010; Koch et al., 2019; Scherr et al., 2014; Schetzina et al., 2009; Schroeder & Smaldone, 2017; Stines et al., 2011; Wright et al., 2013).

**Intrapersonal Level**

The inability to change knowledge and habits regarding PA and healthy eating patterns had negative effects on intervention success. Despite receiving hands-on lessons regarding healthy activities and dietary intake, some children were not making sustained adjustments in their lifestyle choices at intervention follow-up (Hayes et al., 2019; Schroeder & Smaldone, 2017). Student behavioral and learning issues and students being removed from intervention activities for tutoring interfered with intervention delivery (Alaimo et al., 2015; Stines et al., 2011; Wright et al., 2013). These situations served as distractions and decreased intervention involvement for some students.

Student engagement, motivation, and cooperation in intervention actions improved implementation and outcomes (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Centis et al., 2012; Chan et al., 2018; Cunningham-Sabo et al., 2016; Day et al., 2019; Donnelly et al., 2009; Elder et al., 2011; Fung et al., 2012; Gorely et al., 2009; Gutuskey et al., 2016; Hoelscher et al., 2010; Koch et al., 2019; Magnusson et al., 2011; Piana et al., 2017; Scherr et al., 2014; Schetzina et al., 2009; Toruner & Savaser, 2010; Turner et al., 2013). Three studies emphasized the importance of children feeling supported by trusted adults, such as parents and teachers, in intervention participation to increase accountability (Alaimo et al., 2015; Centis et al., 2012; Piana et al., 2017). Children’s acceptance of interventions was related to content because enjoyable interventions enhanced participation. One study discussed the leadership role students assumed within an intervention. These student leaders helped with the design and implementation of activities and felt empowered to improve their own well-being and to influence the health of their peers, which fostered intervention acceptance (Gutuskey et al., 2016). In two studies, the intervention included a school garden component in which students planted fruits and vegetables that they later ate as snacks. This level of involvement helped children have increased ownership of their health behaviors and dietary choices (Day et al., 2019; Scherr et al., 2014).

**Interpersonal Level**

School personnel reported curriculum intrusion concerns, time constraints, and staffing issues as barriers to delivering school-based interventions addressing PA and nutritional intake. School officials indicated that competing academic priorities, multiple role responsibilities, lack of qualified people to provide interventions, and excessive paperwork impeded the implementation of these interventions. Teachers specified that insufficient training and technical support, along with interventions not being incorporated into annual lesson plans, led to negative attitudes, lack of engagement, and feelings of discomfort when delivering interventions (Belansky et al., 2013;
Chan et al., 2018; Day et al., 2019; Elder et al., 2011; Gorely et al., 2009; Hayes et al., 2019; Hoelscher et al., 2010; Magnusson et al., 2011; Scherr et al., 2014; Schetzina et al., 2009; Schroeder & Smaldone, 2017; Toruner & Savaser, 2010; Turner et al., 2013). Parents’ perceptions of stigma and social ramifications associated with obesity resulted in lack of parental involvement and interventions not being supported or endorsed by school administration. Other factors that reduced parental participation included challenges of changing familial norms, limited availability, and reluctance to commit to interventions and provide data (Chan et al., 2018; Centis et al., 2012; Day et al., 2019; Hayes et al., 2019; Piana et al., 2017; Scherr et al., 2014; Schetzina et al., 2009; Schroeder & Smaldone, 2017; Stines et al., 2011; Toruner & Savaser, 2010).

School officials highlighted the importance of adequate training, support, resources, and staff members to facilitate the success of school-based interventions. Interventions that allowed for flexible delivery methods, were easy to implement and enjoyable, and did not have negative effects on instructional time and learning outcomes were favored and more likely to be utilized (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Chan et al., 2018; Cunningham-Sabo et al., 2016; Day et al., 2019; Donnelly et al., 2009; Elder et al., 2011; Fung et al., 2012; Gorely et al., 2009; Hayes et al., 2019; Hoelscher et al., 2010; Koch et al., 2019; Magnusson et al., 2011; Piana et al., 2017; Schetzina et al., 2009; Schroeder & Smaldone, 2017; Stines et al., 2011; Toruner & Savaser, 2010; Turner et al., 2013; Wright et al., 2013). Educational sessions on childhood obesity and staff health screenings helped school personnel prioritize health and understand their role in helping children establish healthy PA and eating behaviors. Support of children also played a part in promoting intervention delivery. Encouragement from parents, teachers, and health authorities helped children understand the importance of healthy lifestyle behaviors (Centis et al., 2012; Day et al., 2019; Donnelly et al., 2009; Hoelscher et al., 2010; Piana et al., 2017; Schroeder & Smaldone, 2017; Wright et al., 2013).

Community Level

Primary barriers included lack of community support and engagement and insufficient communication among stakeholders (Chan et al., 2018; Fung et al., 2012; Hayes et al., 2019). In one study, participants reported that lack of community involvement inhibited implementation due to limited buy-in (Chan et al., 2018). Another study revealed ineffective communication with community members as a hindrance to successful intervention implementation (Hayes et al., 2019). These factors increased burden on schools and made it difficult to deliver interventions.

The central facilitator for implementation of school-based interventions was community members, such as representatives from community health organizations, university personnel, and health care providers, leading intervention activities (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Cunningham-Sabo et al., 2016; Donnelly et al., 2009; Elder et al., 2011; Fung et al., 2012; Hayes et al., 2019; Hoelscher et al., 2010; Koch et al., 2019; Piana et al., 2017; Scherr et al., 2014; Stines et al., 2011; Wright et al., 2013). This support helped relieve teachers from adding intervention delivery as a responsibility. Community members’ work was supplemented by the creation of committees and advisory boards that encouraged teamwork among stakeholders. One study with a school garden promoted
relationships among school nutrition directors, regional produce distributors, and farmers for intervention success (Scherr et al., 2014).

Social/Policy Level

In one study, safety concerns about roads near the school and lack of food storage containers affected the school-based intervention that involved children walking, riding bicycles, and having access to fresh produce (Hayes et al., 2019). Inadequate and unsafe travel routes and food storage policies in the school setting would require governmental decisions and funding for improvements. Another study reported on a school policy that allowed candy as rewards (Stines et al., 2011). This type of reward system can negatively impact interventions by nullifying progress students make in choosing healthy foods (Fedewa & Davis, 2015).

Integration of healthy PA and nutrition policies in schools and support from government departments enhanced intervention delivery. These types of involvement helped to ensure that interventions were meeting established health standards and were promoting participants' well-being (Burke et al., 2014; Day et al., 2019; Hayes et al., 2019; Scherr et al., 2014). Monetary awards were also given to schools in two studies for intervention implementation (Belansky et al., 2013; Hoelscher et al., 2010). These incentives encouraged and reinforced participation.

Discussion and Conclusions

This IR expands on findings from other literature reviews while also offering unique perspectives. In accordance with a recently published systematic review and meta-analysis (Liu et al., 2019), children’s motivation to participate and enjoyment of intervention activities served as barriers or facilitators to implementation, depending on the level of motivation and enjoyment. Another systematic review (Verrotti et al., 2014) reported parental involvement as an essential component for successful school-based interventions. This finding was consistent with the barriers and facilitators identified at the interpersonal level of this IR. An interesting finding of this review that was not reported in detail in the other reviews (Liu et al., 2019; Verrotti et al., 2014) involved in-depth discussions of school personnel in the implementation of school-based interventions. It is important to understand what barriers and facilitators school personnel encounter in order to account for these in intervention development and implementation.

This IR revealed knowledge gaps in the literature as more research is warranted on how to overcome barriers and how to enhance facilitators. Further exploration into intrapersonal and social/policy level elements is especially important because these areas were the least detailed in the studies and greatly contribute to positive and negative implementation effects. In addition, it would be important to examine peer relationships more closely and their effects on intervention implementation and success. Future research can focus on mutual themes in terms of barriers and facilitators to have the largest impact on the most common factors.

Barriers to school-based interventions involved teachers’ lack of time and insufficient resources to implement interventions. The addition of health interventions to teachers’ duties without support from external sources can serve as stressors and lead to non-compliance. Important considerations when designing school-based interventions include giving careful thought as to what can be expected from educators who are already overwhelmed with instructional content and how interventions can be implemented with minimal demands on educational time. Inadequate resources made it difficult to deliver interventions when necessary equipment and facilities were unavailable. School funds are allocated to scholastic areas first, with little to no money remaining for health interventions. A key implication is that free or low cost school-based interventions have a greater chance of being enacted.

The main facilitators to successful implementation included adequate training and support for school officials. School personnel who receive instructions regarding interventions are more likely to understand their responsibilities and benefits to students, which leads to increased adherence. Training sessions that provide in-depth directions on how to deliver interventions should be incorporated before school-based interventions are offered. Adequate support referred to external personnel (i.e. community members) who helped teachers deliver school-based interventions. This component relieved workload burdens on teachers and also allowed stakeholders to be involved with children’s health.

There are several strengths and limitations of this IR. One of the primary strengths is that a medical reference librarian aided with the initial development of the search terms and strategies. The use of Whittemore and Knaff’s (2005) methodological framework guided knowledge synthesis while the SEM helped to frame research findings and interpret their meanings in a logical sequence (Sallis & Owen, 2015). The variety of
study designs and settings provided diverse and in-depth findings regarding barriers and facilitators. A limitation of this IR is that only articles written in English were included. Twenty-three studies involved self-reported measures for data collection, which could have resulted in response bias and telescoping (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Centis et al., 2012; Chan et al., 2018; Cunningham-Sabo et al., 2016; Day et al., 2019; Donnelly et al., 2009; Fung et al., 2012; Gorely et al., 2009; Gutuskey et al., 2016; Hayes et al., 2019; Hoelscher et al., 2010; Koch et al., 2019; Magnusson et al., 2011; Piana et al., 2017; Scherr et al., 2014; Schetzina et al., 2009; Schroeder & Smaldone, 2017; Stines et al., 2011; Toruner & Savaser, 2010; Turner et al., 2013; Wright et al., 2013). In addition, 18 studies discussed issues with participant retention and missing data, which could have altered research findings (Alaimo et al., 2015; Belansky et al., 2013; Burke et al., 2014; Centis et al., 2012; Donnelly et al., 2009; Elder et al., 2011; Fung et al., 2012; Gorely et al., 2009; Gutuskey et al., 2016; Hoelscher et al., 2010; Koch et al., 2019; Magnusson et al., 2011; Piana et al., 2017; Scherr et al., 2014; Schetzina et al., 2009; Toruner & Savaser, 2010; Turner et al., 2013; Wright et al., 2013).

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Understanding the barriers and facilitators to elementary school-based interventions targeting PA and nutritional intake behaviors is critical in the design, development, and implementation stages of interventions. Although studies have described existing barriers and facilitators, gaps exist on strategies to mitigate barriers and maximize facilitators. This review provided a broad evaluation and synthesis of available research in the field of barriers and facilitators to elementary school-based weight management interventions. Further inquiry is needed to investigate how to best address barriers and facilitators to improve implementation and outcomes.

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Abstract - This pre/post experimental study demonstrated that student nurse participation in an online, low-fidelity root cause analysis (RCA) simulation has the potential to reduce medication errors. Traditional nursing education focuses on individual characteristics and responsibility to prevent harm to patients. The modern patient safety movement encourages utilization of systems theory strategies like RCA. The Patient Risk Detection Theory supports using education of nurses to reduce harm to patients. Nursing students report having little knowledge of RCA. Low fidelity, online simulation is an important tool for providing students with high quality learning experiences. The Safety Attitudes Questionnaire (SAQ) was used to assess student attitudes and practices concerning safe medication administration before and after participation in a RCA case study. This was the first use of the SAQ with nursing students. The study included 125 senior-level nursing students from three universities in the southeastern United States. The SAQ was found to be a valid and reliable test of safety attitudes in nursing students. A significant difference in safety climate between schools was observed and correlated positively with NCLEX pass rates. The results of the study provide support for the use of the SAQ to measure nursing student safe medication administration attitudes and practices.

Keywords - Nursing education, simulation, root cause analysis, patient safety, safe medication administration

Introduction

In 2000, the Institute of Medicine (IOM) published a landmark report on the devastating effects of medical errors (Kohn et al., 2000). The report stated an incidence of between 44,000 and 98,000 deaths from medical errors each year. In the 17 years since this report was published, experts have argued that these numbers are too low. Classen et al. (2011) calculated an error rate of 1.13%, which if applied to US hospital admissions at the time, comes to over 400,000 deaths per year. Not all errors cause death, but negative consequences may include temporary or lasting physical harm, increased medical costs, and emotional stress to the patient and family members, as well as to the healthcare workers involved in the error (Wachter, 2012).

To reduce harm to patients, the IOM recommended instituting High Reliability Organizations (HROs) and adopting a culture of safety. HROs are organizations that have fewer than normal accidents. A culture of safety is found in High Reliability Organizations (HROs) like aviation and nuclear power, which have utilized the principles of HROs to reduce harm from accidents (Chassin & Loeb, 2013). HROs minimize adverse events by committing to safety at all levels, from leadership to bedside staff. A culture of safety acknowledges the high-risk nature of the organization’s activities, promotes a blame-free environment where staff can report errors without fear of punishment, and encourages collaboration and discourages hierarchies. According to the Agency for Healthcare Research and Quality (AHRQ), improving the culture of safety within health care is essential to reducing errors (2017). Low safety culture scores are linked to increased error rates, and adoption of specific safety culture measures has been associated with lower error rates (Berry et al., 2016). Nurses have consistently reported a lack of a blame-free environment, as well as problems with organizational commitment to establishing a culture of safety (AHRQ, 2017). Though hospitals routinely survey safety culture, none have been reported to achieve a culture of safety found in HROs (Chassin & Loeb, 2013). Poor teamwork and communication, a culture of low expectations, and high authority gradients all contribute to a failure to achieve a culture of safety (AHRQ, 2017). Though over a decade has passed since the IOM recommended a safety culture in healthcare, the rate of error has not changed (Landrigan et al., 2010).

Ideally, healthcare professionals would experience a culture of safety during their education into the profession (Leape et al., 2009). The educational process should include safety culture assessment to determine if students have adopted the desired norms, values, and practices. Students who adopt a safety culture during the student’s program of study will impact the overall culture of healthcare in the future by improving accountability for safety, promoting teamwork, and evaluating patient safety. A transformation in the education of healthcare professionals is essential to creating and maintaining a culture of safety.
healthcare (Leape et al., 2009). Little is known about safety culture in schools of nursing. What is known is that nursing student error is common and underreported, similar to error incidence in healthcare practice (Reid-Searle et al., 2010).

In nursing education, the most commonly cited reason for not reporting error was fear of punitive action, which is consistent with findings for healthcare in general and indicative of a lack of safety culture Levinson (2012). Barnsteiner and Disch (2012) proposed that a defensive culture is a concern in nursing education. Faculty often feel pressured to produce students who are mistake-free, even though this goal is inconsistent with safety culture principles, and impossible to achieve. Establishing a culture of safety during nursing school may change this mindset.

Leape et al. (2009) argued that reforming the culture of nursing education is important. Registered nurses (RNs) comprise the largest segment of the healthcare workforce with more than 3.1 million RNs in the United States. Because of these numbers, nurses are well positioned to promote safety culture. By promoting a safety culture, nursing professionals will impact the number of highly reliable organizations within healthcare systems resulting in reduced harm to patients.

In the Patient Risk Detection Theory (PRDT), proposed by Despins et al. (2016), organizational and individual attributes affect nurses’ capacity to successfully detect patient risk signals. In the PRDT, educational interventions are designed to facilitate nurses’ ability to detect and prevent error. This research study aimed to support the PRDT by showing that prevention of error is more likely to occur in an organization with patient safety attitudes and procedures that align with those of HROs. Root Cause Analysis (RCA) was used as the educational intervention because it is a retrospective method of error analysis mandated by the Joint Commission since 1996. RCA identifies systems factors that lead to error and suggests solutions to prevent similar errors from causing harm in the future. RCA has been used successfully in nuclear energy and aviation to reduce harm to patients. The PI is engaged in research to explore educational interventions that will improve patient safety attitudes and practices. Schools of nursing need to be encouraged to adopt the principles of HROs in order to reduce harm to patients. The NCLEX is designed to measure minimum competency in patient safety (National Council of State Boards of Nursing, 2020).

The purpose of the study was to determine if participation in a low-fidelity, Root Cause Analysis Online learning module would impact patient safety attitudes and practices of senior-level nursing students as measured by the SAQ. In addition, the study aimed to show that the SAQ is a reliable and valid instrument to measure patient safety attitudes and practices in nursing students.

**Method**

The study was multi-site, experimental pre-test, post-test of 125 senior level nursing students from three schools of nursing in the Southeastern US. This convenience sample included only BSN, pre-licensure students over the age of 18. After enrollment, students were randomized to one of two groups. The experimental group participated in an RCA module; the control group participated in the usual education on error prevention. Modules were designed with input from experts in the field. Students accessed the modules via RedCap, a study management system. Each module consisted of a voice-over PowerPoint uploaded to YouTube. Participants were given the SAQ before and after participation in the modules.

**Conclusions**

It was found that the SAQ is a valid and reliable test of safety attitudes and practices in senior-level nursing students, with means and rankings similar to those found in other studies. The Cronbach’s alpha was 0.98 (N=117). The SAQ scores of the three schools of nursing enrolled in the study had a positive correlation with NCLEX pass rates. No significant difference was found between the experimental and control group on the SAQ.

This study provides evidence that patient safety attitudes and practices can be measured in nursing students. This research is the first use of RCA in a controlled experimental study. Further research is needed to explore educational interventions that will improve patient safety attitudes and practices. Schools of nursing need to be encouraged to adopt the principles of HROs in order to reduce harm to patients. The PI is engaged in research to administer a modified instrument to measure patient safety attitudes and practices in schools of
nursing to support the growth of knowledge and understanding of this important topic.

References


Simulation Experience Increases Compassion and Enhances Student Nurse Awareness of Human Trafficking

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Abstract — To improve awareness about human trafficking, increase compassion, and enhance patient screening for signs of human trafficking, a group of 23 bachelors-level nursing students participated in the Coercion through “Choice” simulation provided by Jasmine Road, a Greenville, SC, non-profit that assists in the rehabilitation of human trafficking victims. Through this experience, students were confronted with the difficult “choices” that trafficked victims often face. Student survey responses after the experience overwhelmingly stated that the experience had improved their awareness of human trafficking as a social issue. Comparative survey results before and after the simulation also demonstrated that students had reduced stigma about prostitution and increased levels of compassion after completing the simulation. Additionally, students were able to provide more thorough descriptions of ways to screen patients for signs of victimization by human trafficking after completing the simulation.

Keywords — human trafficking, nursing, stigma, compassion, screening

Introduction

Human trafficking, also known as modern-day slavery, is a public health crisis. Human trafficking is defined as, “recruiting, harboring, transporting, providing or obtaining a person through the use of fraud, force, or coercion for compelled labor or commercial sex acts” (Byrne et al., 2019). By many estimates, human trafficking is considered the fastest growing industry in the world; over 800,000 individuals are victims of human trafficking annually in the USA alone (Byrne et al., 2019). Victims of human trafficking can be of any socioeconomic background, any citizenship status, and of any age, but the average age when victims are forced into the commercial sex trade is 12-14 years old. Youth risk factors for victimization include history of abuse, involvement with the juvenile justice system or child protective services, and identifying as LGBTQ (Byrne et al., 2019).

It is estimated that somewhere between 50 and 80% of victims of human trafficking are seen by a healthcare provider while under the control of their trafficker (Byrne et al., 2019). They are often seen for sexually transmitted infections, pregnancy or abortion, or for substance abuse-related health concerns. Despite these healthcare interactions, patients are not often screened for signs of victimization by human trafficking, and worse, they can be stigmatized for their sexual history. Research by Dourado et al. (2019) suggests that over 20% of sex workers have faced discrimination at the hands of the health care system, and only about a quarter of sex workers always disclose their status as sex workers, largely due to fears of discrimination (2019). The negative health consequences of stigma can be so impactful that Hatzenbuehler et al. (2013) suggest stigma, itself, should be considered a social determinant of health. The Association of Women’s Health, Obstetric and Neonatal Nurses (AWHONN, 2016) says that nurses must self-reflect to avoid stigmatization of victims of human trafficking, “As part of the educational process, nurses should examine their own perceptions of human trafficking so they do not inadvertently impose those perceptions and leave the individual feeling more victimized and/or criticized. Respect and nonjudgment are key components of the interview and care encounter” (2016).

Through participation in a simulation written and facilitated by Jasmine Road, a Greenville, SC-based non-profit that seeks to rehabilitate victims of human trafficking, bachelors-level nursing students from the University of South Carolina Upstate Mary Black School of Nursing got to learn more about human trafficking, challenge their perceptions of sex workers, and learn how to best screen patients for signs of victimization by human trafficking. Pre-simulation and post-simulation surveys assessed changes in these four measures: self-reported levels of compassion, self-reported awareness of human trafficking, moral judgment of sex workers, and strategies for screening patients for signs of victimization by human trafficking.

Coercion through “Choice” Simulation

The 1-hour Coercion through “Choice” simulation, written by staff and residents of Jasmine Road, provides a narrative about a young girl, Dakota, with a history of childhood abuse who finds herself homeless, jobless and fighting for survival at
the tender age of 17. Throughout the simulation, participants must listen to the details of Dakota’s story and make “choices” to move throughout the room to areas designated as new living quarters. The challenge is that the choices are very limited: an overcrowded shelter, a rundown hotel known for prostitution, the streets, or the home of an abusive boyfriend who forces Dakota into prostitution to fund his drug addiction. Through the vivid descriptions provided in the simulation, students become acquainted with the cycles of poverty and abuse that keep victims stuck in dangerous situations and often debilitating relationships.

While debriefing after the simulation, students were encouraged to process their feelings about the experience. They demonstrated frustration with the lack of choices of the simulation’s central character, Dakota. They described feeling “helpless” and “heavy” when forced to choose between sleeping on the street for a night, staying with an abusive boyfriend, or living in a hotel known for prostitution and illegal drugs. In the simulation, the central character was presented multiple times with the dilemma of going cold or hungry on the streets or engaging in sex for money to afford food and shelter. Students remarked that they were surprised how easily they rationalized the decisions they were making in the simulation.

Surveys were provided before the start and at the conclusion of the simulation to assess students’ self-reported levels of compassion. A modified version of the Santa Clara Brief Compassion Scale was used for self-reporting levels of compassion (Strauss et al., 2016). Students had a 1.74% increase in compassion scores after the simulation. Pre and post-simulation surveys also assessed students’ self-reported awareness of human trafficking based upon a Likert Scale. While all surveyed students agreed that, “Human trafficking is a problem in the Upstate,” more students “strongly agreed” with this statement after the simulation. To assess moral judgment of sex workers as an indicator of stigma, students were asked to what extent they agreed with the statement, “Prostitutes are immoral.” While 8.4% of student respondents “agreed” or “strongly agreed” with this statement before the simulation, only 4.8% of student respondents “agreed” or “strongly agreed” with this statement after the simulation. This suggests that after contemplating the limited choices of victims of human trafficking, students were less apt to form a negative moral judgement of them.

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre</th>
<th>Post</th>
</tr>
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<tbody>
<tr>
<td>To what extent do you agree with this question?</td>
<td>75% Strongly agree 25% Agree 0% Neither agree nor disagree 0% Disagree 0% Strongly disagree</td>
<td>85.7% Strongly agree 14.3% Agree 0% Neither agree nor disagree 0% Disagree 0% Strongly disagree</td>
</tr>
<tr>
<td>“Human trafficking is a problem in the Upstate.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To what extent do you agree with this statement?</td>
<td>4.2% Strongly agree 4.2% Agree 33.3% Neither agree nor disagree 37.5% Disagree 20.8% Strongly disagree</td>
<td>4.8% Strongly agree 0% Agree 28.6% Neither agree nor disagree 23.8% Disagree 42.9% Strongly disagree</td>
</tr>
<tr>
<td>“Prostitutes are immoral.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compassion Score</td>
<td>Average: 4.39</td>
<td>Average: 4.67</td>
</tr>
</tbody>
</table>

Student nurse strategies for screening patients for signs of victimization by human trafficking also improved from pre-simulation to post-simulation. Before the simulation, student survey responses focused mostly on physical assessment of the patient, and after the simulation, student survey responses more frequently mentioned screening patients for substance abuse and fostering a trusting and non-judgmental relationship with the patient.
Sample Student: Suggestions for Screening Patients for Signs of Victimization by Human Trafficking

| Pre-Simulation: | “Look for abnormal bruising or discoloration on the skin. Ask (private) relevant and personal information about their activity and who they are affiliated with.” |
| Post-Simulation: | “Screening starts by building rapport with the victim. Trauma bonding may impede interacting with the client as they may view your help as not being helpful. Ask the client open-ended questions to elicit a response. Have you ever worked without getting the payment you thought you would get? Did anyone you worked for or lived with trick or force you into doing anything you did not want to do? Did anyone ever pressure you to touch another person or have any unwanted physical or sexual contact with another person? Etc. These are a few questions nurses can ask to probe into their life and see what red flags stand out and are cause to investigate further.” |

Conclusions

Experiences like this simulation are valuable for students—to increase their awareness of public health issues such as human trafficking and to partner with community agencies to identify supportive community resources. When surveyed, all participating students agreed that this simulation was a valuable part of their nursing education. Unfortunately, the problem of human trafficking is vast and challenging; it is a relevant topic that should be included in today’s nursing curriculum. Through this simulated exercise, bachelors-level nursing students were able to demonstrate increased measures of self-reported compassion, decreased negative moral judgement of prostitutes, increased awareness about human trafficking and increased skills in screening patients for signs of victimization by human trafficking.

Acknowledgements

This impactful experience for students and faculty would not have been possible without the work of Jasmine Road. For their dedication to the cause of rehabilitating victims of human trafficking and raising awareness of human trafficking, I am sincerely grateful. I am also appreciative for the support and mentorship of Sarah Branan, MSN. She initially introduced me to this simulation opportunity with Jasmine Road, and she was very supportive in bringing this opportunity to campus for students.

References


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Identifying Predictors of Increased Nocturnal Activity by Wildlife Taxa

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Abstract — Increased nocturnal activity by wildlife taxa in response to human disturbance is an increasingly well documented phenomenon; however, identifying the causes of these changes, and whether these causes vary at different spatial scales is less well studied. We identified predictors of increased nocturnal behavior by local wildlife in the Upstate region of South Carolina. Significant increases in nocturnal behavior were detected for all taxa observed as well as for white-tailed deer (Odocoileus virginianus) and raccoons (Procyon lotor). Predictors of increased nocturnality include habitat type, distance to buildings and roads, and dynamic anthropogenic disturbances. Changes in nocturnality are influenced by, and can be mediated by, habitat type.

Keywords — camera traps, human disturbance, diel activity, camtrapR, QGIS

Introduction

As humans continue to alter the natural landscape, it is crucial that we understand the impacts these alterations have on wildlife species (Sutherland, 2007). Historically, wildlife could change their physical location as a means of avoidance when humans encroached upon, and altered, their habitats. However, this type of avoidance is becoming more difficult due to increasing habitat fragmentation and destruction, which severely limit the available refugia (Cruz et al., 2018). Wildlife populations have been observed to minimize their interactions with humans by shifting their periods of activity (Oberosler et al., 2017). For example, wild boars in the Tochigi prefecture of Japan shifted to more nocturnal behavior to minimize interactions with humans during hunting season (Ohashi et al., 2013).

Although the impacts of human disturbances on wildlife behavior are increasingly well understood, most recent research has focused on landscape-level modifications such as clear cutting (Foster et al., 1999). Analysis of smaller-scale and temporary disturbances (e.g., hiking, dog walking, fishing) is rare. Examining the results of human disturbance at multiple spatial scales is vital so that we can develop more useful and more specific management plans for at-risk taxa. Our study examines the effects of human disturbance on the activity patterns of common mammals in different habitat types at local spatial scales in the Upstate region of South Carolina. We hypothesize that there will be increased nocturnal behavior at locations with high levels of different types of human disturbance, and that this effect will be magnified in more open habitats.

Methods

This study was conducted at five sites in the Upstate region of South Carolina between May 2018 and December 2019. Trail cameras (Stealth Cam STC-G545NG) were placed at 15 stations among the five sites (1 to 4 cameras per site). Cameras recorded photos in bursts of three pictures each time movement was detected. Species presence and abundance data were compiled by identifying each taxon present in each burst and recording the number of individuals present. This information was added to the metadata of each image using DigiKam 7.0 (https://www.digikam.org) and the R package camtrapR (Niedballa et al., 2016). Records of the same taxa recorded within 15 minutes of each other were removed from the dataset to increase independence of our observations.

We quantified human disturbance at local spatial scales using multiple metrics. First, we calculated a dynamic disturbance score (DDS) for each camera station. These scores were calculated as the scaled sum of the human activities (e.g., number of humans, dogs, vehicles, farm animals, etc.) at each station per camera trap day. To identify additional factors important in predicting increased nocturnality, we used QGIS 3.10 (QGIS Development Team, 2019) to calculate other local predictor variables. After removal of correlated variables (|r|>0.75), we included the following variables in our analysis: distance to nearest highway (dHway), distance to nearest smaller road (dRoad), and distance to nearest building (dBldg) for each camera station.

For each taxon detected, percent nocturnality (observations between 20:00 and 6:59 hours) was
calculated at each station. Fisher’s exact tests were used to determine whether percent nocturnality varied significantly by disturbance level or habitat type. Using habitat type, DDS, dHway, dRoad, and dBldg for each station, we built sets of generalized linear models (GLM Poisson model with offset) in R (R Core Team, 2019) and used AIC as our model selection criterion to identify the best predictors of increased nocturnality at a local scale.

**Results**

Of the fifteen camera sites, four sites were classified as zero human disturbance (mean DDS=0.6), six sites as low human disturbance (mean DDS=0.3), and five sites as high human disturbance (mean DDS=4.4). We found a significant increase in the proportion of nocturnal disturbance (mean DDS= 4.4). We found a (mean DDS=0.3) , and five sites as high human (when all taxa observed were considered together O. virginianus (raccoons) and P. lotor nocturnal behavior was detected for both taxa between low DDS and high DDS (p<.001) sites. No increase was detected for either of these taxa between low DDS and high DDS sites. There was a significant increase in nocturnality for all taxa between low DDS and high DDS habitats (p<.001, see Table 1). Additional increases in nocturnal behavior were observed for O. virginianus between forest, edge and open habitats (p<.001) and for P. lotor between forest and open habitats and edge and open habitats (p<.001). No increase in nocturnality was detected for P. lotor between forest and edge habitats. To identify the variables most important in predicting increased nocturnality at this local spatial scale, we chose the model with the lowest AIC score. The variables included in this best model were DDS, habitat type, dRoad, and dBldg.

**Conclusions**

We observed an overall increase in nocturnal behavior for all taxa present, as well as for O. virginianus and P. lotor, in more open habitats and sites with a higher DDS. All of the predictors of increased nocturnal behavior (shorter distances to roads and buildings, higher DDS, and habitats with less cover) may be indicative of higher human presence (with the possible exception of canopy cover).

This increased human presence can be categorized as either temporary dynamic disturbance or permanent disturbance. Protected areas, such as national parks, have fewer permanent disturbances such as buildings and roads; however, despite their protected status, these areas are not immune from the effects of dynamic disturbances. With recent increases in outdoor tourism (Margules & Pressey, 2000), a greater human presence in protected areas could lead to greater nocturnal behavior. The effects of these dynamic disturbances can, at least in part, be mitigated by habitat type. While mammals living in both open and forested habitats with high human presence may show more nocturnal behavior, we would expect this trend to be intensified in open habitats (Cruz et al., 2018). Increased canopy cover may decrease the magnitude of changes in activity patterns.

Understanding the role of habitat type and other predictors of increased nocturnality is a necessary first step in understanding how community dynamics will change in increasingly altered (both naturally and anthropogenically) environments. Additionally, knowing whether these predictors are consistent in different types of habitats and across multiple spatial scales will be necessary for improving land management practices. We intend to quantify the predictors of increased nocturnality in other habitat types and at different spatial scales to better understand the role of disturbance in changes in the activity patterns of wildlife taxa.

**Acknowledgements**

We would like to thank the Lander University College of Science & Mathematics and the Beta Beta Beta Research Scholarship Foundation for funding; Kevin Cartee at the Fellowship Camp and Conference Center, Ann Butler and the Greenwood Parks and Trails Foundation, Jason & Ashley Lee, Joanne & Tom Hochheimer, and Fayette Yenny at Lake Greenwood State Park for property access.

**References**


Figures and Tables

Figure 1. Percent of observations for all taxa by time of day at zero, low, and high DDS sites (3537 camera trap days). Differences in percent nocturnality between each category of disturbance were detected (p<.001), nocturnal observations were fewest at zero DDS sites, and greatest at high DDS sites.

Table 1. Proportion of nocturnal (20:00–06:59h) observations of wildlife at zero, low, and high DDS sites and in forest, edge, and open habitats. Data are provided for Procyon lotor and Odocoileus virginianus and collectively for all taxa (different subscripts indicate significant differences, p<.001 for all tests).
Behavioral Patterns of Carnivores in Urban Greenways and Rural Forests

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Abstract – An increase in urbanization creates distinct challenges for native fauna. Decreasing rural forest habitats forces an increase in species richness and subsequently increases competition among carnivores within a given habitat. We sought to determine if the cohabitation of feral and domestic cats (Felis catus) with native carnivores such as coyotes (Canis latrans), raccoons (Procyon lotor) and red foxes (Vulpes vulpes) within urban greenways and rural forests leads to a change in the expected behavior patterns of these animals. We used trail cameras to survey a total of 45 sites within Spartanburg County, SC to determine if there were any correlations between the different types of habitats and the presence and/or absence of a particular carnivore. The cameras were monitored from June-August with a bait station containing a 1:1 catnip and canola oil mixture (baited season) and from September – December without bait (unbaled season). Our study found no significant difference in cat events between baited and unbaited seasons. Domestic cats, raccoons, red foxes and gray foxes showed significantly more events in urban greenways than in rural forests. High-density residential housing, commercial housing, and presence of coyotes did not have an effect on cat events in our study.

Keywords- GIS, Landscape, Mesocarnivore, Mesopredator, Piedmont

Introduction

Increasing urbanization results in an obvious reduction in the availability of rural habitat and subsequently leads to an increase in competition among native wildlife. Though this competition is likely brought about from a sheer lack of space, and thus limited resources, these habitats are also subject to increased species richness resulting from the encroachment of domestic animals. Carricondo-Sanchez et al. (2019) indicates that the combination of these conditions impacts the expected behavior patterns of the wildlife native to these habitats.

This brings to question whether the influx of species into urban greenways includes an increase the number of carnivores present in these habitats. A study conducted by Loss and Marra (2017) suggests that the biggest carnivorous threat to small mammal wildlife in urban greenways is the ever growing feral and domestic cat (Felis catus) population. While the predatory threat domestic cats pose on small mammal populations is well studied, the extent of their habituation patterns in urban greenways remains unclear.

In addition to domestic cats, urban greenways provide a possible habitat for other adaptable carnivores such as red foxes (Vulpes vulpes), gray foxes (Urocyon cinereoargenteus) and coyotes (Canis latrans). A study by Kays et al. (2015) found that while the habitats for feral cats and coyotes often overlap in urban greenways, domestic cats are far less likely to be found in areas with dense coyote populations. As generalists, coyotes are known to be extremely adaptable, yet exhibit a strong aversion to human interaction. This leads us to expect coyote presence in urban greenways with increased nocturnal behavior in these habitats. For this study, we asked the following questions: i.) Do urban greenways have higher carnivore activity than rural forests? ii.) Does baiting cameras with catnip increase the number of feral and domestic cat detections? iii.) Does the abundance of high-density residential housing, commercial housing, or the presence of coyotes affect the number of feral and domestic cat events?

Materials and Methods

We placed Browning Strike Force HD and Bushnell Trophy Cam trail cameras 1 m from the ground, on trees adjacent to obvious game trails in 45 different locations across urban greenways (n= 22) and rural forests (n= 23) in Spartanburg County, SC. Site independence was established by ensuring a minimum distance of 1 Km between each camera. We monitored the cameras for wildlife activity from June 1, 2019 through December 31, 2019. This duration was split into a baited season (June through August) and an unbaited season (August through December), following the protocol of Kelly and Holub (2008). During the baited season, a cotton ball soaked in a 2 mL solution of 1:1 catnip and canola oil was placed inside a 4 oz plastic container. This container was secured to a tree approximately 1 meter in front of the trail camera.
Cotton balls were changed, and the cameras were checked in 10-day intervals, during the baited season, to establish presence and/or absence of each species at each site. During the unbaited season, cameras were checked every 10-14 days.

Wildlife activity was captured by the camera’s infrared motion sensors, which were programmed to capture 2-3 images with each trigger. Time and date stamps were included on each image captured. Individual animals captured within a single 30-minute interval were considered a single event. Event totals were standardized to number of events per 100 days to account for periods when cameras were inactive.

Two sample t-tests were used to compare individual species events across urban greenways and rural forests. We used a paired sample t-test to compare domestic cat events in baited and unbaited seasons. Whether the number of cat events was influenced by an abundance of high-density residential housing, commercial housing or the presence of coyotes was determined using a multiple linear regression. Raw data was square root transformed for normalcy and all statistical analysis was completed in Minitab 19.

Results

There was not a significant difference in the number of cat events per 100 days in the baited season compared to the unbaited season (t = 0.84; df = 16; p = 0.414). Our study found a significant difference between the number of events of domestic cats (t(21)=2.27; p=0.034), gray fox (t(21)=2.35; p=0.029), red fox (t(21)=3.50; p=0.002), and raccoon (t(22)=3.38; p=0.003) in urban greenways compared to those in rural forests. There was not a significant difference in the number of coyote events (t(32)=1.36; p=0.185) between the two habitats. Based on the multiple linear regression, abundance of high density residential housing (t(1)=1.86; p=0.070), commercial housing (t(1)=1.90; p=0.064) and presence of coyotes (t(1)=0.20; p=0.843) did not significantly impact the number of cat events in our study.

Conclusions

Our results show that baiting study sites with catnip does not significantly increase the number of recorded cat events. Therefore, it is not recommended to use this methodology in future studies. This conclusion is consistent with the finding of Read et al (2015). Their research suggests that the concentration of olfactory lures may dissipate over time, especially in hot, dry conditions, rendering usage statistically insignificant. For our survey, there were significantly more events of all species, except for coyotes, in urban greenways compared to rural forests. Gehrt et al. (2013) suggests that these smaller carnivores may adapt easily to urban environments in an attempt to avoid larger predators, which are less likely to inhabit these areas. In another study, Theimer et al. (2015) indicates the increased presence of these small carnivores in urban areas is likely a result of them benefiting from increased availability of resources, stemming both directly and indirectly from human interaction. In contrast to the aforementioned studies, our study yielded no correlation between the number of cat events and abundance of high-density residential housing, commercial housing or the presence of coyotes.

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References


**Figures**

![Graph showing mean (± SE) number of domestic cat (*Felis catus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), and red fox (*Vulpes vulpes*) events per 100 days across urban greenways (n=22) and rural forests (n=23) in Spartanburg County, SC.]

**Figure 1.** Mean (± SE) number of domestic cat (*Felis catus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), and red fox (*Vulpes vulpes*) events per 100 days across urban greenways (n=22) and rural forests (n=23) in Spartanburg County, SC.
Temporal Avoidance of Predators by Omnivores and Herbivores

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Abstract — When threatened, mammals may change their behavior by altering the space they occupy or the times that they are active. In this study, we observed activity patterns of omnivores and herbivores when in the presence of apex predators and mesopredators. We found no evidence of spatial avoidance, and we even found that mesopredators and omnivores were positively correlated. However, we did find evidence that supported herbivore and omnivore temporal avoidance of both higher trophic levels indicating that apex predators and mesopredators suppress activity of lower trophic levels.

Keywords — camera trap, avoidance, apex predator, mesopredator, trophic level

Introduction

Apex predators play an important role in the structure of communities (Ripple et al., 2014). These predators such as black bears, coyotes, and bobcats can kill or instill fear in smaller species which can lead to a trophic cascade, changing the abundance of every trophic level within an ecosystem. When there are fewer apex predators, smaller mesopredators are released from the pressures of competition and predation, which can increase mesopredator populations and threaten lower trophic levels (Ritchie & Johnson, 2009).

Because larger predators pose a threat to smaller mammals, smaller predators and prey may change their behavior to avoid the danger of apex predators. These smaller mammals may try to avoid predators either by moving to a different area or by changing the times when they are active during the day (Brook et al., 2012). For example, raccoon activity was suppressed for a longer time after a coyote sighting than if there were no coyotes sighted in the area (Parsons et al., 2016).

Human disturbance has resulted in the displacement of apex predators, leading to ecosystem change (Ritchie & Johnson, 2009). With few apex predators in a habitat, mesopredator populations increase, potentially changing the threat to lower trophic levels. This study aims to characterize the effects of both apex predators and mesopredators on spatial and temporal avoidance strategies of omnivores and herbivores. We hypothesize that apex predators and mesopredators will have a similar effect on lower trophic levels, causing herbivores and omnivores to be less common in sites where predators are abundant and during times that predators are active.

Methods

This research was conducted in the South Carolina counties of Greenwood, Laurens, and Pickens. Sixteen stations were set up with camera traps (Stealth Cam STC-G545NG) at four sites. The photos were collected and the species present, number of individuals, date, and time for each photo were recorded and added to the metadata of each image using DigiKam 7.0 and the R package camtrapR (http://www.digikam.org; Niedballa et al., 2016). Species were divided into trophic levels and classified as either an apex predator (A), mesopredator (M), omnivore (O), or herbivore (H). The species that were classified as A were coyotes (Canis latrans), black bears (Ursus americanus), and bobcats (Lynx rufus). Trophic level M consisted of gray foxes (Urocyon cinereoargenteus) and red foxes (Vulpes vulpes). Trophic level O was raccoons (Procyon lotor), Virginia opossums (Didelphis virginiana), nine-banded armadillos (Dasypus novemcinctus), striped skunks (Mephitis mephitis), and feral cats (Felis catus). White-tailed deer (Odocoileus virginianus), eastern cottontail rabbits (Sylvilagus floridanus), and eastern gray squirrels (Sciurus carolinensis) were grouped into trophic level H.

To test for spatial avoidance of predators, the data obtained from the pictures were sorted by station. For each station and each trophic level, the number of observations was divided by the number of active camera trap days for that particular location. A linear correlation was used to determine the relationship between each trophic level and all other trophic levels. A t-test was performed to test the significance of r.

To test for temporal predator avoidance, observation windows for herbivores, omnivores, and mesopredators were calculated. An observation window (OW) is defined as the time between an observation of a member of one trophic level and the observation of another member of the same trophic level.
trophic level (Figure 1A). For example, if two deer were sighted consecutively, the OW would be THH. However, if there was a sighting of a coyote between the two deer, it would be THAH. OWs were calculated for every mammal observation. Comparisons were made between the mean OWs at each site that did not include higher trophic levels (e.g., THH) and the mean OWs at the same site that included higher trophic levels (e.g., THAH, THMH, and THOH) using a Wilcoxon signed-ranks test.

Results

Spatial avoidance was not found between any trophic levels, however, we found that mesopredator and omnivore abundance were positively correlated ($r_{5}=.557$, $p=.02$). Herbivore abundance was not correlated with omnivore abundance ($r_{5}=-.631$, $p=.125$), mesopredator abundance ($r_{5}=.241$, $p=.352$), or apex predator abundance ($r_{5}=-.1905$, $p=.465$). Omnivore abundance was not correlated with apex predator abundance ($r_{5}=-.093$, $p=.723$).

Overall, we observed that mammals in lower trophic levels temporally avoided mammals in higher trophic levels. The overall mean OW was 6.7 to 24 times longer when in the presence of higher trophic levels. The length of the herbivore OWs was significantly longer when omnivores ($W_{o}=55$, $p=.0054$), mesopredators ($W_{o}=60$, $p=.0198$), and apex predators ($W_{o}=28$, $p=.02$) were detected (Figure 2A). Mesopredators had a similar effect on the omnivore OWs ($W_{o}=45$, $p<.01$, Figure 2B). We had too few observations ($n=4$) to statistically analyze the effects of apex predators on omnivores; however, the mean omnivore OW was 17 times longer when in the presence of apex predators.

Conclusion

We found no spatial avoidance between trophic levels and the opposite trend was found between mesopredators and omnivores (Figure 1B). The positive correlation between these two trophic levels could be attributed to similar dietary needs. Since there is a possible diet overlap, this could cause animals from both trophic levels to be common at sites with high resources. As expected, we found that lower trophic levels temporally avoided higher trophic levels (Figure 2). We observed an increase in OWs of omnivores and herbivores when in the presence of both mesopredators and apex predators (Figure 2), indicating that lower trophic levels decrease activity during times when predators are also active.

Apex predators have the ability to affect the behavior of lower trophic levels by instilling fear in prey and competing with mesopredators. As a result, apex predators may cause other trophic levels to alter the space or times when they are active (Ritchie & Johnson, 2009). We found that apex predators and mesopredators had a similar effect on the behavior of omnivores and herbivores. Apex predators also suppressed mesopredator activity, but apex predators were rare or absent at most of our sites. Mesopredators were much more common in our study and may have had a larger impact on herbivore and omnivore activity as a result. Future studies should attempt to determine if the suppression of mesopredators by apex predators benefits lower trophic levels by allowing herbivores and omnivores greater periods of activity.

Acknowledgments

We would like to thank the Lander University College of Science and Mathematics and individuals and organizations providing access to camera trap sites: Kevin Cartee at FCCC, Lander University, Ann Butler and the Greenwood Parks and Trails Foundation, Jason and Ashley Lee, Joanne and Tom Hochheimer, and Fayette Yenny at Lake Greenwood State Park.

References


Figures

Figure 1. (A) Method used to determine temporal avoidance. The time between observations of animals in the same trophic level with no other trophic levels detected in between was compared to the time between observations with a higher trophic level detected in between. (B) Comparison of mesopredator and omnivore observations per camera trap day for each site. The two trophic levels were positively correlated ($r_{15} = .557, p = .02$).

Figure 2. (A) The change in the OW of herbivores when in the presence of apex predators, mesopredators, and omnivores. The herbivore OW increased significantly when in the presence of omnivores ($p = .0054$), mesopredators ($p = .0198$), and apex predators ($p = .02$). (B) The change in the OW of omnivores when in the presence of apex predators and mesopredators. The omnivore OW increased significantly when in the presence of mesopredators ($p < .01$). Sample size (n=4) was too small to statistically determine significance between omnivore and apex predator OWs.
Are Omnivores Partitioning Resources?

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Abstract — Increased competition between species who share resources has been known to lead to resource partitioning. The relationship between raccoons (Procyon lotor) and opossums (Didelphis virginiana) has been previously studied, but how these species adjust to increased competition due to the presence of a new competitor, the nine-banded armadillo (Dasypus novemcinctus), is unknown. In this study we observed raccoons, opossums, and nine-banded armadillos to determine if temporal and spatial resource partitioning are occurring. We found no evidence of spatial resource partitioning between the three species. However, we did find evidence of temporal partitioning between raccoons and opossums, and raccoons and armadillos. Our results show that competition is driving species to avoid each other in time, but not space.

Keywords — camera trap, competition, temporal resource partitioning, spatial resource partitioning

Introduction

Resource partitioning occurs as a result of closely related species competing over resources (Schoener, 1974). To minimize competition, species may partition resources through specialization in diet or habitat use. Temporal resource partitioning occurs when species divide habitat use based on the time of day. When species divide resources based on location instead time, spatial resource partitioning is occurring (Schoener, 1974).

As a result of the removal of apex predators and habitat fragmentation, mesopredator populations have increased (Ginger et al., 2003). These changes can lead to differences in the availability of resources, which can impact competition between species in the affected environment (Ritchie & Johnson, 2009). Raccoons (Procyon lotor) and Virginia opossums (Didelphis virginiana) are omnivorous mesopredators known to have many similarities in their habitat use and diets (Carver et al., 2011). Another medium-sized omnivore that requires similar resources, the nine-banded armadillo (Dasypus novemcinctus), has expanded its range into South Carolina within the last 30 years (Taulman & Robbins, 2014). The presence of a new competitor further increases the competition between these species. By partitioning resources, either spatially or temporally, the effects of competition between these omnivores can be reduced (Ginger et al., 2003). In this study, the temporal and spatial patterns of raccoons, opossums, and armadillos were analyzed to determine if spatial and/or temporal habitat partitioning were occurring between the study populations.

Methods

Data for this study were collected in four sites in South Carolina: Fellowship Camp and Conference Center (CF) in Laurens County, Lake Greenwood State Park (LG), the City of Greenwood (GSP and LH), and land near Table Rock State Park (LTR) in Pickens County. Trail cameras (Stealth Cam STC-G545NG) were placed at 16 different stations within four sites. Cameras were initially deployed in May 2018, and additional cameras were set up as they became available. Cameras captured photos in bursts of three. For each image, the time, date, station name, and temperature were recorded. The species observed in the photos were identified and counted, and this information was added to the metadata of each image using DigiKam 7.0 (https://www.digikam.org) and the R package camtrapR (Niedballa et al., 2016). The data were then narrowed to only observations that included raccoons, opossums, and armadillos.

To test for spatial habitat partitioning, the number of times each species was observed at each station was divided by the total number of days a camera was deployed at that station (i.e., camera days). Linear correlations between the number of observations of each pair of species were performed to determine the Pearson correlation coefficient (r) for each pair of species. A t-test was used to test the significance of r.

To test for temporal resource partitioning, the time between sightings of individuals of the same species, or observation window (OW), was calculated. The TRR OW represented the time between one raccoon sighting and the next raccoon sighting at that station when no opossums or armadillos were detected in the intervening time. The TOR OW represented the time between raccoon sightings when an opossum was observed between the raccoon sightings. The TAR OW represented the time between raccoon sightings when an armadillo
was observed between the raccoon sightings (Figure 1a). Nine different OWs were quantified: TRR, TORR, TARR, TOO, TOAO, TAA, TARA, TAOA. To test for raccoon avoidance of opossums across all stations, the TRR and TORR observation windows were compared using a Wilcoxon signed-ranks test. Due to smaller sample sizes, the Mann-Whitney test was used to test for avoidance between raccoons and armadillos, opossum and armadillos, and armadillos and raccoons at individual stations. Sites with fewer than five observations were not tested. All tests were considered significant if \( p \leq 0.05 \).

**Results**

When testing for spatial resource partitioning, positive correlation between the number of raccoons and the number of opossums per camera day was detected (\( r_S=0.56; \ p=0.018 \)). We detected no relationship between opossums and armadillos, or raccoons and armadillos (\( p>0.05 \) for all). Temporal resource partitioning was detected between raccoon and opossums (Figure 1b). The T_{RO} OW was significantly longer than the T_{RR} OW (\( W=-28; \ p<0.05 \)). At two stations (CF1 and CF3), opossums were observed avoiding raccoons (Figure 2a and 2c). The T_{ORO} OW was significantly longer than the T_{OR} OW (\( U_a>300; \ p<0.05 \) for both sites). At station CF1, there was no significant difference in the T_{OR} and T_{OAO} OW (\( U_a=118; \ p=0.436 \)), indicating that armadillos do not avoid opossums. At a third station (LG3), a significant difference in the T_{AA} and T_{ARA} OW was detected, indicating that armadillos avoid raccoons (\( U_a=8; \ p=0.0023 \)) (Figure 2b).

**Conclusions**

We detected no spatial resource partitioning between raccoons, opossums, and armadillos. The positive correlation between the presence of raccoons and opossums is likely driven by the large overlap in the diets of these species. Locations that are abundant is resources likely attract high numbers of both species. Although we saw no evidence of habitat partitioning in space, we did find evidence of habitat partitioning in time. Temporal resource partitioning was observed between raccoons and opossums, and raccoons and armadillos, but not between armadillos and opossums.

Previous research had shown that opossums and raccoons do not temporally partition resources (Carver et al., 2011). The results of this study show slightly different outcomes, likely due to the difference in the methods used. The previous study analyzed the time of day each species was active and found no significant difference. In contrast, our study looked at if the activity of one species inhibits the activity of another, regardless of the time of day. By using this method, we were able to detect more subtle divisions of resources between the different species. Resource partitioning between armadillos and raccoons and opossums has not been previously studied. The recent expansion of armadillos into this area poses a potential increase in competition for raccoon and opossums. We found evidence of this in the temporal partitioning that was observed between raccoons and armadillo. However, the number of armadillos observed in this study was fairly small. In order to study the impact of their presence on raccoons and opossums in more depth, more data are needed. The expansion of the armadillo population is also still relatively new. As the population becomes more established, and raccoons and opossums have more time to adapt to a new competitor, resource partitioning should be observed.

**Acknowledgements**

We would like to thank all the organizations and individuals who provided us with sites for camera traps: Kevin Cartee at FCCC, the Lander University College of Science and Mathematics, Ann Butler, Greenwood Parks and Trails Foundation, Dr. Jason Lee, Joanne and Tom Hochheimer, Fayette Yenny at Lake Greenwood State Park, and the Lander Foundation.

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**Figures**

**Figure 1.** (a) Example of how OW $T_{RR}$ was defined verses how OW $T_{RAR}$ was defined. The OWs were calculated as minutes between observations of the same species. (b) $T_{RR}$ OW compared to $T_{ROR}$ OW for all stations. The $T_{RR}$ OW was significantly smaller ($p<.05$).

**Figure 2.** Results of Man-Whitney test for stations CF3, LG3, and CF1 (a) $T_{OO}$ OW compared to $T_{ORO}$ OW at station CF3. The $T_{OO}$ OW was significantly shorter ($p<.0001$). (b) $T_{AA}$ OW compared to $T_{ARA}$ OW at station LG3. The $T_{AA}$ OW was significantly shorter ($p=.0023$). (c) $T_{OO}$ OW compared to $T_{ORO}$ OW at station CF1. The $T_{OO}$ OW was significantly shorter ($p=.0087$).
Mating Calls of Enchenopa binotata Halesia, a New Member of the Two-marked Treehopper Species Complex

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Abstract – Two-marked treehoppers are a complex of 11 species evolving via sympatric speciation in eastern North America. We recently discovered a twelfth member of this complex, tentatively named Enchenopa binotata Halesia, that uses the Carolina silverbell (Halesia carolina) as a host tree. For this new species, we sought to determine when nymphs emerge, when mating occurs, and to compare male mating calls to other members of the complex. We found that nymphs emerge in mid-April after the flowering period and leaf emergence on Carolina silverbell. Mating activity occurred from early August to late September, but was most pronounced from early to mid-September. Overall, the waveforms of male mating calls for Enchenopa binotata Halesia were similar to other members of the complex. Whine length was comparable to E. binotata Viburnum and E. binotata Cercis and the dominant frequency at the end of the whine was most similar to E. binotata Viburnum.

Keywords: Evolution, Frequency, Insect, Signal structure, Waveform

Introduction

The two-marked treehoppers (Enchenopa binotata) are a clade of eleven species ranging across Eastern North America (Cocroft et al., 2008). The members of this complex are a classic example of sympatric speciation through host shifts to new tree species (Hsu et al., 2018). Species within this complex can be distinguished based on mating calls, the timing of mating activity, nymph morphology, and the host tree used for mating and egg laying. Differences in host tree phenology promote speciation within the group, as well as the strong host fidelity and female mating preference for conspecifics (Mallet, 2001).

Species within the complex rely on courting behaviors and vibrational mating calls on tree branches to find a mate. Male mating calls are similar between species. Each call or signal begins with a whine component of increasing frequency that is followed by a series of pulses (Figure 1). There are, however, unique components to the call of each species. These differences in male signal structure encourage reproductive isolation by female choice (Rodriguez et al., 2004).

In October of 2018, one of us (JJS) made the serendipitous discovery of a twelfth member of this species complex in Spartanburg, SC (Figure 2). This new species uses the Carolina silverbell (Halesia carolina) as a host tree. Several adults were seen on Carolina silverbells, along with numerous egg masses. Within the two-marked treehoppers there is one generation per year, with nymphs overwintering within the egg mass and emerging in spring (Wood et al., 1983). Nymph emergence correlates with flowering or the emergence of leaves in spring (Lin et al., 2002).

In this study, we sought to determine i) when nymphs emerge in spring, ii) when mating activity occurs, and iii) the acoustic features of male mating vocalizations.

Materials & Methods

We monitored Carolina silverbell trees with known egg masses for nymph emergence several times each week from late winter until the beginning of nymph emergence. We recorded the mating calls of male E. binotata at five field sites in Spartanburg County, SC during the summer and fall of 2019. We began attempting audio recording shortly after the first adults enclosed on 28 May 2019. Because we did not know when this species would exhibit mating activity, both during the year and during the day, we monitored treehoppers across a wide temporal range. We recorded mating calls using a Luvay 27 mm piezoelectric disk firmly placed on a thin Carolina silverbell branch using a metal hair clip. The disk was placed within 3 cm of the calling male. Recordings were sent through a Tascam iXR audio interface and recorded on a tablet. While recording, we monitored the temperature of the treehopper using a Fluke infrared thermometer.

Before analyzing male calls, we high-pass filtered the audio at 50 Hz and -12 dB. Using Audacity 2.3.3, we quantified the following components of each male mating call: signal length (sec), whine length (sec), dominant frequency (Hz), number of pulses, pulse length (sec), and pulse rate per second (Figure 1). Within each calling bout, we analyzed the signal with the clearest waveform.
Results and Discussion

We found the first nymphs on 18 April 2019. Clusters of nymphs were on leaf petioles near the base. Similar to other species in the complex, nymphs emerged soon after the Carolina silverbells flowered (occurred on 7 April 2019) and leaves emerged.

The first mating calls were detected on 1 August 2019 and mating activity continued into late September 2019. Although we observed some mating activity in early August, the main period was from early to mid-September. Mating activity occurred in the mornings from approximately 0900 – 1200.

Due to several factors (e.g. wind, microphone placement relative to treehoppers), many of the recorded calls were not of sufficient quality for auditory analysis. We analyzed the waveforms of eight calls collected from five males at three of our field sites. As expected, the male mating calls of *E. binotata* Halesia (Figure 1) were similar to the other members of the species complex (Table 1; Cocroft et al., 2008). Signals ranged from 0.67 – 1.00 seconds in length and were most comparable to *E. binotata* Viburnum and *E. binotata* Cercis (Rodriguez & Cocroft, 2006). The dominant frequency at the end of the whine ranged from 204.1 – 227.3 Hz, which is most similar to *E. binotata* Viburnum. Whine length ranged from 0.351 – 0.682 sec and was most similar to *E. binotata* Ptelea and *E. binotata* Viburnum. The number of pulses ranged from 4 – 6, which is typical of other *E. binotata* species (Cocroft et al., 2008).

Future work will focus on recording additional male mating calls, as well as documenting the calls of females. We have also collected all five nymph stages of *E. binotata* Halesia and are working to describe their morphology relative to other members of the complex (Pratt & Wood 1992).

Conclusions

Similar to other members of the species complex, nymph emergence occurred shortly after the emergence of flowers and leaves on the host tree. The primary mating season was in early to mid-September, with males being most vocal in the morning hours. Similar to other members, male *E. binotata* Halesia signals consist of a whine followed by a series of pulses. Our acoustic analyses show that *E. binotata* Halesia shares similar vocal qualities, such as whine length and dominant frequency, to *E. binotata* Ptelea, *E. binotata* Viburnum, and *E. binotata* Cercis.

Acknowledgments

We thank the Spartanburg Area Conservancy, Partners for Active Living, Pacolet Milliken Enterprises, and Mack Shealy for land access. Melissa Storm provided assistance with building the microphone.

References


Figures & Table

**Figure 1.** Waveform (dB) of a male *E. binotata* Halesia mating call recorded at 26.5 °C in Roebuck, SC. For each call analyzed, we measured the signal length, which includes the whine and a series of pulses.

**Figure 2.** Adult female *Enchenopa binotata* Halesia resting on the branch on a Carolina silverbell (*Halesia carolina*) in Spartanburg, SC. A white egg mass is located near the base of the leaf petiole.

**Table 1.** Mean (± SE) characteristics of male *E. binotata* Halesia mating calls (n = 8) collected from five individuals in Spartanburg, SC.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Length (sec)</td>
<td>0.87 ± 0.05</td>
</tr>
<tr>
<td>Whine Length (sec)</td>
<td>0.55 ± 0.04</td>
</tr>
<tr>
<td>Dominant Frequency (Hz)</td>
<td>213.03 ± 2.88</td>
</tr>
<tr>
<td>Number of Pulses</td>
<td>5.00 ± 0.27</td>
</tr>
<tr>
<td>Pulse Length (sec)</td>
<td>0.07 ± 0.00</td>
</tr>
<tr>
<td>Pulse Rate (number/sec)</td>
<td>18.23 ± 0.79</td>
</tr>
</tbody>
</table>
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Bridging Silos: A Game to Bring Data Management Concepts to All Majors

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Abstract - Information technologies now permeate the fabric of our lives and everyone is affected to varying extents. As a result, a well-prepared college graduate now needs to understand the role data management has in their careers and beyond. This paper describes the importance of data management skills to everyday life and how games are being used to bridge discipline specific silos to foster innovation and broaden the educational experience. The process of devising a scenario-based game is described from conceptualization, to designing, and testing. Concepts from game theory, active learning pedagogies and adult learning theory are used to revise an existing game to meet specific educational goals. The overarching goal of the game is to bring data management awareness, so integral to the information science curriculum, to students in other majors.

Keywords — Data Management, Game Theory, Active Learning, Game Design

Introduction

Within the ivy-covered walls of higher education there exist highly valued and tightly controlled silos of discipline specific knowledge (Cromity & de Stricker, 2011; Miller et al., 2010). This tradition has served the purpose of giving students deep and rigorous insights into their chosen majors. However, the growth and permeation of information technologies into every part of the lives of our students has changed the nature of work, entertainment, and personal relationships. “The capacity to store massive amounts of data and forward them on high bandwidth networks has effected every business sector and generated the need for data skills in the natural sciences, social sciences as well as the arts and humanities [...]” (Boyd & Crawford, 2012). Increasingly and with significant effect, classroom games are forming bridges between academic silos (Meeder & Suddreth, 2012).

A well-designed game encourages deep involvement of the mind with complex reasoning, problem solving, and analysis (Whitton, 2011). Games offer players a chance to fearlessly delve into areas beyond their expertise or even their comfort zones (Lean et al., 2006). For this reason, a game makes a great bridge with which to cross disciplines and form connections that broaden world views. This paper describes the conceptualization, designing, and testing of a game to foster data management awareness to higher education students a non-technical major.

Silos and the Need for Data Management Skills

Data are now a part of all vocations and identifying how it interplays throughout all aspects of our daily lives is now a fundamental skill. Nevertheless, this awareness is often under emphasized or completely neglected in non-technical curriculums.

Across the board, data helps companies find insights, new customers, and process efficiencies that can help them sell more products to the right people, increase productivity, and stretch their dollars further. A 2018 Forbes magazine article summed up the importance of data literacy. “While data scientists are still in demand, the newest conundrum facing today’s organizations concerns the rest of the staff. Data isn’t used in a vacuum: it touches many other roles, and those employees need the literacy to handle it effectively” (Bradford, 2018).

Access to Data Literacy Skills Academically Siloed

Technical concepts such as data management are considered specialty disciplines in academia and the associated skill set tends to remain siloed to the business college, computer science or information management departments (Friedman, 2018). Because of this, students outside more technical disciplines are often unaware of how these technical skillsets could be valuable or required by their future employer (Blanco et al., 2017).

There is considerable cross-discipline literature both from peer reviewed research (Miller et al., 2010) and anecdotal commentary (Gilbert, 2008) addressing the limits and weaknesses of silo thinking. From a business perspective, silo thinking is a symptom of a lack of unified vision and personal insecurities and is part of a culture that either encourages or ignores insular knowledge management practices (Cromity & de Stricker, 2011; Rabary, 2016). The motivation to silo information is often related to perceptions of
power. Futurist Alvin Toffler (1990) noted that knowledge is the ultimate form of power and can be used to acquire both wealth and violence, if applied in the right way. But the sharing of knowledge is also powerful. One clinical audiology article succinctly illustrated the power of inter-discipline collaboration liking it to filmmaking. “[…] it is their success as part of a dynamic collaboration that we remember most” (Pickering & Embry, 2013).

Creating and innovating are fundamental byproducts of information sharing (Blanco et al., 2017). Innovation is also powerful and is often a strategic goal of many organizations, but it cannot be achieved without sharing information across disciplines and ideologies (Kraśnicka et al, 2018).

For the purposes of this paper the question is how to bring the complex topics of data management to students in non-technical majors without boring them thus losing the benefits of the topic. What was needed is a central point of commonality to foster an intrinsic motivation to be involved in the game (Haject, 2017). The concept of innovation, and of being innovative, is a common initiative in every major. A cursory literature review on silo thinking and innovative teaching practices showed that games were a particularly powerful tool to contextualize cross-disciplinary concepts. Games break down silos, drive engagement and let the player mentally apply the experience to their world view (Gudiksen & Inlove, 2018). Scenario-based games can also break down the components of complex subjects and can illustrate how the experience may apply to real life (Lainema et al., 2018; Massey et al., 2005; Sánchez & Olivares, 2011).

**Game Concept and Design**

The game developed to deliver data management concepts to non-technical majors borrows from game theory, adult-learning theory, and active learning pedagogies. Game theory has algorithmic origins and can be quite complex. Game theory lives at the intersection of social science and mathematics, and makes significant appearances in economics, computer science, operations research, and other fields (Hajek, 2017). Game theory, as applied here, provided a process to designing. Game theory also emphasized the benefit that all games have rules and directions which make games portable and repeatable (Whitton, 2011). This alleviates the need for the game designer to be present facilitating flexibility and wider adoption.

Adult learning theory is used here to emphasizes the role of life experience as a component to understanding educational concepts and applying those concepts to problem solving (Whitton, 2011). Active learning practices are being promoted in education and applies here because it focuses on the student being immersed in the content, engaged and part of the problem-solving process (Sarason & Banbury, 2004; Vanhorn et al., 2019).

Fun is also a byproduct of many games and perceptions of the potential for fun increase mental engagement and has been empirically shown to improve learning retention (Massey et al., 2005). Designing games is not the focus of this research nor the authors expertise so an existing game was modified to suit the data management instructional mission. The informational goals of the game are as follows.

1. Identify what types of data organizations gather.
2. Explain how data becomes information.
3. Describe how new data is acquired.
4. Describe how information/data is valued by different organizations.
5. Understand how data is used to create value within and outside of organizations.

The context for which this game was being developed was clear. It was being developed for undergraduate students in a classroom setting. With this clarity it seemed logical to follow what some game designers promote which is to design from the end-user/player(s) back toward the rules and other options (Fee & Holland-Minkley, 2010). A list of probable player and environment conditions was developed:

- Full class able to participate
- Participation had to be constant with no one being left out at any time
- Full play needed to be concluded with discussion time in under 50 minutes which is a traditional class time limit at the target institution.
- No dependence on technology
- Game rules needed to be simple and easy to apply
- Game had to offer a challenge but needed to be relevant to the lives of the students.
- A level playing field was needed so student demographics would not offer any competitive advantage.
- Make the game fun

Using these conditions, a game framework was built around the Dating Game, which was a 1970’s television gameshow. The revised game was titled the Data Game and it followed a format similar to
its progenitor. The class is divided into four randomly assigned groups. Three of the groups will be the “bachelors” or data organizations. These groups are given a sheet that describes what data they use in their daily processes. They are then instructed to choose an existing real-life company that they believe would use data of that type. The possible organizations are:

- Government
- Insurance
- Ecommerce (B2B, C2C, or B2C retail)
- Social Media
- Search Engine
- Telecom Provider

The fourth group will ask questions written in advance on cards to the three data organizations. Follow-up questions can be asked to narrow down what types of organization. The goal of the game is for the fourth group to choose which organization has the most power. The concept of power is not defined for them as that is a large part of the post-play discussion.

**Testing**

The game was tested in a 300-level undergraduate elective course offered in a department of communication. Twenty-two students participated. The game rules and desired outcomes were presented for the first 10 minutes of the class. After the group assignments were made each group was given 10 minutes to read their assignment sheets and decide who they were going to be as a real-life organization. The “bachelorette” group organized and prioritized the prepared questions and discussed possible follow-ups.

Once play began a 15-minute timer was used. Play progressed with little input from the game facilitator. Clarifications of concepts were needed at times as well as questions about how revenue was generated. Once the time concluded, the “bachelorette” group was given 2-minutes to pick which of the organization groups they felt had the most power and what real life company they might be.

After their choice was revealed and the organizational details also revealed there was a post-game discussion on what the students learned. Though the discussion was facilitated, the students drove the direction. The discussion was curtailed after 10 minutes, but it was very active. During the last couple minutes of class, students were asked to comment on the game itself. The comments were:

- Game needs a more well-defined winner and prizes.
- The time allotted was insufficient and the players felt rushed.
- The players unanimously felt that the game did help them learn more about the role of data in their lives and how it will be part of their careers.
- The players also all felt that the game was fun and a good use of the class time.

**Conclusions**

Data management is part and parcel of everyone’s life in the age of information. No longer can discipline specific concepts be siloed within academic institutions if their intention is to offer well prepared graduates. In the case examined here the direction of the sharing effort was from information management to communications. However, the reciprocation is just as valuable. Games are a great way of bridging siloed disciplines and broadening the educational experience.

The single test is insufficient to draw specific conclusion. In future testing more information about the testing environment will be recorded as well as participant demographics. It would be interesting to see if there is a correlation between the demographics of age, work experience, and/or career goals and the lessons students indicate they learned. Game theory suggests that while the game itself is codified the outcomes are not and that experiences with the same game can be quite different from play to play (Hayjek, 2017). The game summarized here needs more rigorous testing and refinement, but initial reactions were positive and encouraging.

Some revisions will need to be in the writing of the instructions which should be made clearer and more succinct. One frustration for both the game facilitator and the students was that the post-play discussion was too short. It is likely that a more simplistic alternative version may be necessary for class times of 50 minutes since the true potential of the discussion the game initiated was limited. Lastly, adult learning theory would suggest that a follow-up be part of the game experience (Whitton, 2011). This follow up could be in the form of an appropriate reflection assignment or a case study conducted at the next class.

The effectiveness of games in providing valuable educational experiences is well documented (Gudiksen & Inlove, 2018; Lainema et al., 2018; Raia, 1966; Sánchez & Olivares, 2011). It was clear from this exercise that the power of class games needs to be explored further and that if more tools and training were to be made available to
instructors that a new level of student outcomes could be realized.

References


Examining Persistence and Dropout Relative to Crisis of Attrition and Social Isolation in an Undergraduate Program

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Abstract: This research examines the crises of attrition in students’ population and study programs using descriptive statistics interpretation for solving social isolation for traditional face-to-face classroom education. The study used a descriptive research design with ‘variable values’ to examine two-degree programs. The study used several testing methods to evaluate the statistical analysis of the social and academic characteristics of freshmen students in both the Informatics and Computer Science programs at the University of South Carolina Upstate from Fall 2018 to Fall 2019. The criterion variable was the student outcome (persistence or dropout), while the general structure matrix pattern was examined to validate the convergent factors. The methodology included a variance of the eigenfunction and values for interpreting the factor structure of the variable values. The findings suggest several mitigating factors which include improved persistence of “enrollment number, program delivery mode, GPA at time of completion and dropout, student orientation, and courses completed at the time of student dropout would help improve academic success for students.

Keywords: Retention ratio, Social isolation, Attrition, Crisis of Attrition, Academic Success.

Background and Introduction

There is a ‘plethora of research’ about persistence in higher education (Cofer & Somers, 2001; Paulsen & St.John, 2002). However, there is a gap in research on the effect of risk factors of persistence, a hidden crisis of attrition, and social isolation among students and program of study in baccalaureate degree attainment (Adebiaye, 2016). While attrition rates in higher education are higher for first-year students (Bank et al, 2013), other researchers like Zavaleta, Samuel & Mills (2015) defined social isolation as the “inadequate quality and quantity of social relations with others at the different levels where human interaction takes place (individual, group, community, and the larger social environment)” (Pg.9). According to Ali and Leeds, (2009) defined retention as students “who progress from one part of the program to the next” (Pg.3). Ali and Leeds (2009) explain that this progression assumes the successful completion of the course of study that allows for movement into the next course in a sequence.

The lack of retention, also called dropout, has always been a historical challenge. Attrition is a ‘decrease in the number of students engaged in a course of study’. Persistence refers to the act of “continuity in higher education; namely on-time completion of the degree” (Martinez, 2003). One major challenge of face-to-face learning is the lack of proper orientation and assimilation amongst students who first arrived at a higher institution. This gap usually results in a feeling of social isolation which ultimately affects their academic success. Since this study examines the effect of hidden attrition and social isolation, the study also ascertains the causes of isolation and feeling of isolation amongst new students that affect both their academic and college success.

Purpose of the Study

Reviewed literature revealed the numerous students' retention issues. McNeely (1938; 2008), showed how the first national retention study involving 25 universities revealed a ‘dropout rate of 45%’. Gütl J. (2015) also identified rates of dropouts to be 35%-50%, while Tinto (1982; McMahon, 2013) had already confirmed earlier that students drop out rates in traditional courses were constantly between 45%-55% over the last century (Pg.6). McMahon (2013) was more specific in their study showing an attrition rate of 80% from the year 2007-2013. A recent study from 2018-2019 showed incomplete rates of 17% in the face-to-face learning model (Mchahon, 2018). This satisfies the objective of this study as it relates to the first year of study. Similarly, Adamopoulos (2013) identified methods like “two-sample comparisons, simple cross-tabulations, logistic and linear regressions as well as Markov processes deployed to study the attrition rates (pg.6). Adamopoulos (2013) also referenced (Tinto, 1993) research on the positive impact of social life and its significance on attrition during the student’s first year of study. Other researchers like Hortulanus et al., (2006) were more assertive that social isolation represents a lack of meaningful social contact among students and also between students and faculty members leading to issues affecting academic success.
The purpose of this study is to identify factors for mitigating social isolation and crisis of attrition on undergraduate students in a face-to-face learning model. The finding in this study will contribute to the body of knowledge in identifying the problem associated with attrition and social isolation among students.

Tinto’s Retention Model – A Conceptual Schema for Dropout from College (Tinto, 1993)

**Research Question**

The specific question addressed in this study was - what impact do the hidden crisis of attrition, and social isolation have on the course retention rate in a face-to-face undergraduate program.

**Methodology**

The study used a survey methodology for data collection which included 45 completed response sets shared in order of the department's numbers. Bartlett’s test of sphericity measure was used to test the appropriateness of factor analysis. Diaz, 2002, Reynolds & Weagley, 2003 measure of sampling adequacy (.935) and Mertler & Vannatta (2010) advanced and multivariate statistical methods were used. The test sphericity ($\chi^2 = 4694.87, p = .000$) which indicates the adequacy of the dataset for this purpose. Mcfadden & Patterson (2009) justified that the “measure of sampling adequacy (SA) for the two programs when greater than .90 is considered acceptable” (Pg.12). A construct validity test was conducted by allowing the questionnaires to be reviewed by a panel of tenured Professors with over 15 years of teaching. Finally, a reliability coefficient test was conducted to calculate the study instrument and its subscales, and the reliability of the instrument was found to be higher ($\alpha = .78$).

<table>
<thead>
<tr>
<th>Step</th>
<th>Observed</th>
<th>Expected</th>
<th>Observed</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>4.572</td>
<td>1</td>
<td>.428</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>4.494</td>
<td>0</td>
<td>.506</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>4.159</td>
<td>0</td>
<td>.841</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1.419</td>
<td>1</td>
<td>1.851</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>13.462</td>
<td>6</td>
<td>3.538</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>4.149</td>
<td>1</td>
<td>1.851</td>
</tr>
</tbody>
</table>

**Table 2.** Above data showed classification at the freshmen level

<table>
<thead>
<tr>
<th>Course offered</th>
<th>2018 (actual expectancy)</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS Computer Science</td>
<td>100%</td>
<td>33.33%</td>
</tr>
<tr>
<td>BS Informatics</td>
<td>100%</td>
<td>25%</td>
</tr>
</tbody>
</table>

**Table 3.** Regression Analysis

<table>
<thead>
<tr>
<th>Anova $^b$</th>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>1.222</td>
<td>2</td>
<td>.666</td>
<td>5.183</td>
<td>.020a</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>6.515</td>
<td>51</td>
<td>.152</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.737</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"a. Values Predictors - (Constant), GPA, last day of attendance"

"b. Dependent Variable: Student persistence"
Statistical Analysis

The table represents the two-year options of (36/45 = 81.8%). This showed persistence for 2019, while 18.2% is for the predicted year of fall 2020. This is an indicator of the prediction probability of persistence to be greater. When other variables in the equation were studied, the result showed “the intercept-only model is in (odds) = -1.504”. The exponentiation of both sides of the above expression would provide a predictive odds of ‘\([\text{Exp} (B)] =.222\)’, representing the predicted odds ‘persistence’ of -1.255. Since 36 respondents showed a high persistence ratio and with only 8 dropping out, then the observed odd calculation resulted in 8/36 = 0.22, which confirmed our predictable ratio generated occurred in favor of persistence in classes. The study also used the “Omnibus Tests of Model Coefficients” which produced a Chi-Square ratio of 1.495 on df. Of 2. This indicates a statistical-significance beyond .5. This is an indication that a ‘Null-hypothesis’ test reacted negatively to adding the year of admission variable. The result is an indication that no significant increase in the ability to predict the enrolment number was viable, hence not a significant factor with the result of p > 0.05 and the null hypothesis is rejected. When the model summary was calculated, we observe that the -2 Log-Likelihood statistics returned 40.33. This statistically measured how poorly the model predicts the decisions - the smaller the statistics the better the model. The Cox & Snell R2 was also tested and showed a result of (R2=0.031) but falls short of a maximum value of 1. The Nagelkerke R2 when tested also showed a result of less than 1 (R2=0.051). To accurately test whether the null hypothesis could have an inference in the prediction, the “Hosmer-Lemeshow” tests for the null hypothesis were used and the results showed the model fits perfectly with observed persistence. Research design showed how the cases are implemented according to their predicted probability of the criterion variable. ANOVA test was also conducted to test the significance of students’ persistence. The result showed students’ persistence of “\(F(2, 41)=4.283, \ p=.02\)”. This represents a non-significant factor. On the evaluation of the ‘last day of attendance’, the result showed a result of “\(B=.16, (p =.01)\)”. Finally, a test GPA using a cross-tabulation of persistence indicates a result of (R=4.435) which represents a correlation factor, which also means a non-significant factor of p=0.22.

Results and Discussions

Effect of social isolation on students’ s performance resulting in drop-out?

The findings indicate that with p>0.05 indexed variables of test for GPA characteristics, the effect was lesser on persistence. This provided insights into understanding other characteristics that are external to student and instructor that impacts student’s dropout. The indexed percentage indication that social interaction amongst and between students could alleviate the problems of social isolation and represent a significant factor in the decision by students to dropout

Impact of the social, crisis of attrition and academic characteristics on retention

The reported test score of 18.18% of the ‘academic characteristics’ factor indicating a lack of interest from students as the reason for dropping out ultimately aligned with the recommendation by Rovai (2003) that “observed patterns of attrition attributed to factors that influenced any dropout decisions by the student. It is also an indication of dissatisfaction by students with the course structure, schedule, low confidence levels on courses and assignments.”

Impact of classroom face-to-face learning methods on retention?

The face-to-face traditional method showed a result of 81.82% enrolment with strong persistence. This indicates strong retention numbers and a clear indicator that this learning “method has a positive effect on the retention of the students enrolled”(Yorke, M.(2014)).

Discussions and Conclusions

The study’s results showed that the attrition rate represents an important factor while the crisis of social isolation was found to be statistically significant in persistence for the two programs. However, when the logistic regression analyses were evaluated, there was no significant effect of social isolation which may have been due to the enrollment data and retention ratio on the two programs. It may also be due to the small number of samples tested. Notwithstanding, a binary logistic regression analysis showed a significant positive effect on attrition if the social isolation problems are mitigated. The data representing retention showed strong viability for a traditional face-to-face delivery method with high ratings for the two programs sampled. This suggests that attrition remained an issue and a major factor in this study. The findings showed the
importance of academic, social, and oriented integration of freshmen compared to indexed by the variables of course structure, design, or finance or family issues having any form of “influence on the persistence of students” (Adebiaye, 2016). Finally, the results showed significant differences in the ratio of dropouts and persistence when comparing both programs. This reinforces findings that social isolation and the hidden crisis of attrition support strategies do lead to improved retention.

Implications and Recommendations for Further Research

It is pertinent to recognize the challenges of social isolation and crisis of attrition during the planning of programs and/or during freshmen enrollment. The readiness of prospective students for higher education, social assimilation during pre-admission orientation or matriculation should be prioritized for an improved retention rate. Future research should include topics on social interaction and inclusions to enhance students’ retention. Other variables like extended family issues, student’s perception of higher education, demographic factors (distribution of respondents, socioeconomic characteristics, population, etc.) could have provided sustainable unbiased estimated data to analyze the p-values and coefficients in regression analysis and recommended for future studies. It is also recommended that a further study be conducted to understand the characteristics that impact the attrition ratio in graduate programs.

References


Patterson, B., & McFadden, C. (2009). Attrition in online and campus degree programs. Online Journal of Distance Education Learning Administration, 12(2).


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Patterson, B., & McFadden, C. (2009). Attrition in online and campus degree programs. Online Journal of Distance Education Learning Administration, 12 (2).


Abstract - This essay is a short version of the concluding chapter of my edited book, Working in the Margins: Domestic and International Minority Women in Higher Education (Webber, 2020a). The book demonstrates the power of transformational communication to challenge, disrupt, and change toxic ideologies in our classrooms, departments, and institutions. In this essay, I briefly discuss the challenges Latinx, Asian, and White domestic and international women experience in the borderlands of academia. I recap the various strands of critical pedagogy used by the contributors to decolonize curricula. I also share the professional and emotional risks we take to help students develop critical thinking skills, expand their perspectives, and enhance their understanding of power, communication, and identity. Working in the Margins is an important project given the promise that transformational communication can provide in promoting critical thinking skills and easing the current political climate of intolerance.

Keywords — critical pedagogy, whiteness, minority faculty

Introduction

My overarching goal for Working in the Margins: Domestic and International Women in Higher Education (Webber, 2020a) was to demonstrate the power of transformational communication to challenge, disrupt, and change toxic ideologies in classrooms, departments, and institutions of higher education. To this end, I asked contributors to share their experiences of marginalization in higher education and to discuss how they use this experience to teach students how to critically think about constructions of difference. The book offers profound insights into the similar and different struggles Latinx, Asian, and White domestic and international women share in the borderlands of academia. Here, I discuss how an ideology of whiteness impedes efforts to teach students how to think critically about the world. Next, I briefly discuss various strands of critical pedagogy that can be used to decolonize curricula. I include the professional and emotional risks domestic and international minority women take to help students develop critical thinking skills, expand their worldviews, and enhance their understanding of power, communication, and identity.

Whiteness in Higher Education

Whiteness is a major impediment to teaching students how to interrogate the ongoing production of racism. Whiteness is an ideology that conflates White culture with American culture, and White experiences as human experiences (Cooks & Simpson 2007, p. 4). Whiteness is bound by race and it also colonizes dominant categories including White ethnicities, American nationality, middle/upper class status, men/masculinity, heterosexuality, and Christianity (Dyer 1988). Members of dominant and marginal groups who are socialized to see the world through the lens of whiteness articulate and universalize these categories by particularizing, marking, and excluding bodies that they perceive to be different from the norm. Some students and faculty members maintain whiteness and mark Others through xenophobic attacks on minority dialects and language. Anzaldúa (2007) writes, “Ethnic identity is twin skin to linguistic identity. I am my language” (p. 81). Denigrating or ridiculing a person’s language, dialect, or accent is hurtful. It is also a common way of excluding a person from the realm of whiteness. Asian and Latinx women experience similar student attacks on real or imagined differences in our linguistic abilities. Intentionally or not, students guard the boundaries of whiteness through linguistic terrorism and stereotypes to construct domestic and international women as unacceptable, unsuitable, intolerable, frightful bodies in the classroom. Yep and Lescure (2018) explain that in this current historical moment of intense sexism, racism, nativism, classism, and homophobia, a basal whiteness is increasingly evident. Basal whiteness is a mean, toxic, uncivilized, narcissistic form of whiteness (p. 131).

Although we are trained in graduate school how to plan, instruct, and assess student performances, most of us do not receive training on how to deal with toxic ideologies such as whiteness, heteronormativity, nativism, classism, and patriarchy. These toxic ideologies travel into our classrooms with students socialized to view Others and the world through discourses of difference. Domestic and international minority faculty are often surprised, shocked, and hurt when students
express their intolerance of immigrants, perform bullying behaviors, question our credentials, and re/marking our difference. These differentiating tactics are exacerbated by the fact that most graduate programs also fail to train White academicians how to self-reflect and interrogate their own performances of whiteness and privilege in the classroom (Jackson et al., 2007, p. 69; Nakayama & Martin, 2007, p. 125). For example, in a discussion with a White male colleague about the difficulties of teaching whiteness and critical race theory, he simply shrugs his shoulders and states: “I never talk about race or any other controversial topics in my classes.” My colleague’s decision and privilege to avoid discussions of race is not uncommon among White faculty members. In their study of White graduate teaching assistants (GTA) at a predominantly White Institution (PWI), Jackson et al., (2007) found that some participants avoided discussions of race in their classrooms because they didn’t want to force White students to learn Black or Asian perspectives (p. 78). Other participants in the study expressed it was too much trouble to integrate diversity in their teaching strategies. When White instructors avoid discussions of difference, they reproduce whiteness and normalize their courses as neutral subjective spaces for learning. Whiteness naturalizes and universalizes White, heterosexual, masculine, middle-class, and Christian perspectives as the only valid way of studying knowledge. Meanwhile, minority and White critical pedagogues bear the burden of teaching difficult topics, modeling critical self-reflection, and helping students develop critical thinking skills.

The transparency of whiteness, the very source of its power, in courses taught by White instructors provides the frame from which students can compare, contrast, and often negatively evaluate their experiences in courses taught by faculty of color and critically aware White professors. The absence of a minority professor, the avoidance of topics related to difference, and the exclusion of materials by and about minorities institutionalizes whiteness in academia. White and assimilated colleagues must learn how to critically self-reflect on how whiteness privileges their identities and directly harms others who are perceived to be different from the status quo. Nakayama and Martin (2007) argue that self-reflexivity is important for all researchers and teachers, and given the centrality of whiteness, it is quintessential for White academicians to consider the ways that their whiteness has influenced and guided their research and teaching (p. 125). Colleges and universities, truly committed to preparing students to participate as competent global citizens in an increasingly diverse world, must provide ongoing professional training to help graduate students and faculty develop critical pedagogical strategies to unravel toxic ideologies such as whiteness.

**Critical Pedagogy**

*Working in the Margins* collaborators decolonize the curriculum through various strands of critical pedagogy (Freire, 2012) including critical love (Hernández, 2020), hemispheric optic (Pariyadath, 2020), embodied pedagogy (Lee, 2020; Webber, 2020b), and an ethic of speaking with others (Heuman & Labrador, 2020). We use our bodies to redirect a colonizing gaze to focus on the power dynamics involved in constructions of identity of self and others. We use our Asian, Latinx, and White working class bodies as texts to teach students how to read the cultural productions of identities in social institutions; interrogate the political nature of power and knowledge; encounter the particularity of their own subject positionality; and rediscover themselves and others as complex human beings constituted within communication processes. These moments of embodiment and engagement provide opportunities for students and faculty to dialogue on how power dynamics constitute and inscribe cultural identities. Simpson (2008) writes that dialogue is a struggle. It is a process of thinking together with others to create richer and more complete knowledge (p. 140). The inclusion of materials by and about people from marginal communities decenters whiteness and also enables minority students to engage in course materials that resonate with their own cultural experiences. Marginalized students need opportunities to see their identities and cultures reflected back in course materials to, at the very least, help them understand their own unconscious assimilation to whiteness. Adding materials by and about marginalized people benefits all students. It provides members of minority groups an understanding of the conditions of their oppression, how to express their marginalized experiences and, as eloquently described by Angela Labrador (Heuman & Labrador, 2020), enables them to rediscover the beauty of their cultures. Centering marginalized identities and experiences also compels students, who travel through culture unaware of the particularities of their identities, to come to know how their presumed universalized identities are paradoxically bound to constructions of difference and the oppression of Others. Critical pedagogy provides opportunities for students to think through different perspectives of the world to understand micro and macro discourses of difference that suture identities, power, and culture.
Critical Pedagogy Is Risky Business

Critical thinking skills, accountability, and the ability to work well with others are highly desired skills and attributes in corporate, civic, and interpersonal life. Yet, teaching these qualities in the United States is risky business for domestic and international critical pedagogues. This is especially the case when students act out their resistance in class and seek alliances with critically unaware professors. Students’ expectations for safe classroom spaces (read free of taboo topics and different bodies) can leave Asian, Latinx, and White domestic and international critical pedagogues isolated in academic departments and universities. Additionally, our embodied pedagogies make us susceptible to scrutiny and attack by students and colleagues. Students can experience disillusionment, pain, resentment, and discomfort when they learn that their assumptions about self, others, and the United States are deeply imbedded in toxic ideologies and disparate relations of power that are reproduced through social institutions including education, family, media, and so on. Some students dismiss our storytelling as braggadocio, whining, or living in the past. Students who resent the challenges to their identity refuse to engage in discussions about difference and sit in classrooms performing “meaningfully loud performances of silence” (Yep & Lescure, 2018, p. 119). Allen (2011) writes, “as students process their learning, they may respond by complaining to other faculty members or administrators, resisting course activities, accusing the instructor of proselytizing, and/or evaluating the course and instructor negatively” (p. 113). When professors and administrators uncritically accept student complaints and gossip about critical pedagogues, they empower students to continue disrespectful behaviors in and out of the classroom.

Unfortunately, some professors, who are unaware of their White privilege in the classes they teach, may respond to student complaints about domestic and international minority women by advocating for so-called safe learning spaces. These professors fail to critically interrogate the articulation of safety with White, cisgender, middle-class, Christian people and cultures. Additionally, student expectations for safe learning environments can be understood as classrooms devoid of taboo topics such as sexuality, race, class, and gender, as well as the absence of different and threatening bodies. Colleagues, who are deeply invested in whiteness, may elevate their own reputations as good professors by allowing students to denigrate their domestic and international colleagues. In effect, when faculty and administrators cosset White fragility, rather than challenge toxic ideologies and differentiating tactics, they sustain and perpetuate systemic racism, Anglocentrism, nativism, classism, patriarchy, and heteronormativity (Diangelo, 2018). Students may define a safe learning environment as a space devoid of intellectual discomfort, controversial topics, and different bodies. Thus, questions on SOPs that ask students to evaluate the extent to which the instructor creates a safe or positive learning environment may be misunderstood as the level to which they enjoyed a class devoid of controversial topics, bodies, and conflict. Student opinion polls/evaluations can create and/or reinforce whiteness and potentially contribute to toxic university cultures.

Conclusion

Whiteness shapes the way Latina, Asian, and working-class White women are marked as Others in higher education. Whiteness is also an extreme disservice to students because it impairs their ability to see how their lives are implicated and interconnected with other human beings in an increasingly diverse world. Working in the Margins (2020) collaborators use various strands of critical pedagogy to disrupt whiteness and provide insight to how teachers and students can learn to share different experiences and perspectives of the world. Critical pedagogy enhances students’ understanding of the complexities of power, communication, and identity. These dialogic educational encounters enable classroom collectives to create bridges between self and others through transformational communication.

Acknowledgement

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References


Career Readiness: Perceptions of Criminal Justice Majors

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Abstract - The university exists in part to prepare undergraduate students for future careers or further formal education. However, little research has been conducted about student preparation for their transition from college to career; instead, the focus has been on the transition from high school to either college or the workforce. Findings from the current study could help inform university efforts to improve student success in establishing careers that directly relate to their degrees. To assess USC Upstate Criminal Justice majors’ and alumni’s perceptions of their career readiness, two online surveys were constructed. The first survey was specifically designed for currently enrolled students and the second for alumni who have graduated within the past five years. This presentation explains the development, distribution, and findings of this survey.

Keywords – Student, Alumni, Career, Readiness

Introduction

Career readiness is an important consideration within the college curriculum for any major. It is imperative that students feel prepared to succeed after college graduation. According to a study completed in Michigan, students admitted that they struggled with the transition to work after their college graduation. Students also reported struggling after graduation to obtain jobs related to their major. Of the alumni in the Michigan study, 15% said their current job is not linked to long-term career objectives (Aronson et al., 2015). This suggests that students may be taking positions outside their career field due to lack of career management skills. Career management skills refer to the resources necessary to accomplish your career goals such as networking, career planning, and life-long learning. Additionally, even if students feel prepared, their employers may not agree. A recent study showed that 17% of employers rated recent graduates as proficient in career management, while 41% of recent graduates believed they were proficient in career management (National Association of Colleges and Employers (NACE), 2018). Information on the attitudes and perceptions of career readiness for college students is lacking. Given this information, we want to analyze current curriculum practices in the Criminal Justice program at USC Upstate. The current paper focuses on the first step of collecting data in order to address the dearth of empirical research specifically by designing a survey pertaining to the perception of career readiness of USC Upstate Criminal Justice students.

Background

There are many studies that focus on the preparedness of high school students for college (see Eunjoo & Gysbers, 2007; Hackman et al., 2018), while it appears that little research has been dedicated to college student preparedness for the workforce. This is especially problematic given that the NACE (2018) states that performance from new graduates was less than average, suggesting that the employers see skill gaps in key areas where college students do not believe the gap exists. Even with this existing gap, there is still little research in this area.

Further, despite the clear evidence that employers are not satisfied with job performance by new graduates, McGraw-Hill (2018) found that only 41% of U.S college students overall felt “very” or “extremely” prepared for their future careers, with more men feeling confident than women. Further, students believed they lacked critical skills, including resume writing, job searching, and interviewing. NACE (2020) only rated recent graduates as 56% proficient in career preparation and less than 43% proficient in both professionalism/work ethic and oral/written communications (based on a seven-point scale in which evaluators rated 28 student behaviors during completion of an internship). This suggests that there are opportunities to improve these skills before graduation, thus improving their overall preparedness and success for post-graduation plans.

Methods

Survey Design

This study will utilize data collected through two survey questionnaires pertaining to perceptions of career readiness among current and former USC Upstate Criminal Justice students. Survey research allows for a variety of methods to
recruit participants and collect data to describe certain aspects or characteristics of a population. As it is often used to describe and explore human behavior, surveys are frequently used in social sciences research (Singleton & Straits, 2009).

Two surveys consisting of closed- and open-ended questions relating to perceptions of career readiness while enrolled at and following graduation from USC Upstate were constructed. To construct the surveys, the investigators reviewed extant literature (see above) and identified themes of questions common to multiple published articles. The main themes were student assessments of career readiness skills, experiential and traditional learning experiences, employment attainment after graduation, and overall attitudes about the job sector. Once the themes were identified, each investigator constructed 25 questions that reflected these themes plus student demographics. Investigators met for several hours to compare questions, identify similarities and differences, and craft coherent survey items that reflected the breadth of the proposed study. Multiple drafts of each survey were pretested by the investigators. Upon the completion of the pretests, the surveys were published online and recruitment began.

Survey Administration

The surveys are hosted on Qualtrics via a secure (encrypted) link. Participants are being recruited through various methods, including an introductory email to current and former Criminal Justice students, the distribution of flyers and handouts across campus, and classroom visits by the investigators. The target population for the first survey is students currently enrolled in the Criminal Justice program at USC Upstate. The sampling frame is made up of currently enrolled (including enrolled but inactive) Criminal Justice students who have valid student email addresses (n=398). The target population of the second survey is USC Upstate Criminal Justice alumni. The sampling frame is made up of students who have graduated with a Criminal Justice degree within the last five years and have a valid email address (n=2500). The anticipated sample sizes are 100 and 625 respectively (approximately 25% of each of the targeted populations).

The current student survey is made up of 30 questions, while the alumni survey contains 24 questions. The main goal for this survey is to gain an understanding of how the students feel about the effectiveness of the Criminal Justice program at USC Upstate in preparing them for their future upon graduation. In order to ensure a high response rate, the link to the survey has been emailed to all current and former students.

Once a potential respondent accesses the website, they are provided an electronic consent form and instructions for completing the survey, as well as advice for maintaining confidentiality (i.e., completing the survey on a private computer). No identifying information (e.g., name, email, address, etc.) will be collected on the survey. The survey will be open and available for a period of eight weeks at which time regression analysis and qualitative, narrative analysis will be performed on faculty office computers using STATA 15.1.

The electronic surveys consist of 24 to 30 questions with a mixture of open-ended, close-ended, and matrix questions. The surveys begin with demographic questions including the participants’ age, gender, current class standing or year of graduation, and GPA. The survey questions then progress to items pertaining to the respondent’s educational experience within the criminal justice program, including what specifically helped them to prepare for the workforce or graduate/law school. Questions pertaining to types of classes, workshops, field trips, and level of faculty and advisor support are also included. The weblink to the survey for current Criminal Justice students is https://uofsc.co1.qualtrics.com/jfe/form/SV_bjsBpgO48Kl9cKjJ and the weblink to the survey for Criminal Justice alumni is https://uofsc.co1.qualtrics.com/jfe/form/SV_qZTLxUdfipPEiUZ.

Anticipated Results

The resulting data will be analyzed to understand which features of the Criminal Justice program are associated with more positive perceptions of career readiness. It is anticipated the investigators will be able to identify specific features associated with a more positive perception of career readiness, as well as which factors are associated with positive outcomes upon graduation. It is likely that students who engaged in experiential learning (e.g., internships and service-learning courses) will feel most prepared for the workforce. The researchers foresee the opportunity for possible recommendations to the department.
Conclusions

While the overarching objective of this study involves measuring the perception of readiness for future plans after graduating from the Criminal Justice program at USC Upstate, the outcome of this project is the construction and administration of a methodologically sound survey questionnaire to current and former USC Upstate Criminal Justice students. The survey has been successfully published and data collection is underway. As of yet, no data analysis has been conducted.

References


Why Have Children and Teens Stopped Reading: Explanations and Solutions

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Abstract — Reading is one of the most vital skills children learn. Like basic arithmetic, reading is a skill that is necessary for everyone to learn in order to function in 21st century society; people need to be able to read to file their taxes, apply for health insurance, read road signs, and a slew of other mundane tasks people don't even realize they are doing. This paper will focus on three main reasons why there has been a decline in active reading—reading for pleasure, not necessity—among teenagers, and what steps can be taken to combat this issue.

Keywords — Adolescent Literature, Teenagers, Reading

Introduction

Children who read at a young age are likely to become better readers, understand and use complex grammatical structures, develop effective writing styles, and build larger vocabularies than those of less active readers (Strommen & Mates, 2004). There are also benefits that come from frequent pleasure reading that are not linked to literacy. The United States Agency for International Development released research saying children who start school without “basic literacy skills” have a three-to-four times higher chance of dropping out, compared to those who do, and children who are read to daily are a year ahead of their reading level. The research also states children who read three thousand words a day are more likely to be in the top two percent on standardized tests, and “good readers often have more financially rewarding jobs” (“Why Reading at a Young Age Matters”, 2015).

To better understand how/why there has been a decline in active readership among young people I created two surveys. One was designed for the Year of Epic Reads Facebook group (which had thousands of members from across the globe) and the other was geared towards high school students, which was distributed to students at James F. Byrnes High School in Duncan, South Carolina. These surveys asked a variety of questions, ranging from demographic information to reading habits to preferred reading format. The results revealed three major explanations as to why fewer young adults are actively reading: the culture around reading, advancements in technology that distract people from books, and the need to modernize books taught in classrooms.

Culture Around Reading

The first question in both surveys asked what gender the responders identified as. Of the five-hundred twenty-six responders in the Year of Epic Reads survey, 96.8% said Female, 1.9% said Other, and 1.3% Male. The high school survey had a far more balanced gender representation, with 51.8% responding Female and 48.2% Male. I knew the responders in the Epic Reads survey were active readers, but I had no knowledge concerning the reading habits of the high school students. Of the fifty-six responders, twenty-four said they enjoyed reading for pleasure, the majority of them female. The divide between men and women when it comes to reading is clear. The Canadian Council on Learning researched why boys don’t read as much as girls and found two main reasons: choice of reading material and the fact that reading is considered a gender activity (“Lessons in Learning”, 2009).

The CCL’s research found girls prefer to read romance novels, plays, poetry, and books about contemporary issues, while boys are drawn to comics, fantasy/science fiction, and special interest books. The article continued to say only a third of classrooms in the United States have books available in boys’ preferred genres, in part because the majority of teachers are female, and the books on their shelves tend to mirror their own interests. There are some links to the idea that having more male teachers could inspire boys to read more, but research found most boys have their opinion on whether or not reading is a feminine activity before starting school (“Lessons in Learning”, 2009).

While little can be done when it comes to controlling what books parents keep in their home, it is important for caregivers to provide materials their children will find interesting. The best way this can be accomplished is to take frequent trips to libraries and make it clear to both sons and daughters they can read whatever books they want. It is also important to dissuade the idea there are books written for only one gender or the other and to have diverse bookshelves. It is essential teachers fill
the shelves in their classrooms with books that will interest students, while also making sure to not separate books based on gender preference (if Young Adult literature has taught the world anything it is dividing people into groups benefits no one).

**Advancements in Technology**

In today’s society children are indoctrinated by screens from the minute they go home. Technology is a tool parents can use to deliberately distract their children when they are not yet old enough to read; shoving a YouTube video about a singing baby shark in a toddler’s face is an easy way to quiet them while the parent is busy. When children grow into their pre-teen and teen years, they are given access to more technology in both schools and homes, whether it be school issued laptops or their own iPhone.

Both surveys asked if the responders found technology a distraction, or if they found a balance between reading and their devices. One hundred sixty-two responders in the Epic Reads survey said they found a balance, however the majority said technology does distract them. Only seven responders in the high school survey said they found a balance. It is important to note some responders said technology is actually helpful for them when it comes to reading, as they use their devices to listen to audiobooks or read e-books, which can be downloaded for free from many public libraries.

When it comes to combatting technology as a hindrance to reading, there are several features on devices today that can limit how long a certain app can be used, or if there will be a time in the day when the device’s features are severely limited. The Amazon Fire tablet, for example, has parental controls that limit a child’s access to their device (Hill, 2017). Once children have grown up and are using more advanced devices, like iPhones, parents are still able to control how long they spend in certain apps with the Screen Time, App Limit, and Downtime features now available in iOS 12 (Welch, 2018). Parents need to make sure their children receive a balance when it comes to using technology, reading, and physical exercise. Indulging in one activity for an extended period of time is fine, but if parents find their child glued to one or the other then it is important to step in and encourage them to take part in a different activity.

**Need to Modernize Books Assigned in School**

In the Year of Epic Reads survey, 60.57% of responders said they agree with the statement “standardized educational practices (assigning older books that are boring or no longer relate to society today) somewhat take away the joy of reading”, while 80.36% of responders in the high school survey agreed with the statement, one saying “As I have gotten older, the books assigned have gotten worse and worse, which make me not want to spend my free time reading.” Books like *To Kill a Mockingbird*, *Night*, and *The Great Gatsby* have been taught in schools in the United States and around the world for years. All three deal with historical time periods and themes that need to be taught. However, it is clear students are animus towards them. Many responders said they believe these books should no longer be taught in schools, but there were some who suggested these books be paired with new, more modern books, and taught together. I personally enjoyed *Night* and *The Great Gatsby* when I read them but have always found books written in the past few years more interesting and relatable than older novels, so I was intrigued by the idea of combining books I love to make English classes more interesting.

*To Kill a Mockingbird* focuses on racial inequality, rape, and growing up in the American south in the 1960s (Lee, 1960). I believe teachers should pair this book with *The Hate U Give* by Angie Thomas, which is told from the perspective of a teenage, black girl whose boyfriend is shot and killed by police after they have been pulled over (Thomas, 2017). *Night* recounts Wiesel’s own experience in Nazi Germany and his time in Auschwitz and Buchenwald (Wiesel, 1960). *The Boy in the Striped Pyjamas* is a fictional story about the son of a Nazi officer, who moves next to a concentration camp and befriends a boy his age who lives on the other side of the fence (Boyne, 2006). Pairing *Night* and *The Boy in the Striped Pyjamas* would expose students to both first-hand experience with the Holocaust and a story that came about through research. *The Great Gatsby* can be paired with *The Hunger Games* by Suzanne Collins. I’m sure there are some who would argue there is no comparing these two books, but I would point out how similar Gatsby and his party guests are to the people of the Capitol—both spend exuberant amounts of money on their clothes and appearances—how the “valley of ashes” can be compared to District 12 and the people in both places who are constantly struggling, and how the fight to climb the social ladder is made literal in the annual Hunger Games where tributes from the districts are forced to fight to the death, the victor being given Capitol-level wealth (Collins, 2008; Fitzgerald, 1925).

I believe linking *The Hunger Games* with *The Great Gatsby* is one of the better pairings because it exposes students to one of the primordial Young Adult books that made many teenagers want to read. *The Hunger Games* is the first in a series, and after
finishing, or reading a good portion of the book in school, students may be interested in learning what happens to Katniss, Peeta, and the other characters in the subsequent novels, which may then spark their interest in other Young Adult books.

Conclusions

It is clear the issues surrounding the decline in active reading among young people are severe. But the benefits of reading from a young age are as equally evident. Parents need to work hard to make sure their children have access to reading material in their homes, while teachers need to do the same in their classrooms. Parents and their children need to have a serious discussion on how to best balance using technology, reading, and physical activity. And, perhaps most importantly, the books taught in schools today need to be updated so the mandatory reading required in schools does not put young people off reading. Exposing students to important works of literature from the past and present is the best way to ensure they receive a well-rounded education while also giving them material they will find interesting. This may, in turn, spark their desire to read outside of an educational environment.

Acknowledgements

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References

RESEARCHER. PHARMACIST. BLUE HOSE.

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Creative Crosswalk Project: Public Art in Pedestrian and Driver Safety

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Abstract—Numerous cities around the world are embracing public art in the form of murals, sculpture, architecture, and various other art forms, as a means of beautifying the area, creating unique visual appeal, and promoting a sense of community amongst the locals. Spartanburg, South Carolina is one such city. In 2015, Spartanburg was officially designated as a cultural district, which is defined as an area in which collaboration is established between art and the local community. Thus, Spartanburg has seen an increase in its public art initiatives, with various artwork being used to revitalize the area. The city also sees heavy foot traffic, as shops, restaurants, and events regularly attract pedestrians to the downtown area. The Creative Crosswalk Project seeks to build upon the city’s ongoing public art initiatives, and enhance driver and pedestrian safety, via the implementation of a series of crosswalk murals created by local artists and designers.

Keywords — art, design, public, mural, crosswalk

Introduction

Public art is becoming more and more prominent across the world. Murals, sculpture, and architecture are just a few of the public art forms being implemented as site-specific art in the public domain (McCarthy, 2006). Street art is one of the most well-known forms of such public art, and it involves creating art on various surfaces in public places such as the exterior walls of buildings, sidewalks, or highway overpasses. Although street art can be a welcome addition to any community, it also has a history and reputation of being viewed in a negative light, as street art often takes the form of graffiti. Street art can even play a role in the city by creating areas that will be photographed and used in promoting the city. It has even been shown that by adding artistic appeal, often to areas designated as “cultural districts,” a local distinctiveness is produced, which attracts tourism, companies and investments, creates employment, and decreases instances of vandalism (Hall & Robertson, 2001; Seifert & Stern, 2005). The majority of street art is often found in urban areas and is connected to graffiti in certain aspects. Although graffiti is often frowned upon, over time, it has crossed the borders between street and youth culture and the art community (Kirkland & McGill, 2016). Many public artists view their works of art as contributions to the community, bringing life to otherwise mundane or derelict areas (Bowen, 1999). The reason for these works of art can vary including making a political statement, creating something beautiful, enlivening an area, or communicating meaning implied through the technology in which they are made (Davis, 2012).

As the downtown Spartanburg area continues to grow, crosswalks become more important and provide pedestrians with a quick and easy way to navigate the city's streets. However, pedestrian safety is always a concern as evidenced by the increase in pedestrian fatalities in the United States from 4,414 deaths in 2008 to 5,977 deaths in 2017. These statistics represent a 35% increase in pedestrian deaths over the course of only 10 years (Retting, 2019). In an attempt to improve upon the safety of crosswalks, some cities are turning to public art such as crosswalk murals. The creation of crosswalk murals adds visual appeal to the city and serves as a means of heightening awareness amongst drivers and pedestrians. This is one of the many ways in which a city can alter some of its most frequently, yet highly ignored spaces. Crosswalk murals stimulate public interaction and allow pedestrians to feel a deeper connection with the city (Anderson & Donaldson, 2019).

In partnership with the City of Spartanburg, the Spartanburg Area Chamber of Commerce, and Chapman Cultural Center, the Creative Crosswalk Project was born. Eight crosswalks were designated to receive murals, and a request for proposals was released to local artists interested in being a part of the project. My design team was selected to paint four of the eight crosswalks in the heart of the downtown Main Street area. Three additional local artists were selected to create murals on the remaining four crosswalks.

Methods

The goal of the Creative Crosswalk Project was not only to create a series of crosswalk murals in the downtown area but also to involve the local community in the project. The challenge in such a goal lies within determining how to involve the
community in the creative thought process yet not in the actual physical implementation of the crosswalk murals. One method for accomplishing such a task was to poll the community on topics such as the pros and cons of being a pedestrian and/or driver in Spartanburg, the qualities of Spartanburg that instill a sense of community, imagery that symbolizes Spartanburg, thoughts on using art to enhance crosswalks, and preferred color palettes and design styles. A series of questions about the aforementioned topics were used to create an online poll via Google Forms. Chapman Cultural Center then utilized email and social media platforms to connect with the Spartanburg community and received feedback on the Creative Crosswalk Project. A total of 85 responses were received for the poll. The poll data was then analyzed and served as an aid in determining the need for more public art in Spartanburg and establishing the overall design concepts for the crosswalk murals. 51.7% of the poll participants stated that having the feeling of community plays a large role in instilling a sense of pride to the public, and 22.3% stated that art and murals brought them a stronger sense of connection to the city. When asked about the pros and cons of being a pedestrian in Spartanburg, 48.2% stated that the city is easily navigable due to the multitude of crosswalks and walking access in the downtown area. However, 38.8% stated that far too many drivers endanger pedestrians by not honoring the right of way. Also, 32.9% stated that crosswalk murals would add uniqueness to the city, and 34.1% stated that crosswalk murals could aid in getting the attention of both drivers and pedestrians. The results indicated the potential value in creating crosswalk murals as a means of making drivers and pedestrians more attentive and promoting safety (Anderson & Donaldson, 2019).

Results and Discussion

Large-scale design projects can easily become overwhelming for a single graphic designer. In fact, within the professional graphic design industry, it is common for larger design projects to involve the collaboration of multiple designers (Landa, 2010). The size and scope of the Creative Crosswalk Project meant that such a collaboration was beneficial. To also transform the Creative Crosswalk Project into an experiential learning project, three University of South Carolina (USC) Upstate graphic design students and one USC Upstate graphic design faculty member collaborated to design and implement four crosswalks on West Main Street in downtown Spartanburg. The challenge of the project was not only to creatively design four crosswalk murals but also to develop an artistic style such that the four crosswalks flowed in unison with one another. Four designers independently working on four crosswalk murals posed a significant challenge to creating a unified series of designs, but by establishing a design team at the start of the project, a plan was created to collaboratively establish specific criteria to unify the appearance of the crosswalk murals (Goldstein, 2005).

The criteria for the crosswalk murals, as generated by the design group, included the following: the use of black as a base for the murals, the colors green, blue, yellow, and orange for the shapes and objects within the designs, the use of geometric shapes with a hint of abstraction, and pattern-based design. With the aforementioned guidelines and parameters established, the design was set to begin. Although the majority of graphic design work is created within the digital realm, the process for creating the crosswalk murals, which required physical implementation onto city streets, was quite similar. The process included sketching, digital renderings, and implementation.

Sketching Phase

The initial stage of the design process was sketching. The sketching phase simplified the project to a series of quickly and loosely drawn concepts. The purpose of sketching was not to fine-tune design concepts, but rather it was to generate a multitude of ideas without focusing too heavily on one or the other. It is quite simple to put together upwards of 100 sketches in a matter of hours. Mistakes and imperfections are of no concern in the sketching phase, as sketches are merely used as guidelines for possible design concepts. The sketching phase is also important in that it is a significantly faster process than digitally rendering every concept using design software.

Digital Renderings

Digital renderings are typically created once the sketching phase has been completed. To generate digital renderings of the crosswalks to scale, the dimensions of the physical crosswalks were a necessity. The crosswalk measurements indicated that each crosswalk consisted of a series of alternating vertical “bars,” each of which measured approximately two feet in width. One vertical bar was white, and the next vertical bar was a “blank” area void of any visual elements, also known as negative space (Lee, 2007). This repeating pattern of vertical bars was consistent across each crosswalk. Based on the width and height of each crosswalk, as well as the number of vertical bars in each, an accurate digital rendering was created for each crosswalk using Adobe Illustrator (Adobe Creative Cloud 2019, Version 24.0.3). The creation of
accurate digital crosswalk renderings expedited the process of exploring various color schemes, shapes, and patterns for the crosswalk designs, and it ensured that all design elements would fit accurately and proportionally between the vertical bars.

**Implementation**

Once the sketches and digital renderings were completed, the final design implementation began. To prepare for the painting process, all of the white bars in the crosswalks were masked off with tape. Two coats of black paint were then applied as the base layer of the murals creating simultaneous contrast, in which the other colors in the mural appeared to have more contrast and vibrancy (Arnston, 2003). Although the implementation of the black base layer was fairly straightforward, the creation of the design templates was much more challenging. The creation of murals, typically found on walls, as opposed to roads, often includes the use of a projector to display the digital design on the wall, thus allowing the designer to use the projection as a template for the design. Unfortunately, the same projection process isn’t as effective or easily implemented when creating murals on the street. With no simple method for placing a projector overhead to cast and create templates for the crosswalk murals, a more complex method was necessary. The completed digital crosswalk renderings were printed on letter-sized sheets of paper and used as references for creating templates on the crosswalks. The designers used chalk to draw the printed designs directly onto the crosswalks. Although this method of generating a template makes it impossible to perfectly recreate the original design by hand, the pattern-based crosswalk designs allowed for some flexibility and slight improvisation in the design process.

Since it is difficult to freehand paint straight lines onto the rugged surface of the asphalt, masking tape was a requirement. Each shape of the patterns was taped to allow for the quick deployment of paint while also maintaining the clean, crisp edges that were needed. Color by color, multiple layers of paint were applied to preserve the life and longevity of the paint. With each layer of paint, a figure/ground relationship was further established between the black background and the colorful shapes, as the shapes became more heavily saturated and jubilant against the black base of the murals (Lee, 2007). The hot July sun made quick work of drying each layer of paint, and within minutes, the paint was dry enough to remove the masking tape, revealing the final mural designs. Two coats of street paint sealant later and the crosswalks were finished, complete with protection from foot traffic and vehicles.

**Conclusions**

A team of four designers was selected to collaborate in the design and implementation of a series of four crosswalk murals in downtown Spartanburg as part of the Creative Crosswalk Project. At the outset of the project, the design team polled the Spartanburg community regarding the impact of art and design in the community, as well as the creation and design of the crosswalk murals. The team’s designs reflected the poll data by incorporating vibrant colors and both geometric and abstract shapes, as well as introducing more public art to the Spartanburg community. Through the Creative Crosswalk Project, the design team was able to create crosswalk murals that now serve as a means of drawing attention and awareness to driver and pedestrian safety, connect with the local community, revitalize easily overlooked spaces, and transform a section of the downtown Spartanburg area (Grant-Smith & Matthews, 2014). A post-project poll of the Spartanburg community indicated that 72.4% of the respondents feel that the crosswalk murals have had a positive impact on pedestrian and driver safety. That number represents a significant increase from the pre-project poll in which only 34.1% of respondents felt that crosswalk murals would enhance pedestrian and driver safety (Anderson & Donaldson, 2019). Likewise, community members say, “Cars noticeably slow down at the crosswalks, and it feels safer to cross knowing you are likely to be seen!” and, “I notice the crosswalks more as both a pedestrian and driver now.” These results indicate that the crosswalk murals were successfully implemented and serve as yet another example of Spartanburg’s commitment to driver and pedestrian safety, public art, and the growing downtown cultural district (Seifert & Stern, 2005). Images of the Creative Crosswalk Project, from concept to implementation, will be included in the presentation.

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Feminism in Action: WGST 101 Service-Learning Partnership with Safe Homes Rape Crisis Coalition

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Abstract - In spring 2019, I redesigned two sections of Women's and Gender Studies 101 as service-learning courses in partnership with Safe Homes Rape Crisis Coalition (SHRCC). This was a fortunate relationship for us because the curriculum for WGST 101 covered both domestic violence and sexual assault as feminist issues. We focused the majority of our service that first semester in conducting a university and community-wide clothing drive that would benefit the SHRCC thrift store. Sales from the thrift store helped to support counseling services for victims and their children, and those who fled violent situations with nothing but the clothes on their backs were given vouchers to shop for necessities in the thrift store. Now in our third semester of service, our service contributions have expanded as our relationship with SHRCC has grown and students' challenges have become clear, and we have found that the ongoing partnership has had a positive impact on student learning and development.

Keywords — Service-learning, feminism, women's and gender studies

Feminist Outreach in the Upstate

Students in service-learning classes at USC Upstate must complete a minimum of fifteen hours of service. As our service-learning project launched in January 2019, I quickly discovered that finding donations was easier for some students than others. I had recently watched Marie Kondo’s Netflix show about “tidying,” and I thought that a clothing drive would be well-suited to a society inspired to declutter. As I explained the project to the class, a few students expressed that they felt confident that they could collect the minimum amount of donations by reaching out to family and friends. One student made an announcement at church on a Sunday, and she received so many donations that she had to borrow the church’s passenger van to transport all of the items to the thrift store. Other students struggled, and I realized that having extra clothing, and more importantly, donating rather than reselling or repurposing extra clothing, was not an option for the working families and communities of some of our students. I therefore arranged for students to contribute service hours by working in the thrift store—sorting and folding clothing as well as organizing and cleaning the shop.

Students who had their own transportation helped students who did not drive get donations from USC Upstate to the thrift store in Spartanburg. Other students wrote notes of encouragement to be placed in toiletry bags for women in the safe house. In that first semester, we collected over one ton of clothing items for the thrift store, made fifty toiletry bags, and wrote over a hundred cards of encouragement. Despite some initial challenges, our project was a success, and I learned through our experiences that semester how to expand our service in ways that would benefit SHRCC and address our students’ unique challenges.

The next semester, we were invited to do a service project at the safe house. Because the location of the safe house is closely guarded, students signed confidentiality waivers before participating, and they took their responsibility seriously. We completed much needed painting inside the main dining room, kitchen, and living room at the safe house. Some of these students had never used a paint roller in their lives nor visited a shelter, and many students shared afterwards that this was a meaningful experience for them. In addition to this on-site project at the safe house, we continued with the clothing drive and our volunteer work in the thrift store. We also held a tabling event in the Campus Life Center lobby in October to promote domestic violence awareness. Jamie Hughes, the campus liaison for SHRCC, spoke to our class twice: once during our unit on domestic violence and again as part of our unit on rape culture. Students developed a real world understanding about how the systems of inequality that we had been studying academically had tangible results in our own communities, but, more importantly, that feminist activism could help to mitigate victims’ suffering and to promote awareness to lessen—and hopefully to one day eliminate—the problem.

In Spring of 2020, this project is now in its third semester, with the largest number of students participating to date: fifty students in two sections of WGST 101. In addition to continuing the clothing drive, working in the thrift store, and hosting a tabling event (this semester, for sexual assault awareness month in April), students will be painting
a therapeutic sensory room for children at the safe house as well as doing landscaping of the grounds. Numerous studies have demonstrated over the past decade that aesthetically pleasing environments are beneficial to those who are healing from trauma. While psychologists have different theories about how healing gardens help individuals (whether they encourage progress through stimulating the limbic system of the brain or whether they foster cognitive functioning), they agree that harmonious garden aesthetics promote recovery (Stigsdotter and Grahn, 2002, p. 62).

**Feminist Impact on Student Experience**

When I began this project a little over a year ago, I did not anticipate the positive effect that this service-learning partnership would have on student learning. Because the service project integrated so well into current course content, the experience of coordinating the clothing drive and other efforts—while not academic endeavors at face value—contributed to the curricular goals of the class by connecting our theoretical understanding of feminist issues to the real world. Students developed problem-solving skills (if I don’t have a car, how will I pick up donations from X?), communication skills (how do I solicit donations, thank donors, or write notes of encouragement?), and empathy for others (how might factors like immigration status or language barriers keep women of color from getting help for domestic violence or sexual assault?).

In addition to intellectual rewards, this project also led to emotional healing for a number of students. One student reflected, “this service learning has really helped me due to things I have been going through this past semester. The lessons we had from Jamie Hughes helped me see the domestic violence I was experiencing in my own relationship. I reached a decision and broke up with my boyfriend of almost a year due to the toxic relationship we had. Although the relationship I was in was not physical abuse, it was mentally abusive and I did not realize it until I engaged in Jamie Hughes[’s] lessons. This really helped me put a lot of things in perspective.” Because the nature of this class and the service-learning project both touch on sensitive issues, more students come to me than likely in an average college class with their own stories of intimate partner violence and sexual assault. Beyond taking the necessary steps of connecting these students with the university’s Title IX coordinator and counseling services, I have also employed feminist pedagogy in incorporating inclusive language into my class discussions so that student survivors do not feel isolated or abnormal. By highlighting the pandemic of domestic violence and sexual assault, I work to destigmatize victims’ experiences. As Corrine Bertram and M. Sue Crowley have pointed out: “in most classrooms there are women and men who have experienced that violence” (Bertram and Crowley, 2012, p. 72). Studies have demonstrated how traumas like rape and sexual assault affect students’ GPAs and how gendered violence has long-term economic impacts on victims’ lives, and researchers are now starting to collect data about how rape and sexual assault affect student retention in college (Jordan et al., 2014; MacLellan, 2018).

**Conclusions**

Service-learning opportunities such as this one with SHRCC can yield high-impact educational results for students but can require additional resources from faculty and the university. Two students from my WGST 101 classes will be returning to SHRCC this summer to complete internships by completing training for and working on the rape crisis hotline. At USC Upstate, I coordinated with our counseling services and our Center for Women’s and Gender Studies to offer a “student survivors support group” so that students inside and outside of the course could have additional resources to work through events that could resurface through feminist course work and service opportunities. This support group is now ongoing with its first cohort of students. Confronting these issues is a necessary step toward women’s empowerment and equality.

**Acknowledgements**

A huge shout out to all of my students in WGST 101 sections in Spring 2019, Fall 2019, and Spring 2020 for all of their dedication and hard work that made this service-learning a success. Also, thank you to Jamie Hughes at SHRCC for sharing his experience with our classes, and to Dr. David Marlow for guidance and institutional support.

**References**


Learning and Serving: Linguistics in Child Literacy

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Abstract — Throughout America, the number of Spanish-speaking immigrants is on the rise and has been for decades. Through service learning, the University of South Carolina Upstate provided our Linguistics for Language Teachers and Learners course the unique opportunity to partner with United Way to serve as Reading Buddies with students at Lone Oak Elementary. Our class was fortunate enough to be paired with students of English as a Second Language. This paper describes the experience and learning of one student.

Keywords — ESOL, Spanish, Elementary Service Learning

Introduction & Literature Review

Between 2000-2001 and 2010-2011 South Carolina experienced the largest growth in numbers of non-English speaking students in schools with 610% (Horsford & Sampson, 2013). Many efforts are underway to meet the challenge this proposes. The United Way, for example, “improves lives by mobilizing the caring power of communities around the world to advance the common good” (United Way, n.d.) and, in partnership with Spartanburg District 6 and Lone Oak Elementary school, has developed the Reading Buddies program which serves students who are behind in literacy. English Language Learners, more commonly known as ELL students, often suffer poor test scores and classroom grades because of a lack of adequate EL instruction (Fry, 2007, p. 2). This is due, in part, to the neglect placed on heritage language support. Anna L. Vallance of Wayne State University writes, “While the U.S. government is pouring thousands of dollars into foreign language programs, the same country’s education system is neglecting and, in some cases, opposing the maintenance of English learners’ heritage languages, despite the fact that research shows the detriments of doing so” (p. 3). This is often reflected in the students’ feelings of inclusion or self-worth in and out of the classroom. Further, literacy not only improves students’ confidence and self-image, but also increases their likelihood of lifelong success (Kennedy et al., 2012). In an effort to increase literacy rates in our community, each member of our class meets for an hour each week with one or two ELL students and provides free, exciting, and valuable English-language experience while observing course concepts in the real world.

Background & Methodology

This study has been unique for me as a student of Spanish as a Second Language. While many of my classmates are bilingual Spanish and English-speakers, my experience with the students at Lone Oak is a bit different. This is one of the few benefits of being an emergent bilingual, rather than being fluent in Spanish. I am able to relate to my students more fully because we are undergoing the same process of language learning and acquisition. The steps my students and I have taken so far throughout the semester are all consistent with what we have studied about second language acquisition in our course. Second language acquisition is often frustrating and rarely easy, especially when accounting for the stress of immigrating to a country and experiencing total immersion. Most of my linguistics classmates and myself are studying to become teachers one day. Reading Buddies is such a beneficial opportunity for us to apply topics like phonology, learning versus acquisition to help ELL students in an authentic environment. As we are in a service-learning linguistics course, many of our discussions are centered around the applicability of linguistics and the accessibility of language to all groups of people. The course also emphasizes the need for citizens committed to supporting and encouraging ELLs and native speakers learning ‘foreign’ languages.

I have been fortunate enough to be placed with two fifth grade students from Mexico. The students, called Rosa and Maya for the purposes of this paper, both immigrated to the United States within the past two years. Rosa has only lived in the US for two months, so her English skills are much farther behind those of Maya. Maya would be considered, at this point, conversationally bilingual. While still behind the target reading scores for her grade, she easily possesses functional fluency. Rosa, on the other hand, is able to comprehend much of what is said but produces very little. This is helpful in our sessions, where Maya is able to guide Rosa’s language development by clarifying my instructions.

We meet each Friday morning just before their recess time. During our sessions, we are placed in a resource room with only another group of Reading...
Buddies present. Often, we are handed a folder with a few phonology or letter and number-learning activities. So far, the students have been asked to bring their own books, as long as they are in English. Occasionally, we like to read through Spanish books with them as well to emphasize the importance of literacy in their home language (Vallance, 2015). I hope that by the time of this presentation in April, we will have stream-lined the sessions and been able to collect more material. Currently, some of our classmates are brainstorming ways to collect more bilingual or English books to use with our students. The book of choice is important because students are more likely to acquire language when they are interested in what they are reading (Kennedy et al., 2012). We hope to not only assist the students in improving their test scores, but also to grow a lifelong love for reading.

**Connecting Course and Service**

So far, my students have aided my learning immensely by helping me to sharpen both my English and Spanish grammar skills. Linguistics for Language Learners and Teachers is a course that helps create connections between language theory and real life. I see many of our course concepts reflected in Rosa’s learning specifically. Because she is still in the beginning stages of second language development but is strong in her native language, I apply Krashen’s Input Hypothesis to my sessions with her. Comprehensible input is crucial for language acquisition. Krashen “refers to [comprehensible input] as i+1,” meaning that students are most receptive to input that is just above their current level of ability, as opposed to much easier or more difficult (Freeman & Freeman, 2014, p. 64). For example, she has memorized her numbers one through ten in English and can now recite them and identify their symbols with relative ease. Rather than asking her to keep regurgitating that same cluster of information or suggesting she memorize the numbers through one thousand, we began learning to spell and write out the numbers in English. We are able to build on what she already knows to foster the healthy development of new knowledge. In the same way, effective language learners can create “production-based output” (Freeman & Freeman, 2014, p. 68). Throughout the semester, I am confident that I will be able to observe more acquisition patterns in my students. I am especially eager to track Maya’s progress as we acquire more challenging books and practice materials.

Despite evidence of the truth of some of Krashen’s findings surfacing during our meetings, other non-psychological factors contribute to the language-learning process. Many times, the “broader social context” is arguably more necessary to observe. Schumann’s Theory of Second Language Acquisition accounts for social distance. This is especially prevalent in learners who feel like an outsider in their environment. This is what makes the ELL experience such a stark contrast to the EFL (English as a Foreign Language) experience. Students who feel uncomfortable, or feel they are practicing ‘survival English’ may experience lower motivation, culture shock, or animosity towards an unwelcoming society (Freeman & Freeman, 2014, p. 67). Rosa and Maya are fortunate to attend a school where native Spanish-speakers are in the majority. This allows them to feel comfortable in an otherwise unfamiliar environment. I have noticed, however, an air of self-consciousness when speaking with native English-speakers or those of different races. I look forward to learning more about these girls as not only students, but as members of a larger culture.

**Conclusions**

For the remainder of the semester, my students and I will continue to work through increasingly rigorous material. Throughout this time, I hope to continue to study the effects of Krashen’s and Schumann’s theories of second language acquisition. My students are eager to continue to immerse themselves in the English language and show pride in their accomplishments thus far. My presentation in April will provide a more nuanced perspective as I serve, learn, and assess cultural impacts. As I work with Maya and Rosa on their English literacy, they help me grow in social and linguistic proficiency.

**Acknowledgements**

My professor and I would like to offer our sincerest thanks to the faculty, staff, and students of Lone Oak Elementary school for allowing us to be their partners for the remainder of the semester. Also, we would like to thank United Way for offering their guidance and resources to us. Without them, a program of this caliber would be impossible.

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Supporting ESL Students Through College

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Abstract - When people think of a student, they might have many different definitions in mind. Some might simply think of anyone who attends some sort of educational environment with the purpose of learning or reaching a specific goal, but my purpose with this case study is to bring attention to a specific category—English as a Second Language (ESL) students. With this narrative, I focus on the issues that this group of students who seek to obtain their degree might face, and these issues can be present within lower grade levels, but they are simply not addressed. By conducting a SWOT analysis, I am able to focus on one student’s struggles throughout higher education.

Keywords – service learning, English as a Second Language, supporting college students

Introduction

Although there is a large population of ESL students within the United States of America—especially in South Carolina, where the population of ESL students increased by 410% between 2003 and 2013—there is still a level of underrepresentation in higher education in the Upstate that needs to be addressed (Lbreiseth, 2018). By conducting a case study, I have the opportunity to bring awareness to those few ESL students who enter into higher education with the intent of creating a career for themselves.

At the age of twenty, navigating a new country can be difficult, especially when that country is over 6,000 miles away. For my student Sunni, not only did he have to move from Uzbekistan to the United States of America, but he has also had to become acclimated to a country that speaks a language that is rarely utilized in his native country—English. After attending high school in the United States, by the time he reached college, Sunni is considered an intermediate English speaker. At this stage, an individual can typically hold a conversation, but they might struggle with being able to grasp all of the features that English entails.

When I first met Sunni, he was able to communicate at an introductory level. Within the ESL community, we tend to use terms like “conversational English,” which refers to a student’s ability to converse with native English speakers. In terms of Freeman, his conversational English is well developed. At his level, students can reach a point where they have memorized key phrases and questions such as, “Hi, how are you,” and can entertain small talk. His academic English is where he struggled the most, which was even more concerning, seeing as he attended high school in the United States.

Communication between the two of us was on a very basic scale. Throughout most of our sessions, Sunni preferred to utilize a form of Grammar-Translation by implementing YouTube videos and textbooks into our lessons. The Grammar-Translation method is when “students learn to translate from one language to the other, [and] they study the vocabulary and grammar of the target language” (Freeman, 2016, p. 29). During a session, we might look at phrases that are regularly utilized within his remedial English classes, such as pronouns, subject-verb agreement, and thesis statement.

Strengths

Because Sunni and I do not share a common language, the only way I was able to understand him at times would be through his use of an online translator. This became even more difficult because his translator did not cater to his native language, Uzbek, so he had to utilize Russian, which is also a second language for him. Instead of prohibiting his use of a translator, I integrated it in the beginning, as often as he needed to because “teaching should be learner centered” (Freeman 2016, p. 41). Being able to use his translator as a resource allowed me to incorporate his translator as form of scaffolding. Scaffolding simply acknowledges that students often need a certain level of support and as examined by Silvia Restivo, “Heritage language is crucial for ESL students because it promotes self-esteem, enhances personal and cultural identity, increases the ability to adjust to new environments, and supports English acquisition instruction” (Restivo, 2013). I realized that with even a small amount of scaffolding, Sunni would make progress. While working with Sunni, I also realized that his conversational language slowly but surely improved and Freeman (2016) recognize that in 1981, Cummins found that “students developed two types of language proficiency: conversational language and academic language” (p. 101). Sunni was able to talk to me without me having...
to ask him to repeat himself several times. Sunni was receptive and when he did not understand something, he did not hesitate to ask me, which would often require me to rephrase my statement. His development of conversational English was one of his strengths because even if he did not understand exactly what his textbook might have been saying, he could at least communicate with me on a basic level.

Weaknesses

While scaffolding was helpful for Sunni, his dependence on the scaffolding concerned me because it catered to his weaknesses, in terms of ESL teaching and learning. Towards the end of the semester, after acknowledging his progress, I was sure to provide him with praise because “insecurities can be even stronger when a student feels out of place and speaks a different language,” but I also wanted to ensure that Sunni knew that no matter how much progress he made, I still had faith in him (Freeman, 2016, p. 233). I could tell that Sunni’s level of comfortability had prospered, as well as his confidence while speaking. Because of his constant conversational language acquisition, he lacked motivation when focusing on actual academics. As an example, in terms of Gibbons’ challenge zone, when Sunni and I simply spoke, he would be in the comfort zone. The comfort zone can be defined as “high support and low challenge,” which just means that Sunni was receiving more scaffolding and less challenge (p. 244). When asked to read something on his own from a text, he would enter the frustration/anxiety zone, “high challenge and low support” (p. 244). During high school, Sunni would have had to develop a certain level of academic language proficiency and according to Restivo, “For ESL students, acquiring English language proficiency is crucial in order to succeed academically” (Restivo, 2013). So, in terms of learning, Sunni’s greatest weakness would have to be his lack of motivation, in terms his efforts to understand academic language. When simply conversing, Sunni was able to excel at his level. When faced with having to focus on academic language, Sunni was barely willing to try.

Opportunities

Because we were able to work together on a consistent basis, I often was able to try different teaching methods with him beyond Grammar-Translation (Freeman, 2016). Over the semester, I included the big question method. According to Freeman (2016), “a better way to organize curriculum is to explore big questions,” which allowed Sunni to remain focused on one central theme (Freeman, 2016, p. 78). Instead of thinking about it as a question, however, seeing as at the adult setting, there is not a formal standard like there is in K-12, I thought about it in terms of a theme. Since Sunni was still in the process of learning English, I centered the theme around him. By doing so, I was able to incorporate his native languages and culture, which kept him interested. Freeman also suggest that when trying to support a student’s language and culture would be to “allow bilingual students to respond in their home languages to demonstrate comprehension of content taught in English” (p. 211). Every day, we would start the session by asking about each other’s day. From there, I was able to ask Sunni a series of other questions. Most of the time, he understood what I was saying, but he would have specific things that he wanted to say and could not figure out how to do so in English. Instead of discouraging the translator, I allowed him to respond in his native language, which gave me a general idea of how he was progressing. In terms of opportunities, Sunni definitely was able to display his proficiency when a combination of oral and written language was utilized, instead of simply one or the other.

Threats

While tutoring Sunni, I noticed that, although he was willing to try out different approaches, particular methods simply did not work for him. One of those methods was the Audio-Lingual Method in which, “the teacher engages students in dialogues and drills to form good habits in the [target language]” and as stated before, the use of dialogue is something that Sunni thoroughly enjoyed (Freeman, 2016, p. 29). One aspect of the ALM method is that, in order to successfully utilize it, all errors must be corrected immediately. Because of this, I often found that he was not only frustrated with ALM lessons but with himself and maybe even with me. There would be times where he would huff because I did not understand what he meant. According to Lucie Moussu (2010), “Length of exposure to their teachers proved to be a key variable...and students' attitudes towards their...ESL teachers were significantly more positive at the end of the semester” (Moussu, 2010, p. 749). Sunni’s attitude could have been a matter of his frustration, my lack of understanding, or a matter of him not understanding what I meant. At times, it also could have been due to the monotony of the ALM sessions. If I would have continued with the ALM method, Sunni’s conversational language acquisition would have suffered as well, and his attitude towards me...
would have been mostly negative, due to my seeming inability or willingness to accommodate him.

**Conclusion**

In summary, Sunni was a student who, in the beginning, depended heavily on scaffolding. Not only this, but he often entered the frustration/anxiety zone, due to his lack of understanding and my own. The Grammar-Translation method was utilized the most upon first meeting but instead of staying on this path, I attempted the ALM method. I soon realized that it was not benefiting either of us, and thereafter, I mostly used the big question method and kept Sunni as the central theme throughout the semester. His conversational language acquisition had already been well developed before meeting with me, but he obtained a few more words to use throughout every day, while also being able to converse with more people in English. Upon examination, Sunni might have been a little too dependent on his translator as a means of communication, but he can now hold a comprehensible conversation with the language he has developed.

While this analysis centers around one student, I hope that colleges, universities, and any organizations that hope to cater to this population of students will understand that many ESL students come from different backgrounds and because of this, they need special attention. Although students at Sunni’s level tend to avoid higher education, this study proves that there are students out there who might want to further their education, but they simply need the tools—someone who is willing to help—in order to succeed. There students have much to offer our institutions, but we have to be willing to work through their strengths and maximize their opportunities. A language is meant to join people together; therefore, someone’s lack of knowledge about a language should not isolate them. By taking the time to identify a student’s strengths and weaknesses, opportunities and threats, we also strengthen ourselves and expand our insights as a community.

**References**


5 X 5 Independence, LLC
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Abstract - Placing Visual Assistants with a disabled local entrepreneur raised awareness of transportation challenges faced by special needs groups, specifically the visually impaired with regard to their ability to gain and maintain employment. 5 X 5 Independence, LLC was formed to explore and develop a ride-share based non-profit serving the employable visually impaired. Seven currently employed visually impaired individuals participated in interviews. State and local agencies provided useful information. The project resulted in development of an initial operations budget, a panel discussion to continue raising community awareness of need, and a presentation to potential funders.

Keywords – visually impaired, ride-share, transportation, employability, non-profit

Introduction

Through a Service-Learning engagement and providing Visual Assistance to a local entrepreneur raised awareness of transportation challenges faced by special needs groups, specifically, the visually impaired with regard to their ability to gain and maintain employment. 5 X 5 Independence, LLC was formed to explore and develop a ride-share based non-profit serving the employable visually impaired. Seven currently employed visually impaired individuals participated in interviews. Using a personal vehicle and with the study author acting as the initial driver, project results indicate an initial operations budget of $114,000 is needed to run 5 X 5 Independence, LLC for the first year. Over a 5-year period, an estimated $570,000 would be needed to fund operations. 5 X 5 Independence's initial goal would be to recruit and able to pay additional drivers. Project results also include a panel discussion to continue raising community awareness of need, and a presentation to potential funders.

5 X 5 Independence, LLC

Project Origination, Background, Significance and Impact

Through USC Upstate's course, Topics in Service Learning (SL) at Work, Community Partner Dennis Hayes receives support through students working as Visual Assistants. When Mr. Hayes first received service-learning support, he was CEO of Hayes Security, LLC. When this project began Mr. Hayes was (and still is) CEO of Genesis Tech. Blind as a result of retinitis pigmentosa, Mr. Hayes continues to work and to provide business development support for many organizations. A significant task that SL Visual Assistants provide to Mr. Hayes is transportation. One of Mr. Hayes' first SL students, Brad Hamilton is now a graduate student in USC Columbia's College of Social Work. I met Brad when I served as Visual Assistant to Mr. Hayes during Fall 2017. My personal SL experience led me to learn more about the challenges faced by groups of people with limited access to transportation. Particularly meaningful to me is the degree of difficulty the visually impaired face personally and professionally when it comes to transportation, especially when it comes to being able to get to work, to execute their lives, and ultimately to remain employed.

For example, with rapidly changing workforce demographics and increasing emphasis for universal accessibility, research studies demonstrate the need for greater employment accessibility to all segments of the workforce (Apfelbaum et al., 2016; Rockmann & Ballinger, 2017; Salas et al., 2017). Chaiyachati et al. (2018a, 2018b) addressed transportation barriers from the perspective of rideshare services provided to Medicaid recipients with nonemergent scheduled primary care appointments. They theorized that rideshare based transportation would increase attendance for scheduled appointments and that ridesharing could be an efficient, cost-effective alternative to nonemergent medical transportation. While the first study did not establish improvement for completing scheduled appointments, a subsequent study which addressed sampling limitations of the initial study did establish improvement in show rates for Medicaid recipients. This study demonstrated that during the study's time frame, the typical transportation show rate worsened while rideshare show rates improved.
This means that patients were 2.57 times more likely to show up when they used a rideshare program. These findings are particularly interesting since individuals who are visually disabled are at increased risk for needing public assistance such as Medicaid.

A related study by Aarhaug and Elvebakk (2015) addressed the impact that universally accessible transport has on individuals with disabilities and on those with no accessibility issues. Examining before and after perceptions and usage of public transportation, particularly bus routes, they emphasized that the solution is having public transport designed universally for door-to-door usage, not just bus-stop to bus-stop. A previous study conducted by Audirac (2008) concluded that to implement a universal design for transport we must use a multi-tiered accessibility framework. This research suggested that transportation systems need to be tailored to various accessibility challenges. Similarly, Cmar et al. (2018) investigated the transportation accessibility for individuals who suffered from vision loss. They found that vision impaired individuals had increased levels of self-efficacy when they have easy access to transportation. This boost in self-efficacy is thought to be a result of disadvantaged individuals being able to successfully obtain and maintain a job because of access to consistent transportation (Cmar et al., 2018).

Locally, we found that United Way Piedmont had partnered with another company to provide rides to work for workers who could not provide their own transportation but that the program operated for one year only and ran out of funds before a long term impact could be determined and before the individuals who used the service could remain employed long enough to save enough money to provide their own reliable transportation.

Research Statement

This research project addressed how much it would cost to develop and run a local rideshare service to provide low cost transportation for the employable visually impaired for up to 5 years. With this objective, 5X5 Independence, LLC was established. Standardized interviews were conducted with 7 visually impaired individuals who are employed. While interviews were happening, attempts to contact Uber and Lyft were made. Additional attempts to talk with Ride Austin of Austin, Texas and Common Courtesy, Atlanta, GA were made. While those attempts were unsuccessful, conversations with United Way Piedmont were held to find out about previous local attempts to provide accessible transportation for special needs groups. Initially, 5X5 information gathering attempted to focus on transportation barriers for five different groups of individuals with special needs. These groups included the visually impaired, women recently released from incarceration, the elderly, veterans, and the homeless. Realizing that the needs of the five separate groups were so huge, 5X5 Independence research narrowed its focus to be that of the visually impaired with the hope that the resulting model could be applied to the additional special needs groups.

Results and Conclusions

Demographics

Seven South Carolinians participated in the interviews. All are visually impaired. 6 live local to Spartanburg, 1 in Lexington. Interviewees included males (4) and females (3) between the ages of 30 and 70, Americans of European descent (6) and Americans of African descent (1). 5 of the 7 interviewees are known to have completed degrees in higher education. All but one interviewee is gainfully employed. 4 of the 7 are working parents.

Transportation Needs

Each interviewee needed a minimum of 2 rides per workday and spent $7 to $15 per ride. Note these costs reflect what they pay for other rideshare and/or taxi services. Some interviewees, particularly the parents, required up to 6 rides a day. None of the participants could execute their lives using existing DIAL-A-RIDE subsidized ride providers. DIAL-A-RIDE services were too unreliable and too slow for the interviewees to be able to execute their normal day-to-day living requirements. All interviewees developed networks of volunteer drivers, but none could rely on volunteers or family for all of their transportation needs.

All interviewees were familiar with ride share services and were intrigued with and willing to take part in a ride share nonprofit focusing on their particular needs. Anecdotally, each of the participants exhibited extremely well-developed organizational skills, logistical planning abilities, and a phenomenal desire to help others.

With these research findings, 5X5 Independence’s initial goal is for grants or funds to be provided for up to a 5-year period such that individuals with employable skills who are visually impaired would be able to
1. Reduce their out-of-pocket costs to maintain current employment.
2. Acquire secure employment given access to low-cost, long-term transportation.
3. Save enough money from their employment to be able to take over more of their own transportation costs.
4. Be employed long enough to qualify for and receive employment promotions so that they manage & pay for all of their transportation costs.

Using the minimum number of 2 rides per day ranging 10 to 15 miles each way for 1 to 5 riders per weekday and assuming that these rides could be either one-way or round-trip and that each ride could be provided by a driver using their own vehicle at an hourly compensation rate of minimum wage plus vehicle maintenance costs, the attached business plan budget was developed.

**Acknowledgements**

Our interviewees made this study possible and we are grateful for their participation in the study; interviewees included Donna Early (SC Commission for the Blind), Dennis Hayes (Genesis Tech), Amanda Holley (USC Upstate student), Jessica Bates McKinney (USC Upstate faculty), Scott Smith (USC Upstate Office of Disability Services), Rhonda Thompson (SC Commission for the Blind), and Zunaira Wasif (SC Commission for the Blind). We are grateful for project guidance from Dr. Tina Herzberg and Jessica Bates McKinney of USC Upstate. In addition, we would like to thank the following organizations and agencies for their support of this work: South Carolina School for the Deaf and Blind, SC Commission for the Blind, United Way Piedmont, and USC Upstate’s Office of Disability Services.

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As a chiropractor, you can make a difference in your community, help people with a natural approach to health, and improve patients’ lives. Sherman College’s doctor of chiropractic program is unique in its approach to health care and known globally for producing doctors who are highly skilled in their delivery of chiropractic care.

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The Effect of Economic Satisfaction on Trust in Government and Support for Normative Democracy in Tunisia

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Abstract - The purpose of this research is to explore whether economic satisfaction, within Tunisia, effects trust in government and support for normative democracy. The issue at hand is that Tunisia, and the rest of the Arab world, has seen a surge of protests and demands to democratize their countries as well as modernize them. Old regimes have been replaced in almost all countries within MENA, with nothing more than oppressive autocratic rulers. It seems that only Tunisia succeeded in its demands to democratize and is now experimenting with normative democracy. Though they now have a democracy, Tunisians are still not satisfied with their economy and this lack in satisfaction has had a negative effect on trust in government. Tunisians, surprisingly, still support democracy and this is a phenomenon that was looked at during the research. Methods used to gather information were taken from data sets compiled by Arab Barometer wave V. The concluding results show that as satisfaction with economy goes up, both trust in government and support of democracy, go up. In conclusion it was discovered that satisfaction with economy plays a salient role in how Tunisians view their government.

Keywords – Tunisia, satisfaction, trust in government, democratization, Middle East, North Africa

Introduction

After the Arab uprisings that started around late 2010 early 2011, there evolved a massive reconstruction of regimes in the Middle East (Gelvin, 2015). Many of the old ruling autocratic regimes, were replaced from within their own countries by massive protests. The men and women of the Middle East wanted to end the status quo of their countries ruling classes, and in their stead begin to construct democracies in a region where autocracies have been extremely hesitant to change domestic and international conditions (Gelvin, 2015). Almost all efforts at democracy have shown to be failures. All but one, that is, Tunisia. A country with an interesting history and a fascinating demographic, that has resulted in some semblance of subsequent success in being the only Middle East and North African country to arise from the uprisings with an experimental democracy. Tunisia, though, has many obstacles in its way before it can begin to flourish and consolidate a democratic regime. Their still exists for example significant dissatisfaction with the economy. As Arab Barometer wave data shows, those who stated the current economy was good or very good went from 27 percent down to 7 percent from 2011-2018. Tunisians are vastly unsatisfied with their country's economy, and it follows logically that their government is to blame. Arab Barometer also shows that when surveys during the period of 2010-2018 asked “To what extent do you think that there is corruption within the national state agencies and institutions in Tunisia” the numbers were, 69 percent and 90 percent, respectively (“Tunisia - Arab Barometer”, 2019). The percentages run in tandem with their trust in government. Tunisians who expressed trust in their government fell 40 points to 20 percent between the years of 2011-2018. With such a decline in rates of satisfaction within the country for the economy and government, it would seem obvious, then, that Tunisian's support for democratic reforms would be low. But in fact, when asked whether they agree or strongly agree to the following question, “Democracies have problems, but are better than other systems” most Tunisians chose the view of strongly agree. From 2011-2018 those who agree or strongly agree rose from 70 percent to 79 percent. (Noticeably it was 85 percent in 2016 alone.) So how is it that satisfaction with the economy and trust in government can be so low, while support for democracy is high? It could be ascertained that due to Tunisia’s prior categorization as a “Rentier State,” Tunisians felt and still do, forced, because of economic and political discord, to forfeit basic freedoms and support the government; one that only hands out liberties as favors for patronage (Gelvin, 2015). Tunisians call for democracy in the stead of domineering regimes that operate within the structure of such economic conventions. A shift to democracy in the region would most likely play a significant role in bolstering the economy and alleviate political and social stress, allowing freer markets and more democratic governments (Clark & Khatib, 2017).

Data and Methods

The data used for this study comes from Arab Barometer wave V survey data. The data was collected from 12 Arab countries between 2018 and 2019. The study utilized data gathered from Tunisia.
as the survey asked respondents specific questions concerning their levels of satisfaction with their current economy, their trust in their current government, as well as their support for a democratic style of governance. To test how satisfaction with the economy affects both trust in government and support for normative democracy I performed two logistic regressions. However, before conducting the analysis, other variables such as, gender, religiosity, and education were gathered to aid in correlating possible effects of tertiary variables that may be pertinent to outcomes of the statistical regressions. In this study we isolate certain attitudinal views on economic status to identify its effect on trust in government and support for normative democracy.

**Dependent Variable**

The first dependent variable is support for normative democracy and the second is trust in government. Support for democracy has been evaluated by looking at polls that asked respondents to answer if they agree or disagree that democracy is better than other types of governmental systems. The first dependent is coded numerically as, 0 for strongly disagree, 1 for disagree, 2 for agree, 3 for strongly agree. The second dependent, trust in government, asked respondents to gauge their level of trust ranging from, 0 for no trust, 1 for little trust, 2 for some trust, 3 for great trust.

**Independent Variable**

The independent variable in this research is Tunisians satisfaction towards their current economic situation. This variable comes from the newest wave of Arab Barometer, where the respondents were asked how they would evaluate their current economic situation in their country. The variable is coded on a numerical scale that denotes 0 for very bad, 1 for bad, 2 for good, and 3 for very good.

**Results**

Logistic regression indicated that satisfaction with the economy elicits more support for Normative Democracy, while increases in religiosity and education are shown to have positively significant effects on support (see Table 1). Logistic regression also revealed that (i) satisfaction with the economy has a strong positive effect on trust in government, (ii) higher levels of education result in less trust in government and (iii) religiosity and gender are not significant factors that impact trust in government (Table 2). Implications of the regression analyses are discussed in the conclusions section.

**Table 1. Effect of Satisfaction with the Economy on Normative Democracy**

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with the Economy</td>
<td>.059</td>
<td>.024</td>
<td>.014</td>
</tr>
<tr>
<td>Gender</td>
<td>-.016</td>
<td>.032</td>
<td>.612</td>
</tr>
<tr>
<td>Religiosity</td>
<td>.187</td>
<td>.035</td>
<td>.000</td>
</tr>
<tr>
<td>Education</td>
<td>.067</td>
<td>.017</td>
<td>.000</td>
</tr>
<tr>
<td>Constant</td>
<td>1.729</td>
<td>.047</td>
<td>.000</td>
</tr>
</tbody>
</table>

**Table 2. Effect of Satisfaction with the Economy on Trust in Government**

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with the Economy</td>
<td>.418</td>
<td>.030</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>.020</td>
<td>.040</td>
<td>.615</td>
</tr>
<tr>
<td>Religiosity</td>
<td>.053</td>
<td>.043</td>
<td>.218</td>
</tr>
<tr>
<td>Education</td>
<td>-.126</td>
<td>.022</td>
<td>.000</td>
</tr>
<tr>
<td>Constant</td>
<td>.626</td>
<td>.058</td>
<td>.000</td>
</tr>
</tbody>
</table>

**Conclusion**

The research reveals a few interesting points. First it shows that satisfaction with economy does lead to support for democracy and this support is a significant factor with Tunisians. It calls into question the legitimacy of “Rentier States” and widespread corruption within Tunisia and MENA. As Middle Eastern governments become more corrupt and fail to provide basic rights and fail to facilitate institutionalized reform within their borders, support for their regime will continue to be
Tunisians support the ideology and practices of democracy and trust their governments more when they are more satisfied with their economy. Many ruling bodies within MENA, tend to run their regimes under the guise of being a democracy (Clark & Khatib, 2017). Yet in truth, they operate with the “Rentier State” mentality, causing the citizenry to act dichotomously within the confines of specific and diffuse support for government. Tunisians and the citizens of greater MENA battle with specific support for government, and they constantly judge and evaluate the utility of their government’s faculties. Though, clearly, they judge it to be inept. While this seems to be true, the citizenry is captive to their own situation and must submit to trained diffuse support because the government holds power over basic economic and individual freedoms (Easton, 1975). Thus, the Arab uprising, which was an attempt to change the state of things (Gelvin, 2015). As Tunisia goes forward with its experimental democracy, in an Islamic state, it must contend with the issue of what an Islamic democracy is, how specific and diffuse support work in democracy, and how modernization and democratization change the economic status of their country and MENA.

Acknowledgements

I would like to greatly thank, Dr. Placek, and, Dr. Damrel, for their help, expertise, and continued support and academic guidance. Without their help this project, and many other advancements in my academic career, would not have been as bountiful or prosperous. Thank you both.

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Does a Person’s Wealth Affect Trust in the European Parliament?

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Abstract — In recent years there has been a growing level of distrust in the European Union and its Parliament by citizens of its members states, coming to a head with the withdrawal of the United Kingdom from the EU following a national referendum. Faced with this loss of legitimacy by a such a large and influential democratic governing body, recent scholarship has focused on determining what factors affect the trust an individual might have for the intergovernmental organization. Many studies have shown income level affecting trust in government institutions including the EU. A separate study found one of the greatest predictabilities for an individual's trust in the European Parliament is their trust in their own state's governing body. This begs the question of whether income simply increases trust in governing bodies in a general sense or has some separate effect on the individuals trust in the EU. Using European Social Survey data and employing a regression analysis, the study finds an impact even after controlling for trust in national parliaments by income level and an even greater impact by their feeling about their household income.

Keywords — European Union, European Parliament, Trust, Income

Introduction

As the influence of European Union (EU) as an economic and political bloc grows on the world stage so does the influence of the Union’s governing body, the European Parliament (EP), over the various member states, enjoying a wide jurisdiction on the regulation of trade, immigration and other areas of integration of those states. In recent years the European Union has seen a growing opposition to its authority and actions with the most publicized of these having resulted in the leaving of the United Kingdom from the political union. With this recent pushback against the efforts to create a more integrated and unified Europe, as well as the financial issues that face many of the member nations in the European Economic Area and the Euro itself, it has become extremely important to measure and understand the level of support those citizens within the EU have for the institution of the European Parliament.

When an individual attempts to determine whether an institution as vast and complex as the EP is working towards their own best interest an individual may look at their own economic and social position in their life and how it has improved under the governance of the institution, affecting the individuals view on the legitimacy of the EP. This study is not the first to look at economic factors and its relation to the trust in the European Union with researchers Dotti Sani and Magistro (2016) showing a clear link between the trust that an individual had for the European Parliament and how negatively the European state in which they reside was affected by the 2008/2009 economic recession also finding “Subjects with perceived lower levels of income are expected to have experienced a steeper decline in trust than people who consider themselves better off in terms of income”.

The greatest shortcoming in this study that I wish to address is evident when looking at the research done by Harteveld et al. (2013), who when looking at three possible theories of trust, found that the primary factor that could be used to predict an individual’s level of trust in the EP was their level of trust in their own state's governing body, even greater than their opinion of the effectiveness of the EU. It is unknown if the income level of an individual affects only the individual’s level of trust for the European Union or if this income difference equally affects an individual’s trust in their own national government. The study must be expanded to consider an individual’s trust for their own state’s government in order to accurately show if the economic crisis affected people’s trust in the idea of a unified and integrated Europe, or their trust in governing bodies in general. Thus, I wish to reexamine the affect income has on trust in the EP, controlling for trust in the individual’s state government.

The regulations set forth by the European Union have significant economic impacts on the nations and companies under its jurisdiction. A nation or company with established economic strength might be more in favor of regulations as their economic position is stable, while an economically weaker nation or company might not want restrictions to be placed on how it can grow its own economy or profit. Since individuals with higher forms of income are typically tied to more economically prosperous companies, they might be more accepting and
trusting of the European Union as a whole. Thus, I offer the following hypothesis: **H1: The higher the level of income an individual living in a member state of the European Union, the higher their level of trust in the European Parliament.**

However, one must also account for the fact that within the European Union many countries have different costs of living. Though an individual’s income level might be lower, the purchasing power within their nation of their income could be higher than an individual paid more living in a state with a higher cost of living. It might be the case that in order to accurately compare income and trust a study must examine the individual’s feelings towards their income controlled for their actual income: **H2: The more comfortable an individual living in a member state of the European Union feels about their level of income, the higher their level of trust in the European Parliament.**

**Data and Methods**

The data used to test the hypotheses in this study comes from the European Social Survey 8, implemented in 2016. The European Social Survey (ESS) is a multi-country survey whose purpose is to measure the changing public attitudes and values in over thirty European states. This study only includes those countries that were member states of the EU at that point the ESS was conducted. From this survey, all of the twenty-eight member states of the EU except Malta, Romania, and Luxemburg have questions about the individual’s level of income and trust in the European Parliament. While only twenty-five countries have a question regarding the individual’s level of income, twenty-six have question regarding an individual’s feeling about their income as only Romania and Malta are excluded from this measurement.

**Dependent Variable**

The study will focus on a single dependent variable to determine an individual’s level of trust in the European Parliament as an institution. The concept evaluated is the individual’s expressed level of trust in the Parliament. This solely relies on the single ESS variable of the individual’s trust in the European Parliament. This variable ranges from zero to ten with zero indicating no trust in the European Parliament and 10 representing complete trust. While information on an individual’s level of trust in other EU institutions would allow for even greater understanding of the trust in the European Union as a whole, there is not currently data regarding individual views towards these institutions across Europe.

**Independent Variables**

The primary independent variables in this study are an individual’s level of income and an individual’s feeling about their income in relation to the ability to get by on a day to day basis. The individual’s level of income is expressed through deciles with the highest decile (10) representing the highest income group with the lowest (1) presenting the lowest decile. These deciles are determined through the relation of income levels with each decile having roughly the same percentage of individuals and is calculated after taxes and other compulsory deductions are removed. Due to the difference in cost of living in many countries it is important to example an individual’s economic position, not only through numerical values, but though the individual’s feeling about their income. This is expressed through an ordinal variable range of one to four with one representing the ability to get by as “very difficult on present income” and four representing “living comfortably on present income”.

The study will control for the factor shown in Harteveld et al. (2013). An individual’s trust in their own country’s parliament can be an affecting factor in an individual’s trust for the EP. Highest completed level of education must also be controlled as education level and income level have been shown to be correlated in my studies and has also been controlled for in the research done by Dotti Sani and Magistro. Interest in politics was controlled by both sets of research referenced as it can affect one’s knowledge and feelings towards the EP and thus will be controlled in this study as well.
Results

Table 1: Effects Income Level and Feeling about Household Income Level on Trust in European Parliament

<table>
<thead>
<tr>
<th></th>
<th>Effects of Income Level on Trust</th>
<th>Effects of Feeling about Household Income Level on Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling about Household Income</td>
<td>-</td>
<td>.060***</td>
</tr>
<tr>
<td>Household Income Level</td>
<td>.030*** (.002)</td>
<td>.038*** (.002)</td>
</tr>
<tr>
<td>Trust in National Parliament</td>
<td>.551*** (.002)</td>
<td>.554*** (.002)</td>
</tr>
<tr>
<td>Highest level of education</td>
<td>-.003+ (.002)</td>
<td>-.002+ (.002)</td>
</tr>
<tr>
<td>Interest in Politics</td>
<td>.077*** (.006)</td>
<td>.032*** (.005)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.945*** (.026)</td>
<td>1.448*** (.033)</td>
</tr>
<tr>
<td>Observations</td>
<td>133,397</td>
<td>133,178</td>
</tr>
</tbody>
</table>

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Conclusions

Given the findings above, income level showed a statistically significant impact even after controlling for trust in national parliaments, income level has a variably different impact on an individual’s trust for their own state governmental institutions and for the European Union institution of the EP. This can possibly be attributed to those individuals with higher levels of income living in states with governments that are less trusted by the populace being more willing to trust the European Parliament than those with lower income in these countries as they might be more internationally active in both business and socially, having a greater understanding of the difference between their own governing bodies and the EU. This finding holds true even when controlling for an individual’s feelings about their household income.

Additionally, it was found that there was a greater impact on trust when testing for an individual’s feelings about their level of income than the individual’s actual income. This having a greater positive effect than actual income level even when controlling for variable can simply be attributed to the idea of legitimacy discussed earlier in this study. Though the individual might not necessarily be making as large of a sum of money, the individual feels that their needs are provided for and therefore believe the government must be working for their betterment.

Despite the very limited nature of this study, it raises interesting questions about what factors have meaningful impacts on an individual’s trust for the European Union beyond those factors that cause the individual to trust all governing bodies. Further studies into other factors would shine light on those areas then that might cause a strengthening in trust in national governments while weakening trust in the EU. It seems that factors with this impact must exist as we see a growing discontentment with the European Union from some countries, wishing to govern themselves. Determining what these factors will be important for understanding the nature of human trust and international relations.

Acknowledgements

I would like to thank both Dr. Matthew Placek and Dr. Allison Ellis for encouraging me to take part in this symposium. In addition, I would like to thank Dr. Placek for his guidance throughout this process.

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Femicides in Latin America

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Abstract - Femicide is the ultimate form of gender violence against women that results in inevitable death. It derives from a distorted sense of ownership and entitlement among men, and it is increasing at an alarming rate. The purpose of this work is to identify the underlying factors and causes that contribute to the occurrence of femicides within Latin American societies as well as to propose a solution. The methodology consists of analyzing official data reports, surveys, expert statements, and real-life testimonies in conjunction with current events such as protests and marches. The results demonstrated that femicides are a byproduct of a sexist culture fueled by the negligence of governments and machismo. Additionally, the findings indicate that advocates and supporters no longer trust the government and demand change through social movements that promote awareness.

Keywords - Femicide, Sexism, Government Negligence, Latin America, Gender Violence

Introduction

Gender violence against women has become a serious issue in Latin American societies with femicides being the leading cause of homicides. With governments refusing to take accountability, the Gender Equality Observatory notes that “Official information for 15 countries in Latin America and the Caribbean shows that at least 3,287 women have been victims of femicide or femicidal violence” (Femicide or Feminicide, 2020). Sisters, mothers, and daughters are constantly disappearing without a trace. Not infrequently, their remains are the only thing found along with a lack of culprits. However, change is nonexistent and, as Lorena Arroyo (2018) notes: “Every two hours, a woman dies in Latin America for the simple fact of being a woman.” Most experts in the field believe the contributing factors to be gang violence, poverty, and human trafficking. Although relevant, they have overlooked systematic sexism within Latin American culture. My research will focus on femicides being the product of a toxic culture along with providing a comprehensible solution. Additionally, it will explore relevant testimonies and display governmental negligence.

Machismo in Latin America

Femicides and gender violence are deeply rooted within Latin American culture. They are anchored to negligent governments, sexism, and machismo. The reality is that governments ignore the violence against women and completely deny it. In many cases the victim is blamed for her actions even after death. This creates a false notion within men that allows them to justify their actions as they believe that there are no consequences. Garcia-Navarro (2014) notes that a survey on sexism revealed that “half the men surveyed said that men required more sex than women and that women should be submissive to men. Almost 80 percent said it would be unacceptable if the woman didn’t keep her house clean.” Those sexist ideologies pave the way for machismo, an exaggerated sense of masculinity. Zimmerman (2020) better defined it as a “cult of male virility, in which the ideal man is bold, intransigent, and sexually aggressive” (p. 3). It causes men to treat women as their property and take ownership over them. However, the problem arises when women refuse to become submissive which leads to the gender violence. Additionally, this display of sexism and machismo across culture is noticed by everyone including children. It imprints gender roles from an early age and creates a repetitive vicious cycle. Oxfam (2019), a global movement of people who fight against inequality notes that it’s a cycle in which there’s a “tendency to consider acts of violence against women and girls as normal.” Thus, the normalization of gender violence poses a grave danger and opens a pathway to femicides.

Law and Protest

There are laws that attempt to punish those who commit femicides, but they are rarely enforced. Ziff and Raul (2018) note that “El Salvador passed a law in 2011 and “in the first 16 months after the law was enacted only 16 of the 63 reported cases were solved due to a systematic lack of investigation”. In 2007, Mexico passed the General Law of Access for Women to a Life Free of Violence; however, as Watson (2015) notes “Between 2011 and 2013, 840 women were killed, 145 of these killings were investigated as femicides”
This is a recurring event across all Latin America, and it demonstrates that enacted laws are futile. Consequently, women and supporters have lost all hope as there has been no change. This has led to an increase in protest and marches. Protests have been one of the best ways to raise awareness against gender violence and femicides. Yearly, women and supporters march across Mexico City to demand a stop to femicides and its known as the International Day for the Elimination of Violence Against Women. Last year, protesters grew furious as the security minister declared yet another violence alert. They were tired of seeing a lack of action as Mexico has declared 32 gender violence alerts since 2007. The protesters stated in the Mexican women demand article to Straitstimes (2019) that “In Mexico state, we’ve had a gender violence alert for four years running, and it hasn’t done anything. They keep killing women.” However, the reality is that protest only serve as a form of awareness and provide no real solutions.

Laws and protest are only a false hope to women as nothing has changed. Semple and Villegas (2020) notes that according to the Mexico office of U.N Women “The overall number of women who die violently in Mexico has also increased, rising to 10 killings per day in 2019 from seven per day in 2017.” The Annual Report (2018) of Human Rights in Guatemala notes that “The 2018 figures show 9,924 registered denunciations of sexual crimes between January ... and November and 307 femicides in 2018.” All the figures continue to increase and show no improvement. In Honduras, the Human Right Council notes that “According to the data from the Observatory on violence, 5,837 women were murdered from 2002 to 2017. While from 2014 to 2017 there have been 1,944 registered cases of femicide, only 33 have been tried in that period.” This demonstrates that women are dying waiting for a change that is nowhere in sight.

Schools and Communities

There is a solution to stop femicides; however, it won’t be conceived overnight, and it will take time and effort. The key lies in knowledge and adequate teaching as the road to travel must be paved by education. Currently, protest and allies have brought gender violence and femicides into the limelight. These groups have been instrumental in creating awareness of femicides nationwide. However, they are still not enough, and the pattern of violence continues. They demand change from the top, but it rarely trickles down to the people. To make a real impact, a change from a macro to a micro level is needed with an emphasis on social awareness in schools and communities.

The question then arises of how to make a change when even laws that promote reasonable ideas fail. The answer lies in learning and cooperating collectively. Currently laws are being neglected, communities are living in fear and protest only serve as a temporary stop. There is no unity when it comes to finding a concrete solution between all factors. To stop this, community, government, school and organization leaders must collectively meet without pointing fingers and become part of the same agenda. After, they must start at the lower end of the scale and work with schools. They need to create a curriculum that brings awareness to gender violence and denounces sexism. This will break the cycle of machismo as children will learn from an early age of its dangers and learn how to disassociate themselves from such concepts; thus, halting femicides and reducing gender violence.

Conclusion

Femicides in Latin America are exponentially increasing and there is no end to the wave of violence against women. The negligent government keeps on blaming women and refuses to incarcerate their perpetrators. This is due to a sexist culture that harbors machismo creating a never-ending cycle of violence and death. There are laws in place to protect women, but they are rarely enforced. All those frustrating factors have caused women and their supporters to seek out social justice. However, protest only bring awareness and no concrete solutions.

Latin America rides on the wheels of a toxic, sexist, and an abusive culture; it’s in constant turmoil and disorder. Communities, governments, schools, and protest leaders must band together to stop the wheels set in motion by their ancestors. However, stopping them will not suffice, they must break the wheels to truly create a unified Latin America. The reality is that the world cannot be left in complete disarray; it must be left in a better state than when it was found. After all, there are more than 650,526,730 (Population of Latin America and the Caribbean, 2020) reasons why Latin America must change.

Acknowledgement

I would like to express my deepest gratitude to Dr. Polchow for her constructive suggestions throughout the development of this research work. Dr. Polchow’s availability and willingness has been very much appreciated and instrumental.
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Abstract - Faced with cultural crisis and foreign imperialism, Chinese modernizers called on women to strengthen the Chinese race through fetal education, an ancient practice where pregnant mothers regulated their environment, emotions, and deportment to positively influence the fetus. As discussions of fetal education developed over the twentieth century, they popularized new ideas of eugenics, biomedicine, and modern forms of discipline, which lay the groundwork for the intensive state intrusions into women’s reproductive lives seen in China today.

Keywords: China, pregnancy, eugenics, fetal education, biopower

Introduction

Faced with cultural crisis and foreign imperialism at the turn of the twentieth century, Chinese intellectuals turned their attentions to the bodies and behavior of pregnant women in an effort to save the nation by strengthening the Chinese race in utero. In particular, they called for a return to the ancient practice of taijiao, or fetal education, in which pregnant mothers regulated their environment, emotions, and deportment so as to positively influence the development of their impressionable fetus.

This research traces debates over fetal education from the end of the nineteenth century to the rise of World War II and examines how arguments over pregnancy hygiene became an arena for contesting the meaning of science, motherhood, and the nation. During a period of epistemological transformation, when fundamental ideas about gender, the body, and society were in flux, writers drew upon or rejected different aspects of classical Chinese medicine, eugenics, and Western biomedicine to support their particular vision of a modern Chinese nation.

This project lays out four different stages in the modern discussions of fetal education. In the first stage, modernizing intellectuals sought to use traditional fetal education to strengthen the Chinese race, with some advocating modern disciplinary techniques to ensure compliance. Next, writers continued to promote fetal education while using a syncretic blend of Chinese and Western science and cultural anecdotes to prove its efficacy.

Modernizing Fetal Education

The earliest accounts of fetal education praised the queen mothers of China’s ancient Zhou dynasty, whose careful practice of fetal education helped shape, in utero, the sagely nature of the great founding kings of the Zhou dynasty. For over two thousand years, female didactic writings and gynecological texts passed down knowledge of fetal education, instructing pregnant women to regulate their posture, speech, emotions, and environment so as to positively influence the fetus within (Kinney, 2004). At the end of the nineteenth century, however, as Chinese elites responded to the trauma of European and Japanese imperialism, they began to write about fetal education in new ways (Judge, 2008; Richardson, 2015). Gripped by Social Darwinian fears of national annihilation and influenced by new ideas of eugenics and nationalism, modernizers such as Liang Qichao and Kang Youwei called upon women to harness the power of fetal education to strengthen the Chinese race in utero. (K’ang & Laurence, 2005; Liang, 2002).

Efforts to use fetal education for racial strengthening represented a new form of biopower, a term coined by Michel Foucault to describe the efforts by modern states and institutions to harness the labor and bodies of their populace by disciplining individuals in ways that ultimately trained them to discipline themselves (Rabinow &
Rose, 2003). This new form of fetal education was distinct from traditional fetal education, which had been rooted in an older, late imperial form of biopower that was embodied through Confucian ritual performance and education. In Kang Youwei’s posthumously published utopian work Datong shu (The Great Unity), he continued to draw upon the classical Chinese medical principle that the maternal environment influenced the moral and physical development of the fetus. However, he called for fetal education to be enforced through distinctly modern disciplinary methods of confinement, surveillance, and coercion (Foucalt, 1995, K’ang & Laurence, 2005). Specifically, Kang called for all pregnant women to be institutionalized at a proposed Human Roots Institute to ensure that they ingested only upright flavors, listened to harmonious music, and read both the Confucian analects and modern texts on hygiene, all while being measured and monitored daily by female doctors (K’ang & Laurence, 2005). While Kang’s plan was theoretical, it foreshadowed the emergent modern disciplinary methods of surveillance and institutional coercion, while clearly articulating the willingness of China’s modernizing elites to subordinate women’s reproductive bodies to the goals of the state.

By the early twentieth century a new kind of discourse about pregnancy emerged that drew upon both Chinese and Western scientific and cultural traditions. This syncretic approach is best represented by Song Jiazhao’s 1914 work Taijiao, or “Fetal Education,” a loose Chinese translation of a popular Japanese pregnancy self-care guide by Shimoda Jirō. Like earlier writings, Taijiao urged women to practice fetal education to strengthen the nation, but it also drew upon an eclectic mix of Confucianism, classical Chinese medicine, Western biomedicine and psychology, and popular stories about pregnancy to make its argument. Through his work, Song helped popularize Western ideas about the female body, even as he presented them as fully compatible with Confucianism and classical Chinese medicine (Richardson, 2015). Unlike Kang Youwei, Song did not advocate that modern institutions regulate pregnant women’s bodies and behavior. Instead, Song drew upon an older form of late imperial biopower as he presented pregnancy as a woman’s sacred duty of creation. In essence, Song called upon women to perform a particularly female method of Confucian bodily self-discipline, self-cultivation in service to their reproductive contributions to family and nation. At the same time, Song’s message was not simply a return to tradition, but rather a conservative response to the challenges of modernity, something evident in his tirades against the dangers that lewd books and stimulating movies posed to pregnant women.

The syncretic approach of Song Jiazhao and others of his generation played a critical role in making modern ideas such as eugenics, evolution, and Western biomedicine more culturally accessible for a popular Chinese audience. Nonetheless, as intellectual currents shifted in favor of the New Culture movement (1915-1925), Song Jiazhao’s Taijiao suddenly found itself on the losing end of a cultural debate. When the New Culture movement broke out in 1915, a year after Taijiao’s first publication, iconoclastic intellectuals rejected all that was old, Chinese, “superstitious,” and Confucian in favor of the new, the young, the Western, and the scientific. For the New Culturalist and folk studies scholar Huang Shi, fetal education’s association with Confucianism and Chinese traditions made it the antithesis of all that was new and scientific. However, Huang Shi’s greatest vitriol was reserved for Song Jiazhao, as a representative of an earlier generation of intellectuals. In the binary iconoclasm of the New Culture movement, there was no room for Song’s syncretic modernity (Huang, 1931).

By the 1920s and 1930s, New Culture intellectuals weren’t the only ones to reject fetal education. Pan Guangdan, an American-educated eugenicist who opposed the social liberalism of the New Culture movement, also rejected fetal education on the grounds that it was unscientific. For Pan, fetal education was unscientific not because of its association with traditional Chinese culture, but because it did not accord with Mendelian genetics, and as such was suspiciously Lamarckian. Pan did not believe that environmental factors of any kind—whether in utero or ex—could affect a person’s basic nature, which he believed was determined solely by the quality of their genetic inheritance. He feared that ideas such as fetal education might lead women to consider dysgenic marriages in the hopes of improving their offspring through fetal education and nurturing parenting. While Pan’s extreme commitment to Mendelian genetics was not representative of the mainstream popular or scientific opinion, his writing further indicates an intellectual shift away from the syncretism of the previous generation in favor of an exclusively Western scientific paradigm (Richardson, 2015).

By 1937, popular pregnancy advice books, such as the special edition on pregnancy published by the Shanghai fashion magazine Ling Long, no longer framed their advice in terms of fetal education or Confucian behavior. While the advice book warned about medical charlatans and advocated the importance of going to modern medical clinics to be
thoroughly examined, few modern medical institutions were available at the time, and the author acknowledges that women did not like the invasive medical examinations performed there. The primary goal of the guidebook is to arm expectant mothers with scientific knowledge of pregnancy through text and diagrams to make it predictable, measurable, and quantifiable. Thus they offered a new model of an enlightened scientific pregnancy in which the pregnant mother herself had internalized the biomedical understanding of her own reproductive body and could thus scientifically manage her pregnancy. By arming herself with modern scientific knowledge, the pregnant mother offered the best defense against the dangers of childbirth and unhealthy infants (Richardson, 2015).

Conclusion

Since Chinese intellectuals first sought to use fetal education to save the nation at the turn of the twentieth century, the question of how to reconcile fetal education with modernity has been debated and discussed from many different perspectives. From the onset, these discussions promoted the values of eugenics, including not only the idea that scientific management could improve the human population, but also the idea that reproduction should be in service to the state, and that women were responsible for ensuring the health and quality of the offspring. At the same time, discussions of fetal education gradually introduced Western scientific ideas of anatomical medicine, first through the earlier syncretic writings of men like Song Jiazhao that showed Western science as compatible with Chinese medicine, and later by writings that rejected Chinese traditions in favor of Western science alone. While authors varied between whether they saw the matter of pregnancy as something that a woman could oversee herself, or whether it required the coercive assistance of modern institutional surveillance the idea that a women’s reproductive behavior was a matter of national concern already paved the way for greater state interference. Collectively the early twentieth century discussions of fetal education helped popularize modern biomedical and disciplinary paradigms that subordinated women’s reproductive power to the state laying the groundwork for the increasing state intrusions into women’s reproductive lives that we see in contemporary China ranging from eugenic regulations on reproduction, to the One Child Policy, to the promotion of larger family sizes.

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Abstract — As the technology within the realm of Deep Learning progresses, it is necessary to understand all the most recent research and libraries in order to properly showcase the practical applications of Deep Learning methods with the latest technology. Of these Deep Learning methods, Deep Reinforcement Learning and Deep Q-Networks can be used with the libraries TensorFlow, OpenAI Gym, and TF-Agents to create an Artificial Intelligence (AI) that performs actions to learn from its interactions and maximize reward without being explicitly taught about its environment. Our research uses the newest version of TensorFlow, TensorFlow 2.1, to implement such an AI with OpenAI Gym to play the Atari game Space Invaders with the goals of achieving the highest score possible and showing how the high score changes depending on the Deep Q-Learning variants used, changes to the Deep Learning algorithm’s hyperparameters, and number of iterations.

Keywords — Deep Reinforcement Learning, Deep Q-Network, TensorFlow, OpenAI Gym, Python

Introduction

A computer program that can learn and perform tasks without human supervision has always been a popular topic in AI and has many academic and commercial uses in both robotics and game theory along with applications that involve some form of user interaction or dynamically improve over time. Some of the challenges presented by this to Machine Learning algorithms in the past were that Machine Learning algorithms required a defined environment and definite solution that could be derived from patterns found from the input. It would be impossible to create such a model of the real world for robotics, and it would simply be too impractical for games since the algorithm would have to account for the state of every object in the game, resulting in potentially millions or more features to handle by a machine.

A Machine Learning method for overcoming these challenges is Reinforcement Learning, which does not have the same requirements of other Machine Learning algorithms. Reinforcement Learning is an algorithm that focuses on maximizing cumulative rewards and minimizing penalties within an indefinite environment. Deep Learning can be applied to Reinforcement Learning to perform Deep Reinforcement Learning, which uses Deep Neural Networks with Q-Learning, a model-free algorithm.

Reinforcement Learning is one of the oldest fields of Machine Learning that has been around since the 1950s to produce different types of applications (Sutton, 2018). However, Deep Reinforcement Learning has only recently gained traction with the use of research by DeepMind that demonstrated an AI that can play Atari games from scratch using a Deep Convolutional Neural Network (Mnih et.al, 2013). With the intent of partially replicating this research with the newest Deep Learning technology and demonstrating how it performs in a modern simulated environment, we decided to develop an AI with TF-Agents (Guadarrama et.al, 2018) that uses Deep Reinforcement Learning developed from TensorFlow to play in a simulated Atari environment wrapped within OpenAI Gym (Brockman et.al, 2016).

Development of the Deep Reinforcement Learning AI

There are three main components that should be considered when creating an AI that uses Deep Reinforcement Learning to navigate an environment using image inputs: image preprocessing, optimizing rewards, implementing Deep Q-Learning, and training and testing the agent.

Image Preprocessing

Training the model with the raw images is ordinarily computational expensive, so three methods should be used to preprocess the images collected to reduce complexity and speed up training: converting images to greyscale, reducing the image size, and stacking the frames (Thomas, 2019). The first step is to convert the images to greyscale to reduce the number of input Convolutional Neural Network filters required by the first layer. The next step is to make the image inputs smaller to reduce the number of features, but not so much as to significantly affect performance. The last step is to stack the image frames on one another to simultaneously input them all into the Convolutional Neural Network layers in order to determine the velocity of objects in motion.
Optimizing Rewards

With Reinforcement Learning, an agent in a program makes observations of its environment and takes actions with the effect of receiving either rewards or penalties for these actions. This means any action the agent makes in response to its environment that helps it accomplish its objective will give it rewards, and any action the agent makes that offers no benefit or impedes its progress will give it penalties, or in the case of a game with a score, the score will be used as its rewards.

The algorithm that determines what actions an AI should take to achieve the highest amount of rewards is called the policy. The optimal policy that maximizes the rewards the AI gains is unknown in the beginning, so the AI uses an algorithm that determines the highest Q-Value—which is the summation of its rewards from a set of possible actions the agent can take—called a Q-Learning algorithm (Géron, 2019, pp. 628). However, Q-Learning by itself is very inefficient since it must retain all possible states of the game, which can involve the positions and existence of all in-game objects, which can result in a very large matrix that is expensive to traverse. Another problem of Q-Learning by itself is that it chooses random actions based on its current state, which is impractical for large neural networks. The AI uses a combination of Deep Learning and Q-Learning along with a replay buffer, or experience replay, to solve these problems.

Implementing Deep Q-Learning

Due to the sheer complexity of saving every state of the game and randomly iterating through possible actions based only on latest experiences, only relevant states the AI has learned should be used and saved. The AI accomplishes this by using a Deep Q-Network that will approximate a Q-Value for each possible action for a state and save data as state, action, reward, and next state. The Q-Learning algorithm to approximate the Q-Value is as follows:

\[ Q(s, a) = r + \gamma \max Q(s', a') \]

, where \( s \): state, \( a \): action, \( r \): reward, \( \gamma \): discount factor, \( s' \): next state, \( a' \): next action

Q-Learning algorithm

There are three main variants of a Deep Q-Network that the AI implements based on techniques developed by DeepMind (2013) to measure each variant’s effect on the overall performance of the AI: Double DQN and Dueling DQN. It is normally very time-consuming work-intensive to implement and debug these algorithms, so we decided to use the open-source TF-Agents library that already provides some of these algorithms for use with TensorFlow and OpenAI Gym.

Training and Testing the Agent

To properly train the agent, it is necessary to set up the environment and import the applicable libraries and toolkits. To set up the initial environment, we received a Google Cloud Platform research grant to obtain access to their Machine Learning servers. Using their servers, we created an environment in Jupyter Notebook with TensorFlow 2.1 installed and added a GPU in order to speed up the training process. We applied the Reinforcement Learning AI to a simulated video game environment created using the TF-Agents library that wraps the OpenAI Gym Atari environment.

Following the addition of all necessary tools to our program, we built the training architecture using TF-Agents and OpenAI Gym. The first step after creating the TF-Agents environment wrapper was to create the Deep Q-Network and apply the Deep Q-Learning algorithm and replay buffer along with a driver and observer to collect experiences from a given policy and display them with a logger to provide functionality for comparing the data. The next and final step was to create the main training loop that trains the agent based on the given policy. This is also when we compared the results of using different Deep Q-Network variants and making changes to hyperparameters such as the type of optimizer and its hyperparameters—learning rate, decay rate, and momentum—, the size of the replay buffer, and the Convolutional Neural Network’s parameters to determine which Deep Q-Network variant and hyperparameters allow the agent to achieve the highest score in the least amount of training time for the current environment while simultaneously measuring the change in performance based on the number of iterations used to train the agent. The overall mechanism of the training environment is shown in the Figure 1.

Results

We successfully set up a Deep Reinforcement Learning environment and trained the Deep Learning AI using DQN, Double DQN, and Dueling DQN along with an Experience Replay. However, TF-Agents did not fully support Dueling DQN so we implemented Dueling DQN on our own. We changed several hyperparameters of the algorithms and trained the AI for up to 200,000 steps each and from our data, we saw that most changes to the hyperparameters did not make a significant impact on the performance of the AI, but as shown in Figure 2, it showed that Double DQN managed to perform better than both DQN and Dueling DQN to achieve
an average high score of around 400 points, with its highest scores at around 1000. We also observed from generated animations that the AI developed new strategies as well as exploit strategies that already allowed it to achieve a higher score, such as hiding behind the cover near the bottom and hitting the purple drone that occasionally flies by near the top to gain more points, showing the learning process of the AI.

Conclusions

We can conclude from these results that the AI has successfully undergone the process of learning and—at least up to 200,000 steps—Double DQN is a better algorithm to use than DQN and Dueling DQN and changes to hyperparameters make little short-term difference. It’s expected to perform better with more training steps taken.

References


Figures

1. Calculate Action with DQN
2. Simulate Action and Calculate Reward with OpenAI Gym
3. Train DQN with an Optimizer

Figure 1. Mechanism of Deep Reinforcement Learning Environment with TF-Agent and OpenAI Gym

Figure 2. Comparison of Average Episode Length and Return/Reward vs. Training Steps on DQN and DDQN
Applying a Novel Deep Learning System to Local Protein Structure Prediction

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Abstract — Since local protein 3D structure prediction is very important for biochemical study and drug design, researchers have developed many machine learning algorithms to predict local protein 3D structures using the sequence information only. Understanding the sequence-to-structure relationship is key for the successful structure prediction. Previous approaches including the single shallow learning model, the single deep learning model and clustering algorithms all have disadvantages to build the precise mapping function exploring such relationship. In order to further improve the performance of the local protein structure prediction, Clustering Deep Recurrent Neural Network (CDRNN) is proposed. In this model, the whole protein dataset is divided into multiple cluster subtrees. A RNN is trained for each cluster in the subtrees so that each RNN can be used to learn the computationally simpler local sequence-to-structure mapping function instead of attempting to capture the universal sequence-to-structure mapping function for the whole dataset. Compared with other traditional approaches, our experimental analysis indicates that the local 3D structure prediction accuracy has been improved noticeably when our proposed model is adopted.

Keywords — Local Protein Structure Prediction, Deep Learning, Shallow Learning, Recurrent Neural Network and Clustering

Introduction

The protein three dimensional structure (protein 3D structure) plays a significant role in defining its functional sites and chemical interactions with other related proteins (Branden, 1999). Knowledge of protein 3D structure is useful in drug design and other biomedical applications. Experimental techniques to determine protein 3D structures are labor-intensive and costly. In contrast, the efficiency of high throughput sequencing techniques has resulted in a large number of known protein sequences. Consequently, the gap between the number of known protein sequences and experimentally determined protein 3D structures has widened substantially (Rost & Sander, 1996). The constraints of using experimental techniques to determine protein 3D structure, coupled with the availability of protein sequences, have motivated researchers to develop machine learning algorithms to predict local protein 3D structures using only protein sequence information.

Understanding the protein sequence-to-structure relationship is the most important step for local protein structure prediction. Unfortunately, the three traditional approaches including a single shallow learning model built on an entire dataset (Hua & Sun, 2001), a single deep learning model built on an entire dataset (Mi et al., 2017), and clustering algorithms (Han & Baker, 1995) all have disadvantages to understand the protein sequence-to-structure relationship effectively. Both single shallow learning models and single deep learning models may encounter difficulty in figuring out the universal mapping function that describes the complex sequence-to-structure relationship for the whole protein dataset because each protein family has unique functional and structural characteristics (Han & Baker, 1995). Clustering algorithms, such as K-means and K nearest neighbor algorithm, assume that the distance between different protein sequence segments can be evaluated with exact precision (Zhong et al., 2007). When the distance function for these clustering algorithms cannot be well defined, the clustering algorithm may struggle to learn the sequence-to-structure relationship and consequently incorporate irrelevant and noisy information into one cluster.

In order to overcome disadvantages of the traditional approaches, we developed a Clustering Deep Recurrent Neural Network (CDRNN). Our CDRNN organized multiple deep Recurrent Neural Networks (RNNs) (Mi et al., 2017) using a hierarchical tree structure. The hierarchical tree structure was used to partition sequence segments into multiple level clusters. The RNN is a special type of neural network that carries out the same task for every element of a sequence and provides output dependent on the previous computational results. Each RNN was trained to model sequential dependencies and interactions between amino acids in sequence segments belonging to one cluster in the hierarchical tree structure. In contrast to the traditional approaches described above, our approach was designed to capture the precise local sequence-to-structure mapping function, which can
potentially improve the accuracy of local 3D structure prediction.

**Methodology**

The process we used to build the CDRNN working model can be divided into four phases. In the first phase, we designed the parallel improved K-means clustering algorithm to partition samples in the whole dataset into multiple one-level clusters. Each sample in the dataset is a sequence segment of nine successive amino acids created by the sliding window method. In the second phase, we applied the hierarchical clustering algorithm to each one-level cluster having low structural similarity to produce the cluster subtrees. Then, we merged these cluster subtrees into a final hierarchical structured tree. In the third phase, the RNN model was designed to evaluate the strength of the sequence-to-structure relationship for each sample belonging to the same cluster. In order to achieve this goal, samples in one cluster were labeled as positive or negative based on their structural deviations from the representative structure. Basically, each RNN was the binary classifier to study the distinctive sequence-to-structure mapping function for one protein family. In the fourth phase, the decision values of different deep RNN models and cluster distance scores in the hierarchical tree were combined to make the intelligent decision about which cluster the sample should belong to. Finally, the 3D representative structure of the selected cluster was assigned to this sample.

**Dataset and Experimental Setup**

*Data Source*

Our protein training dataset consisted of 3,952 protein sequences acquired from the Protein Sequence-Culling Server (PISCES) (Wang & Dunbrack, 2003). In total, a half million sequence segments were generated using the sliding window method in the training set. In this work, each sequence segment was considered as one sample. Four hundred protein sequences from the recent release of PISCES were incorporated into the test set. The 3D structures of protein sequences in the training set and the test set were obtained from Protein Data Bank (PDB) (Berman et. al., 2000). Any two protein sequences in the training set and the test set shared less than 25% similarity, which ensured that our dataset did not carry redundant protein sequences. The training set was used to construct the computational model and the test set was used to evaluate the performance of the computational model.

*Model Evaluation*

The local protein 3D structure in our work was characterized using a distance matrix and torsion angles. The distance matrix was used to describe the distance between each pair of amino acids in the protein sequence (Baldi et al., 2000). Torsion angles were used to define the rotation of the protein sequence chain around the two bonds on both sides of the Cα atom (Kolodny & Linial, 2004). In order to evaluate the performance of different computational models, we designed two sets of accuracy criteria that we called Accuracy One and Accuracy Two. Two sets of accuracy metrics were based on Distance Matrix Root Mean Square Deviation (dmRMSD) and Torsion Angle Root Mean Square Deviation (taRMSD). dmRMSD and taRMSD were used to assess how close the predicted protein structure was to the real protein structure in terms of distance matrix and torsion angles respectively. Smaller dmRMSD and taRMSD indicated better prediction results.

Accuracy One was defined as the percentage of predicted samples with dmRMSD less than 2.5 Å and taRMSD less than 35 degree. Accuracy One specified the percentage of samples with acceptable 3D structure prediction. Accuracy Two was defined as the percentage of predicted samples with dmRMSD less than 1.5 Å and taRMSD less than 30 degree. Accuracy Two represented the percentage of samples whose 3D structure can be predicted reliably. Both dmRMSD and taRMSD need be considered at the same time in order to estimate the prediction accuracy rigorously.

*Results Analysis*

Our CDRNN model had higher Accuracy One and Accuracy Two percentages compared to a single shallow learning model (e.g., Logistic Regression and Support Vector Machine), a single deep learning model (e.g., Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN)) and clustering algorithms (e.g., one-level K-means clustering algorithm and hierarchical clustering algorithm) (Table 1).

*Conclusions*

In this work, our proposed CDRNN model was used to predict local protein 3D structure. Compared with other traditional approaches, the CDRNN model is more effective understanding sequence-to-structure mapping functions. Consequently, our proposed model achieved better experimental results.
Acknowledgements

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References


Tables

**Table 1.** Our CDRNN improved Accuracy One and Accuracy Two for local protein 3D structure prediction

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<td>Accuracy One</td>
<td>56%</td>
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<td>66%</td>
<td>71%</td>
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<td>Accuracy Two</td>
<td>44%</td>
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Mathematical Characterization of Generalized Lomax Distribution

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Abstract — In this work, we introduce a new four-parameter cubic rank transmuted Lomax (CRTL) distribution, a generalization of the Lomax distribution using the cubic rank transmuted map proposed by Granzatto et al. (2017). Some of the mathematical properties of the proposed distribution are discussed. Expressions for the quantile function, reliability function and log-likelihood function are derived. We plan to compare various statistics to show the versatility and fitting of the model using survival data in medical research.

Keywords — Lomax Distribution, Cubic Rank Transmutation Map, Parameter Estimation

Introduction and Model Formulation

In recent years, several new statistical distributions have been proposed by composing discrete and continuous models. “Generalizing distributions is an old practice and has ever been considered as precious as many other practical problems in statistics. It simply started with defining different mathematical functional forms, and then induction of location, scale or inequality parameters” (Tahir et al. 2016). Shaw and Buckley (2007) have proposed and studied a new generalization method of statistical distributions called quadratic rank transmutation mapping. Let \( G_1(x) \) be the baseline distribution of the distribution \( F_1(x) \). A random variable, \( X \), is said to have a transmuted probability distribution function (PDF), \( f_1(x) \), with the cumulative distribution function (CDF) \( F_1(x) \) if

\[
F_1(x) = (1 + \lambda)G_1(x) - \lambda G_1(x)^2, \quad |\lambda| \leq 1 \tag{1}
\]

The corresponding PDF of the transmuted probability distribution is

\[
f_1(x) = g_1(x)\left(1 + \lambda - 2\lambda G_1(x)\right). \tag{2}
\]

where \( g_1(x) \) is the PDF of the baseline CDF \( G_1(x) \). Note that when \( \lambda = 0 \), equation (1) reduces to the distribution \( G_1(x) \) of the baseline random variable.

Furthermore to the work by Shaw et al. (2009), several generalized models using quadratic rank transmuted map have been proposed by many authors. One of the main results using this approach was proposed by Aryal et al. (2009): The Transmuted Extreme Value Distribution. A few others to be noted are works by Ashour et al. (2013), Nofal et al. (2017), Chhetri et al. (2017), and among others. For a list of compounding distributions, we refer Tahir et al. (2016).

Recently, Granzatto et al. (2017) have proposed a new family of transmuted family of distributions, known as the cubic rank transmuted distributions. They extended the work of Shaw et al. (2007) by adding an additional parameter. A random variable, \( X \), is said to have a cubic rank transmuted probability distribution with CDF \( F(x) \) if

\[
F(x) = \lambda_1 G(x) + (\lambda_2 - \lambda_1)[G(x)]^2 + (1 - \lambda_2)[G(x)]^3, \tag{3}
\]

and the corresponding PDF is given by

\[
f(x) = g(x)[\lambda_1 + 2(\lambda_2 - \lambda_1)G(x) + 3(1 - \lambda_2)G(x)^2], \quad 0 \leq \lambda_1 \leq 1, -1 \leq \lambda_2 \leq 1. \tag{4}
\]

The Lomax distribution is a heavy tailed distribution originally proposed by K. S. Lomax, who used it in his analysis of business failure lifetime data. The distribution is widely used in survival analysis, actuarial science, and business. The CDF and PDF of the Lomax (L) distribution are given by

\[
G(x; \alpha, \beta) = 1 - \left[1 + \left(\frac{x}{\beta}\right)^\alpha\right]^{-1} \quad \text{and} \quad g(x; \alpha, \beta) = \frac{\alpha}{\beta}\left[1 + \left(\frac{x}{\beta}\right)^\alpha\right]^{-(\alpha+1)} \quad \tag{5}
\]

respectively, where \( \alpha > 0 \) is the shape and \( \beta > 0 \) is the scale parameter.

Substituting (5) into (3) and (4), we get the PDF \( f(x) \) and the CDF \( F(x) \) of cubic rank transmuted Lomax distribution as shown below:

\[
f(x; \theta) = \left[\frac{\alpha}{\beta}\left(1 + \frac{x}{\beta}\right)^{-(\alpha+1)}\right]\left[\lambda_1 + 2(\lambda_2 - \lambda_1)\left(1 - \left(1 + \frac{x}{\beta}\right)^{-\alpha}\right)\right] \tag{6}
\]
Mathematical Properties

In this section, we derive some mathematical expressions of quantile function, reliability analysis and the maximum likelihood function of the cubic rank transmuted Lomax distribution.

Quantile Function and Random Number Generator

We use the inverse transformation method to compute an expression for the quantile function of the proposed model. The q-th quantile \( x_q \), \( 0 \leq q \leq 1 \), of the cubic rank transmuted Lomax distribution is defined by

\[
q = \Pr(x \leq x_q) = F(x_q) = G(x_q; \alpha, \beta) \left[ \lambda_1 + (\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_q}{\beta} \right)^{-\alpha} \right) \right],
\]

(8) where \( \Theta = (\alpha, \beta, \lambda_1, \lambda_2)^T \). We use equations (6) and (7) to develop mathematical properties of the proposed distribution.

Reliability Analysis

The reliability is the probability of an item not failing prior to some time \( t \) which is defined by the formula \( R(t) = 1 - F(t) \), where \( F(t) \) is the CDF of the cubic rank transmuted Lomax distribution (7). The hazard rate function of the cubic rank transmuted Lomax can be expressed as

\[
h(t) = \frac{f(t)}{1 - F(t)} = \frac{\left( x_q \right)^{\alpha-1} \lambda_1 + 2(\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_q}{\beta} \right)^{-\alpha} \right)}{\left( 1 - \left( 1 + \frac{x_q}{\beta} \right)^{-\alpha} \right) \left[ \lambda_1 + (\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_q}{\beta} \right)^{-\alpha} \right) \right] + (1 - \lambda_2) \left( 1 - \left( 1 + \frac{x_q}{\beta} \right)^{-\alpha} \right)^2},
\]

(10)

Maximum Likelihood Function/Parameter Estimation

Let \( X_1, X_2, \ldots, X_n \) be a random sample from the CRTL distribution with observed values \( x_1, x_2, \ldots, x_n \) and \( \Theta = (\alpha, \beta, \lambda_1, \lambda_2)^T \) be the parameter vector. The likelihood function for \( \Theta \) can be written as

\[
L(\Theta | x) = \frac{a^n \prod_{i=1}^{n} \left[ 1 + \left( \frac{x_i}{\beta} \right)^{\alpha+1} \left( \lambda_1 + 2(\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_i}{\beta} \right)^{-\alpha} \right) + 3(1 - \lambda_2) \left( 1 - \left[ 1 + \left( \frac{x_i}{\beta} \right)^{\alpha} \right]^2 \right) \right] \right]}{\left[ \lambda_1 + (\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_i}{\beta} \right)^{-\alpha} \right) \right] + (1 - \lambda_2) \left( 1 - \left( 1 + \frac{x_i}{\beta} \right)^{-\alpha} \right)^2},
\]

(11)

Taking the logarithm on both sides of (11), the log-likelihood function of the CRTL distribution can be written

\[
L(\Theta | x) = n \ln(\alpha) - n \ln(\beta) - (\alpha + 1) \sum_{i=1}^{n} \ln \left( 1 + \left( \frac{x_i}{\beta} \right)^{\alpha+1} \left( \lambda_1 + 2(\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_i}{\beta} \right)^{-\alpha} \right) + 3(1 - \lambda_2) \left( 1 - \left[ 1 + \left( \frac{x_i}{\beta} \right)^{\alpha} \right]^2 \right) \right) \right) + \sum_{i=1}^{n} \ln \left( \lambda_1 + (\lambda_2 - \lambda_1) \left( 1 - \left( 1 + \frac{x_i}{\beta} \right)^{-\alpha} \right) \right) + 3(1 - \lambda_2) \left( 1 - \left[ 1 + \left( \frac{x_i}{\beta} \right)^{\alpha} \right]^2 \right).
\]

(12)

To obtain the estimate of parameters \( \alpha, \beta, \lambda_1 \) and \( \lambda_2 \), we can use some numerical schemes, for instance Newton Raphson method, to solve the equations

\[
\frac{\partial L(\Theta | x)}{\partial \alpha} = 0, \quad \frac{\partial L(\Theta | x)}{\partial \beta} = 0, \quad \frac{\partial L(\Theta | x)}{\partial \lambda_1} = 0,
\]

and \( \frac{\partial L(\Theta | x)}{\partial \lambda_2} = 0. \) (See Chhetri et al. (2017)).

Conclusions and Future Directions

In this article, we have proposed a new distribution called the cubic rank transmuted Lomax distribution. We have used the Lomax distribution as the baseline distribution and a recently proposed method, the quadratic rank transmuted map (QRTM) by Granzotto et al. (2017) to construct the cubic rank transmuted Lomax distribution. We derived mathematical expressions for quantile function, reliability analysis, likelihood function and log-likelihood function. We are currently working on simulation results and applications of the proposed model. We will generate samples of sizes \( n = 100, 200, 400, 500, 1000 \) and \( 2000 \) from the cubic rank transmuted Lomax distribution and repeat the simulations 1000 times and obtain the estimates.
and mean square errors. One of the standard ways of model selection criteria is by obtaining various statistics: the AIC (Akaike information criterion) = \(-2 \ln(\hat{\theta}) + 2q\), the BIC (Bayesian information criterion) = \(2 \ln(\hat{\theta}) + q \log(n)\), the CAIC (consistent Akaike information criteria) = \(-2 \ln(\hat{\theta}) + \frac{2q n}{n-q-1}\) and the HQIC (Hannan Quinn information criterion) = \(-2 \ln(\hat{\theta}) + 2q \log (\log(n))\), where \(\ln(\hat{\theta})\) denotes the log-likelihood function evaluated at the maximum likelihood estimates, \(q\) is the number of parameters, and \(n\) is the sample size, for example see Chhetri et al. (2017). Motivated by Rady et al. (2016), we have some potential data sets related to bladder cancer research to check the fitting and versatility of the proposed model. We will compare our model with the Power Lomax, Kumaraswamy Lomax, Transmuted Lomax, Weibull Lomax, Exponential Lomax, McDonald Lomax, Beta Lomax, Inverse Power Lomax and other competing models. Due to the presence of the additional parameters in our model, we expect to get a better fit than some of the previously mentioned models. We hope that this work will serve as an alternative in modeling survival data in medical research.

Acknowledgements

We would like to thank Dr. Becky Hillman and our division chair Dr. Kajal Ghoshroy for their encouragements. We are also very thankful to our academic dean Dr. Eric Reisenauer and USC Sumter for providing travel grants to attend and present our work at national conferences.

References


Polynomial Functions for Finding Multiplicative Inverses at All Odd Primes

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Abstract — In trying to expand an earlier topological computation result to all odd primes, a problem arose about finding formulas for lists of coefficients modulo $p$. In finding these formulas, we were able to make a connection with a number theoretic problem about finding the multiplicative inverses. In particular, this gave rise to formulas with polynomial complexity rather than exponential.

Keywords — Number Theory, Modular Arithmetic

Introduction

My dissertation (Reid, 2017) involved the construction of a finite topological spectrum at the prime $p = 3$, with a set of nice homological properties. Since then I have worked to generalize this construction to all odd primes. The computations can be carried out individually at each prime, resulting in a slightly different structure, where similar terms have different coefficients. This paper outlines the development of formulas adaptable to every odd prime and that can be used to carry out the construction in the general case.

Modular Arithmetic and Multiplicative Inverses

Modular arithmetic is a system for doing computations where only a finite number of values are allowed. We choose a positive integer $n$, called the modulus, and are restricted to using the integers $0, 1, 2, \ldots n - 1$. Numbers outside of this range are reduced by dividing by $n$ and taking the remainder. For example, modulo $7$, $23$ would be reduced to $2$ since $23 \div 7 = 3$ with remainder $2$. We write $23 \equiv 2 \pmod{7}$. Our usual operations of addition and multiplication work as expected, with the extra step of reduction after the normal operation.

Modular division is more complicated as fractions don’t exist if we can only use the numbers between $0$ and $n - 1$. If we want to divide $4$ by $6$, modulo $7$, what we really want is to find the number that when we multiply by $6$ is $4$ more than some multiple of $7$. That is, we try to solve the equation $6x \equiv 4 \pmod{7}$. A solution to this equation can be found using brute force, trying all the values $0$-$6$. In this way, we can see that $3$ is a solution (since $6 \times 3 = 18$, which reduces to $4$). However, changing the modulus changes this result. For example, modulo $9$, this equation has no solutions, and modulo $10$, it has two solutions: $4$ and $9$.

In general, the equation $ax \equiv 1 \pmod{n}$ has a unique solution exactly when gcd$(a, n) = 1$, that is, $a$ and $n$ are relatively prime. If we pick a prime modulus $p$, these types of equations will always have unique solutions. From here, we assume that $p$ is a prime number, and we focus on the equation $ax \equiv 1 \pmod{p}$. This number $x$ is called the multiplicative inverse of $a$, and is denoted $a^{-1}$.

The problem of finding multiplicative inverses has many applications, most importantly in cryptography. In the RSA cryptosystem (Rivest et al., 1978), one step of determining the decryption key for a message involves computing multiplicative inverses modulo some publicly known modulus. It is also used in the decryption step of the ElGamal cryptosystem (ElGamal, 1885).

One tool for finding these inverses is Fermat’s Little Theorem (Judson, 2018, pg 93): If $p$ is any prime number, then for any integer $a$, we have $a^{p-1} \equiv 1 \pmod{p}$. Factoring the left hand side gives us $a \cdot a^{p-2} \equiv 1 \pmod{p}$, so that the multiplicative inverse of $a$ is just $a^{p-2}$. As an example, the multiplicative inverse of $3$, modulo $7$ is $3^5 = 243$, which reduces to $5$, as $243 \div 7 = 34$ with remainder $5$. We can then easily check that $3^5 = 15$, which reduces to $1$, so that $3^{(-1)} \equiv 5 \pmod{7}$. In the work below, we see a method for computing these multiplicative inverses simultaneously for all primes, rather than working each one out individually.

Analyzing the Coefficients

In working through the topological constructions at different odd primes using SAGE, I was able to generate lists of coefficients for corresponding terms for each odd prime up to 31. For example, the coefficient of an element $x$ might be $2$ for $p = 3$, $4$ for $p = 5$, and $0$ for $p = 7$. The goal was to create functions, in terms of $p$, to generate these coefficients for all odd primes, including those that had not yet been computed. The patterns that appeared came in three main types: constant, linear, and non-linear. Examples of each are given in the
chart below. For details about the generation of these coefficients see Reid (2017).

### Table 1: Examples of 3 types of Coefficients

<table>
<thead>
<tr>
<th>Prime p</th>
<th>Constant</th>
<th>Linear</th>
<th>Non-linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>17</td>
<td>14</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>23</td>
<td>14</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>29</td>
<td>14</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>31</td>
<td>14</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>

The constant pattern appears when a term is multiplied by the same value at all primes. In the example above, that constant was 14. For any prime less than 14, the coefficient is reduced, forming a somewhat chaotic mix of numbers, but once we reach primes greater than 14, the coefficient stabilizes. With enough data points, these patterns are relatively easy to pick out.

Linear patterns can be detected by picking out a relationship between the change in \( p \) and the change in the coefficient. In the second column above, we see that as \( p \) increases by 2, then the coefficients increase by 1. This gives us a nice linear relationship between the columns, with formula given by: \( \frac{p+1}{2} \). This formula extends past \( p = 31 \), as an odd prime plus 1 will always be even, so that it is evenly divisible by 2.

In the third column above, with non-linear coefficients, the values increase and decrease between the rows. However, if we divide the prime numbers into two categories, we can actually detect two separate patterns. For those primes that have the form \( 4k + 3 \) (3, 7, 11, 19, 23, 31), we see that as \( p \) increases by 4, the coefficient increases by 1, and we can form a linear formula for these coefficients \( \frac{p+1}{4} \). Similarly, for the primes that have the form \( 4k + 1 \) (5, 13, 17, 29), the relationship is that as \( p \) increases by 4, the coefficient increases by 3, so we get a formula: \( \frac{3p+1}{4} \). As in the linear case above, the numerators of these fractions always work out to be multiples of 4, so the division results in whole numbers. The issue is then to try to combine these formulas in a way that captures the behavior at all primes, not just a subset of them.

### Relation to Multiplicative Inverses

In creating these two formulas for the different types of primes, we realized that these formulas both compute the multiplicative inverse of 4 modulo \( p \). If we multiply by 4, we get \( p + 1 \) and \( 3p + 1 \). In both cases, if we reduce modulo \( p \), only the one is left over. That is: \( 4 \cdot \frac{p+1}{4} \equiv 1 \mod p \), and \( 4 \cdot \frac{3p+1}{4} \equiv 1 \mod p \). This connection helped to create a combined formula that worked for both types of primes. The denominator of 4 needed to stay, and the polynomial in the numerator needed to end with +1 as the constant term. This polynomial also needed to have degree at least 2 as the table above shows the relationship is not linear.

The formula that satisfies all of these requirements is \( \frac{3p^2+1}{4} \). For primes of the form \( 4k + 1 \), the numerator evaluates to \( 48k^2 + 24k + 4 \), and for primes of the form \( 4k + 3 \), the numerator is \( 48k^2 + 72k + 28 \). In both cases, this value is divisible by 4. The last thing to check is that the formula agrees with the two linear formulas generated at the end of the last section. Below is a proof of one of these facts:

If \( p = 4k + 3 \), then \( \frac{3p^2+1}{4} \equiv \frac{p+1}{4} \mod p \). Start by replacing \( p \) with \( 4k + 3 \) on both sides and simplifying:

\[
\frac{3(4k+3)^2+1}{4} \equiv \frac{(4k+3)+1}{4} \\
\frac{48k^2 + 72k + 28}{4} \equiv \frac{4k + 4}{4} \\
\frac{12k^2 + 18k + 7}{4} \equiv k + 1 \\
\frac{3k(4k+3) + 9k + 7}{4} \equiv k + 1 \\
\frac{9k + 7}{4} \equiv k + 1 \\
\frac{2(4k+3) + k + 1}{4} \equiv k + 1 \\
\frac{k + 1}{4} \equiv k + 1
\]

Going from step 4 to 5, and from step 6 to 7, uses the fact that the computations are being done modulo \( p \), so multiples of \( p \), or in this case multiples of \( 4k + 3 \), are equivalent to 0 and can be removed. A similar computation works if \( p = 4k + 1 \), so this function computes the multiplicative inverse of 4 at any odd prime. Similar techniques led to similar formulas for other multiplicative inverses, some of which are shown in the table below. It should be noted that if \( n = p \), no inverse exists and the formula does not hold. For example, the formula for \( 3^4 \) does not hold at \( p = 3 \).

### Conclusions

These formulas give a method for computing the multiplicative inverses at every odd prime rather
than just a single prime at a time using results like Fermat’s Little Theorem. This also gives a better way to represent the coefficients in my calculations going forward. Using the notation of inverses rather than functions of \( p \), it becomes easier to carry out the computations for combining products of these coefficients. For example the product of \( 3^{-1} \) and \( 4^{-1} \) would just be \( 12^{-1} \), rather than having to multiply the polynomial formulas.

References


Table

<table>
<thead>
<tr>
<th>N</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula for ( n^{-1} ) at all odd primes</td>
<td>( \frac{p + 1}{2} )</td>
<td>( \frac{2p^2 + 1}{3} )</td>
<td>( \frac{3p^2 + 1}{4} )</td>
<td>( \frac{4p^4 + 1}{5} )</td>
<td>( \frac{5p^2 + 1}{6} )</td>
<td>( \frac{6p^6 + 1}{7} )</td>
<td>( \frac{7p^2 + 1}{8} )</td>
<td>( \frac{p^4 - 2p^2 + 1}{9} )</td>
</tr>
</tbody>
</table>
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A Study of White Oak (Quercus alba) Growth in Clinton, South Carolina

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Abstract — Dendroclimatology is the study of the effects of environmental changes on annual tree growth rings and has been used extensively in climate change research. Currently, the understanding is that tree rings will be wider during moist/cool years, and narrower during dry/warm years. The purpose of this research was to determine the influence of the local micro-environment on tree growth. To understand the response of white oaks in different environments, cores were taken from white oaks in an urban, transitional, and natural forest. The results from the core measurements showed that urban white oaks do not vary as much as the PDSI (Palmer Drought Severity Index) would suggest. Along with this, the white oaks from the transitional and natural forest appear to show greater agreement with the changing PDSI values. Based on the results from the statistical analysis of core ring data and the PDSI, we concluded that white oaks in a more stable environment respond less to climatic changes than white oaks in environments that are more stressed. Therefore studies using tree ring data for climate proxies should gather data from trees in more stressed environments, which better represents the actual growth signal of these plants.

Keywords - dendrochronology, dendroclimatology, PDSI, white oak, Quercus alba

Introduction

White Oaks have been the focus of research for dendrochronological studies due to their great sensitivity to seasonal changes in moisture and temperature and abundance throughout Eastern North America (Anning et al., 2013). Past research from Clark (2018) and Searle et al. (2012) used the Palmer Drought Severity Index (PDSI) to correlate moisture and temperature measurements per year to growth rate of trees. They compared growth patterns to PDSI values and found great similarities which support their hypothesis of the effect of urbanization on tree growth. Our study found that specifically in a small, urban town that these results are quite different from those in the previous studies mentioned.

The purpose of this study was to determine the degree to which the PDSI, a standardized index of precipitation and temperature, correlated to yearly growth in three different white oak habitats in the Piedmont of South Carolina. This would help to determine if other factors, both abiotic and biotic, may have caused some of the anomalous growth attributes noted in white oak chronologies (compared to the PDSI) in previous studies. Our hypothesis is that white oaks growing in more stressed environments are more reactive to PDSI changes.

Methods

The study consisted of sampling 3 different locations in and around Clinton, SC. Within Clinton, the sample locations included Presbyterian College campus (PC Campus), Young Forest (YF), and Musgrove Mill State Historic Site (MM). The environment types included an urban area with heavy foot traffic (PC Campus), a transitional forest (YF) consisting of mature oaks and shortleaf and loblolly pines bordered by developed pastures, and a natural forest located within a state historic site (MM), respectively. Cores were obtained with a Haglöf 2 Thread Increment Borer. Standard dendrochronological techniques were used to measure tree ring widths (Figure 1) and assessed by the Velmex and Measure J2X system. The measurements were analyzed through COFECHA, ARSTAN, and Excel programs.

Results

Based on our analysis of tree ring data, we found that PC campus white oaks had the highest average growth found from the tree ring data. Musgrove Mill had the lowest average growth and Young Forest was found to be in the middle. The tree ring data frequently follows the positive and negative peaks of the PDSI data (Figure 2). Tree ring width responses were not as drastic as PDSI levels, and in some cases, are opposite to what might be expected. As an example of this inconsistency, in 2000 a low PDSI occurred but the PC Campus tree had a relatively high growth rate. Similarly, in 2013, a higher PDSI resulted in a lower tree ring growth response.

Conclusions

It was found that although the results indicate
a relationship between the growth of the white oaks and the PDSI, the correlation between the two variables in this study were lower than the correlation suggested by Clark (2018). This lower correlation indicates that while PDSI is a good tool for relative prediction of white oak growth, it is not always as accurate as would be expected. This lack of correlation may be caused by different factors beside the moisture and temperature range implied by PDSI and those referenced in this study. The use of the PDSI to infer growth ring response may be good as a general predictor of climate vs. growth, but may not be as useful in understanding the variability in growth that may be due to other factors, such as soil differences and other abiotic factors. Biotic factors such as competition with other nearby trees for resources, the genetic differences in trees at different microsites within a forest being studied, or possible differences in microbial associations with the roots and leaves may also have significant effects on annual growth.

Acknowledgements

Special thanks to the Presbyterian College Biology Department and the PC Summer Fellows program for the support and funding of this research. Much thanks to Kobie Kirven, Kristen Miller, and Adrianna Cody for help and support. Special appreciation to Dr. Rischbieter.

References


Clark L. (2018). A study of the effects of urbanization as a proxy for climate change on the dendroclimatic and soil microbial signals of White oak (*Quercus alba*) in the upstate of South Carolina. Summer Fellows, Presbyterian College, SC.


Figures

Figure 1. Section of core PCDL 022 under dissecting microscope view showing the years 2012-2015. Notice the differences in width between 2014 and 2012.
Figure 2. PDSI (green) data correlated against tree ring width data. The y-axis contains the standardized values of PDSI and tree ring widths.
Assessing the Soil Microbiome Surrounding Quercus alba as a Possible Cause for Inconsistent Tree Growth Patterns in Relation to the PDSI

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Abstract – White oak (Quercus alba) is one of the most commonly studied tree species in dendroclimatic research due to the consistent growth signal it produces in response to changing climatic conditions. Recent studies of white oak in the upstate of South Carolina has shown, however, that this correlation is not always as consistent as reported in the literature. In some cases, low or negative PDSI (indicating low moisture, or more severe drought conditions) has resulted in statistically higher tree growth rates. The purpose of this study was to analyze the soil microbiome from three different environments to determine the possible contribution of beneficial soil bacteria to high white oak ring growth rates during drought conditions indicated by the Palmer Drought Severity Index. This analysis used 16S rRNA sequencing from soil samples taken from three different microenvironments near Clinton, South Carolina to determine the bacterial components from each location. The results showed significant differences in bacterial diversity between the locations sampled. An analysis of the bacterial populations that differ between the sites has revealed a possible link between the soil microbiome and higher than expected growth rates in white oak during elevated drought conditions.

Keywords - Microbiome, White Oak, Quercus alba, South Carolina

Introduction

Dendroclimatology has been an important contributor in understanding the past responses of trees to changing climates and other environmental factors such as urbanization (Clark, 2018). While the correlation between moisture and temperature in relation to tree growth is well established, there are significant examples showing that the response of a tree is not always directly related to these factors. While studies in the 1970’s on white oak provided evidence for the effects of local soil conditions being an important cofactor in eventual growth responses (Estes, 1970), there has been little data to show the possible contributions of the soil microbiome to unexpected growth responses, as was found in a previous study in the South Carolina Piedmont (Cody & Samuel, 2019).

The purpose of this study was to determine the soil microbiome components in three study locations, using modern DNA/RNA extraction techniques. This data was then coupled with a dendroclimatic analysis of white oak growth patterns from the same three sites. Preliminary data had already established that one of the three sites had the highest number of anomalous tree ring/PDSI growth events (Cody & Samuel, 2019). The hypothesis for our study was that there would be a statistically significant difference in the microbiome composition between the three study sites, and that the different microbial populations would be composed of groups that might have provided ecological services to help the trees overcome poor growing conditions.

This study was conducted by collecting soil samples and white oak tree ring cores from three locations around Clinton, South Carolina (Figure 1). The study sites included an urban area with heavy foot traffic (Presbyterian College (PC)), a transitional forest consisting of developed pastures surrounding older growth oak-hickory-pine forests (Young Forest), and a mostly undisturbed natural forest located within a state historic site (Musgrove Mill State Historic Site). A number of abiotic parameters were analyzed in the areas surrounding the white oak trees, including various aspects of the soil (soil type, soil mineral components, soil compaction), and CO2 levels (using an Amprobe CO2-100 CO2 Meter). Biotic factors were also analyzed, including tree spacing, location of sampled trees with respect to obvious human stressors (pathways, etc), and overall health of the trees being sampled. This part of the overall analysis was conducted to determine if there were any obvious differences in the abiotic or biotic conditions that might have been the reason for tree ring growth anomalies observed in the dendroclimatic part of this research. Since there was little difference in any of those factors analyzed, our research then focused on analyzing the soil microbiome to determine if there were differences in the soil bacterial populations that might account for plant growth differences not predicted by the PDSI. Soil samples were collected and sent to MR DNA Molecular Research in Shallowater, TX, where sequencing...
using 16s rRNA probes was accomplished. Genomic data from this analysis was sent back to Presbyterian College, and the data provided by that analysis was processed in the program QIIME to generate graphical representations of the bacterial populations present in the soil samples.

![Collection sites near Clinton SC (PC Campus; Young Forest; Musgrove Mill).](image)

**Figure 1.** Collection sites near Clinton SC (PC Campus; Young Forest; Musgrove Mill).

## Results

A number of significant results were obtained from the analysis of the QIIME graphs developed from the MR DNA genomic data. The nine phyla of bacteria identified in Table 1 were among the bacterial populations that were present in at least 1.0% of the samples. Among these, the highest percent presence were noted for the phyla Acidobacteria, Actinobacteria, and Proteobacteria populations regardless of the location sampled (Figure 2). There was a similar percent presence for the phyla of the Unassigned, Bacteroidetes, Gemmatimonadetes, Planctomycetes, and Proteobacteria. There was a larger difference between the locations for the phyla Acidobacteria, Actinobacteria, and Chloroflexi.

## Conclusions

From the analysis of the data collected, it was concluded that there was a significant difference in the populations of microbial organisms from the three locations sampled. Specifically, the Presbyterian College location, which had the highest incidence of low PDSI-high growth ring levels also had higher levels of the phyla Acidobacteria, Actinobacteria, and Proteobacteria. Two of the three phyla (Actinobacteria, and Proteobacteria) are involved in important soil activities such as humus formation and the decomposition of organic molecules, and also contain the nitrogen fixing Rhizobiaceae (Actinobacteria and Proteobacteria respectively). In more severe conditions, elevated levels of soil nutrients and humus could certainly have provided an advantage, and potential ameliorating effects during drought conditions. Since this was an initial study of the soil microbiota, future research will be aimed at looking at a finer scale determination of which actual species of bacteria might be the most important in providing the ability for white oaks to have high growth rates in high drought conditions. Aspects of the phyllosphere may also provide useful information relative to the growth anomalies detected by the dendroclimatic data.

## Acknowledgements

Special thanks to the Presbyterian College Biology Department and the PC Summer Fellows program for the support and funding of this research. Many thanks to Kobie Kirven, Kristen Miller, and Sharmila Samuel for their help and support. Special appreciation to Dr. Rischbieter for his support of this research.

## References


Figures and Tables

Table 1. Relevant microbial populations from the analysis of the soil samples.

<table>
<thead>
<tr>
<th>Bacterial Phylum</th>
<th>Description/Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crenarchaeota (Archaea)</td>
<td>Ubiquitous to most environments</td>
</tr>
<tr>
<td>Acidobacteria</td>
<td>Ubiquitous, especially in soils, pH and nutrients are populations dynamic controls, acidophilic.</td>
</tr>
<tr>
<td>Actinobacteria</td>
<td>Important in decomposition of organic materials such as cellulose and chitin, an important part of humus formation.</td>
</tr>
<tr>
<td>Bacteroidetes</td>
<td>Important in gut microbiomes due to fermentation of polysaccharides.</td>
</tr>
<tr>
<td>Chloroflexi</td>
<td>Very diverse, monoderm (one membrane, thick peptidoglycan yet many stain gram negative)</td>
</tr>
<tr>
<td>Firmicutes</td>
<td>May play important roles in sustaining the stability of the rhizosphere microbial communities.</td>
</tr>
<tr>
<td>Planctomycetes</td>
<td>Reproduce by budding. Anammox anoxic, anaerobic ammonia oxidation.</td>
</tr>
<tr>
<td>Proteobacteria</td>
<td>The family Rhizobiaceae contributes to nitrogen fixation.</td>
</tr>
<tr>
<td>Verrucomicrobia</td>
<td>Can be found in the soil, shows a compartmentalized cell</td>
</tr>
</tbody>
</table>

Figure 2. Comparison of soil bacterial populations. High Percent Presence levels can be seen in the phyla Acidobacteria, Actinobacteria, and Proteobacteria.
Geographic Variation in the Secondary Metabolites of Usnea strigosa

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Abstract — Chemotypes of the lichen species Usnea strigosa are well documented, and methods to identify common secondary metabolites are well established. However, geographic variation in secondary chemistry of this species has not been thoroughly investigated. In this study, we examined the presence of documented chemotypes in Upstate South Carolina and describe geographic variation in secondary metabolites both within and between collection sites. We discovered the absence of the most common chemotypes and found distinct chemical signatures that show geographic patterns with some compounds present only in specific locations and others common throughout the region.

Keywords — lichens, secondary metabolites, thin-layer chromatography, geographic variation

Introduction

Lichens are a complex symbiosis that can include up to three fungal partners and an algal or cyanobacterial photobiont (Tuovinen et al., 2019). Usnea strigosa, the bushy beard lichen, is a common fruticose lichen found attached to branches of deciduous trees throughout the southeastern United States (Hale, 1962). Usnic acid is present in U. strigosa, yet multiple chemotypes exist that produce other, more variable secondary metabolites. In general, the chemistry of lichen-forming fungi is complex, with more than 800 secondary metabolites identified to date (Boustie & Grube, 2005). The five major chemotypes of U. strigosa identified by Brodo et al. (2001) are: (1) the most commonly reported variant in the southeast that produces psoromic acid, (2) producers of norstictic acid and galbinic acid, (3) those that synthesize primarily usnic acid, (4) producers of fumarprotocetraric acid, and (5) thamnolic acid producers.

A typical lichen’s thallus is composed of an outer cortex, a photobiont layer, and an inner medulla, with each region potentially possessing different secondary chemistry (Brodo et al., 2001). Prior research has described the medulla color of U. strigosa as either white or red (Hale, 1962); dark red, white, or partly red (Brodo et al., 2001); or lacking pigment entirely (Nash et al., 2007). Hale (1962) investigated the relationship between medulla color and the presence of psoromic acid and norstictic acid in those chemotypes in much of the Eastern United States, but the chemotypes of U. strigosa found in South Carolina are virtually unknown. Research on other species of Usnea has shown that different chemotypes may inhabit different geographic regions (Kayes et al., 2008). We investigated geographic variation in the secondary chemistry of U. strigosa at two spatial scales (within sites and between sites) with the goals of (1) identifying the unique chemical signatures of this taxon in Upstate South Carolina and (2) comparing our lichens to the chemotypes described by Brodo et al. (2001) and Hale (1962).

Methods

We collected samples of U. strigosa at 7 sites in Abbeville, Anderson, Greenville, Greenwood, and Pickens counties between October 2019 and February 2020. At each site we collected 7-20 lichens for a total of 100 samples. We identified, labeled, and stored them in coin envelopes until they were processed. Samples were rinsed under DI water, dried, and finely chopped. After the medulla was exposed during processing, we recorded its color (white, red, or partly red). Three samples from each site were spot tested using para-phenylenediamine (PD), potassium hydroxide (K), and sodium hypochlorite (C) to detect the presence of psoromic acid, norstictic acid, galbinic acid, thamnolic acid, fumarprotocetraric acid, and usnic acid (Brodo et al., 2001).

Thin-layer chromatography (TLC) was conducted using 20 x 20 cm silica gel coated glass plates. Small samples (0.02-0.04 mg) of U. strigosa were soaked in 500 µL of cold acetone for five minutes to extract secondary metabolites. After extraction, the plates were spotted with 16 µl of a known compound, usnic acid (0.7 mg/ml), at the center of the plate and at each end of the plate. Ten 40 µL U. strigosa samples were spotted on each plate. For all samples, spots were made on the plate by sequential 8 µL aliquots with drying time between each addition. Plates were run in solvent C (toluene and acetic acid, 170:30) and solvent G (toluene, ethyl acetate, and formic acid, 139:83:8). Solvents C and G were chosen for our analyses because of their chemical stability and reliability for secondary
metabolite identification. Solvent G was used to separate compounds with low Rf values that tend to cluster at the bottom of the plates when using solvent C (Orange et al., 2001).

The solvent front for solvents C and G were run to 130 mm before the plates were removed from the TLC chamber and dried for 15-30 minutes. Secondary metabolite spots were marked during observation under short-wave UV and long-wave UV light. Once marked, we sprayed the glass plates with 10% sulfuric acid and heated them at 100-110°C for 10-15 minutes. Cooled plates were observed for a second time under UV light, and any new spots were marked. We calculated relative Rf values for each spot on each plate using an established method (Orange et al., 2001) that allowed us to compare our results to previous research. These Rf values scale the distance traveled by secondary metabolites relative to the solvent front and are standardized using control substances (in this case, usnic acid). We tentatively identified the common lichen compounds in our samples using these relative Rf values and the intensity and color of each spot under daylight and UV light. We determined how many of our samples fit the chemotypes described by Brodo et al. (2001) and Hale (1962) and identified patterns between chemotype and medulla color. To describe geographic variation between and within our collecting sites, we used non-metric multidimensional scaling (NMDS) via the vegan package in R (R Core Team, 2019).

Results

Because we used usnic acid as a known substance when running our TLC plates, we could easily identify this compound in our lichen samples, and it was ubiquitous (n=100). We were able to tentatively identify other secondary metabolites in our samples. Compounds tentatively identified as diffractaic acid (n=44) and isoarthothelin (n=46) were common. We detected galbinic acid in some lichens (n=9), but these samples lacked the norstictic acid that would identify them as chemotype 2 as described by Brodo et al. (2001). Chemotype 3 (n=84) and chemotype 5 (n=16) were common among our samples, but we did not observe any lichens that would be classified as chemotype 1, 2, or 4. Chemotype 5 lichens were found at four of the seven sites, and each of these lichens had a red or partly red medulla. We did not find an obvious relationship between medulla color and chemotype for any other secondary compounds. Additionally, we have yet to identify any lichens that produce psoromic acid, and we have not yet determined whether norstictic acid is present in our lichens.

In one case, we found conflicting results between TLC and spot testing for a secondary metabolite. Although spot testing results indicated that psoromic acid was present in some of our lichens (PD+ yellow, K-), TLC results did not support this finding, as psoromic acid (Solvent C: Rf = 41, Solvent G Rf = 59) was not detected on any of our plates. NMDS was used to visualize chemical space (stress= 0.108, k=4). We plotted each lichen sample within this space and connected samples from the same location with polygons. To describe geographic variation in secondary chemistry, Figure 1 shows the relationship between the individual lichens, collection sites, and the 76 potential secondary metabolites identified using TLC.

Conclusions

Our samples did not closely match the chemotypes described by Brodo et al. (2001) or Hale (1962). These findings suggest that the secondary chemistry of U. strigosa may be more variable than previously reported. The few studies published also examined specimens from a limited geographic area, and consequently, multiple authors have defined their own chemotype classes. While this has led to results that appear conflicting, it may simply indicate extensive geographic variation. We observed substantial geographic variation in secondary chemicals even at the relatively small scales at which we measured it (both between collection sites and within these sites).

Studies involving lichens and their secondary metabolites are important to our understanding of the extremely complex symbiosis of the fungal partners and their photobionts. Although it may seem useful to identify simple, readily identifiable chemotypes, we think that important information may be lost in this oversimplification. In future work, we plan to more completely identify the secondary compounds present in our samples and determine which of these compounds are responsible for the geographic variation within and between our collection sites.

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References


Figures

*Figure 1.* NMDS ordination plot of chemical space showing the relationship between the individual lichens (larger symbols), collection sites (polygons), and the 76 potential secondary metabolites (small + symbols) identified using TLC.
Testing the Effectiveness of Passive Gravitational Separation for Quantifying Limno-Terrestrial Tardigrades

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Abstract — To study the interactions between tardigrades and their substrates, it is necessary to be able to capture, count, and identify the tardigrades living on a given substrate. Historically, this has been an extremely time-consuming process. Even under optimal circumstances, quantifying tardigrade density has been difficult. Using modified burettes and gravity, we were able to condense the found tardigrades from a lichen substrate into a small subsample of water. We captured 92.3% of all found tardigrades in this water sample through four trials. Our method is inexpensive, requires much less active time than other methods, and could be adapted to quantify tardigrades from many different substrate types.

Keywords — tardigrades, meiofauna collection, lichens

Introduction

Limno-terrestrial tardigrades live in the thin, ephemeral layer of water occasionally present on bryophytes and lichens, and these communities can be complex with many tardigrade genera present on a single lichen (Meyer, 2006). A lichen is a complex symbiosis of fungi, yeast and at least one photobiont partner (Tuovinen et al., 2019). Lichens produce many secondary metabolites with functions ranging from UV protection to antimicrobial properties. Recent research suggests that lichens with lower levels of some classes of metabolites are colonized by larger numbers of microscopic animals compared to those with higher levels (Asplund et al., 2015). We are ultimately interested in determining how these secondary metabolites affect the population dynamics of tardigrades inhabiting lichens. Although tardigrades are capable of surviving a range of inhospitable environments encompassing elevated radiation, extreme desiccation, and microgravity (Nelson et al., 2010), little is known about how the secondary compounds of lichens might impact their biology.

One difficulty in studying the relationships between tardigrades and any of their vegetative substrates is that tardigrades are easy to observe but extremely time consuming to quantify. By some estimates, it would take a team of biologists more than two years to count and identify the tardigrades contained in a one cubic decimeter sample of soil. Historically, tardigrade harvesting methods relied on soaking substrates and subsequently examining subsamples of water or painstakingly scrutinizing the entire aquatic sample (Ramazzotti & Maucchi, 1983). Not only are these methods time consuming but many organisms ultimately escaped detection. Other methods have been developed that have a 96% collection rate using laboratory raised tardigrades, but they are either complex or use expensive, specialized equipment and have not been tested with tardigrades collected from natural substrates (Afzal et al., 2019).

The purpose of our research is to describe the collection method we devised and present data to demonstrate its utility. This alternative collection method takes advantage of our observations that tardigrades reliably sink to the bottom of a water column. We use passive gravitational separation to concentrate the bulk of tardigrades collected from a lichen in a small 4 mL subsample of water. This method is inexpensive, uses equipment common to most biology labs (with slight modifications), and substantially reduces the active time required to count the tardigrades contained in a sample.

Methods

We collected lichen samples from two locations (Greenwood County and Pickens County) in the upstate region of South Carolina. We placed these samples in glass finger bowls and soaked them in 15 mL of spring water. During previous trials, we determined that the optimal soaking time was between eight and ten hours. Following this soak, each lichen was homogenized using an immersion blender that was made water-tight by adding Teflon tape to the outside of the mouth of the blender bowl. Homogenization was considered complete when all pieces of the lichen sample were broken down to uniformly sized particles. After the sample was thoroughly homogenized, we poured the mixture through a set of sieves (2000 µm top sieve and 500 µm bottom sieve) stacked over a medium-sized finger bowl. The immersion blender was rinsed with 30 mL of spring water, and this rinse water was also poured through the sieves. This collected water along with the debris and animals...
that passed through the smaller diameter sieve is referred to as filtered sample A (FSA). Our previous observations suggested that the bulk of the tardigrades would be contained in FSA. Preparing FSA filtered out the larger pieces of debris; however, larger tardigrades could potentially be caught on the smaller screen of the bottom sieve. To lessen the chance of missing the larger tardigrades, the 500 µm sieve was inverted and rinsed thoroughly with 30-45 mL of spring water into a second medium-sized finger bowl which is referred to as filtered sample B (FSB).

After the sieving process was complete, the contents of FSA were poured into a burette (burette 1), and the contents of FSB were poured into a second burette (burette 2). We modified these titration burettes by cutting off the tip of each burette and filing it smooth just above the narrowing of the tip. We also drilled through the valves to ensure the opening through which the water flows was uniform in size. These modifications helped prevent debris from impeding the flow of water into the finger bowls used to collect tardigrades. Clumps of debris would potentially act as a net, causing tardigrades to become entangled at the tip and be excluded from the target subsample. If this occurred, the number of found tardigrades would be much smaller, and more tardigrades would possibly be captured in subsequent subsamples. Both scenarios would necessitate that a larger volume of water be used to reliably capture most of the tardigrades in the water sample.

Once the filtered samples were poured into the burettes, both burettes sat undisturbed for at least 12 hours to allow the tardigrades to settle to the bottom of the water columns. After the required settling time, subsamples were collected from each burette and observed under a dissection microscope. Subsample 1 was the first 4 mL of water released from the bottom of each burette. Subsamples 2 and 3 were collected in similar fashion and were each also 4 mL in volume. The remaining water in burette 1 was released from the bottom and divided among two more finger bowls (subsample 4 and subsample 5 from burette 1) for observation. The remaining water of burette 2 was treated the same way (subsample 4 and subsample 5 from burette 2). The tardigrades in all subsamples were counted under a dissection microscope using a hand-held tally counter. The finger bowls containing each subsample were placed on top of a 5mm grid printed on an acetate sheet to increase accuracy of counts. The grid allowed for systematic tracking across the finger bowl without missing any areas or counting areas twice. We used these methods to count the tardigrades on four lichen samples, and we tallied the number of found tardigrades in each subsample from burette 1 and in each subsample from burette 2. We compared the number of found tardigrades in our target sample (subsample 1 of FSA and subsample 1 of FSB) to the number of found tardigrades in each subsequent subsample of FSA and FSB.

Results

Each lichen sample required approximately 30 to 36 hours for processing from the initial soak through the final counting of all found tardigrades in every subsample. Although there was variation in the processing time for each sample, the amount of active time comprised a fairly small proportion (~25%) of the total processing time. Each sample required approximately 30-60 minutes of active preparation followed by 8-10 hours of inactive time for soaking, another 60 minutes of active time for homogenizing and sieving, and 12 inactive hours for settling. The total amount of active time required for counting tardigrades ranged from 5 to 6 hours. On average, 92.3% of found tardigrades were contained in our targeted subsample; moreover, 90.3% of tardigrades collected were found in subsample 1 of FSA (see Figure 1).

Conclusions

We have developed and refined a time and cost-efficient process for collecting limno-terrestrial tardigrades that allows for the detection and quantification of a large percentage of total found tardigrades in a fairly small and manageable volume of water. We feel confident that in future use of this method, counting only the individuals in the target sample will provide an accurate estimate of the number of found tardigrades in the sample and lower the required active time to 4 hours (or 15% of the total processing time) per sample. With additional sets of modified burettes, this process could be further streamlined allowing for simultaneous sampling of multiple lichens in a very reasonable amount of time. We plan to use this method to investigate the impacts of lichen secondary metabolites on tardigrade populations. We feel that this method could easily be adapted for use on multiple substrates, and we plan to test its efficacy in collecting and quantifying soil-dwelling and aquatic tardigrades.

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development; and Andrew Schwendemann, Kerry Hansknecht, Jason Lee, and Jennifer Maze for lending equipment and supplies.

References


Figures

Figure 1. The mean number of found tardigrades (± SD) in each subsample of filtered sample A and filtered sample B. The box enclosing subsample 1 indicates our targeted subsample size containing the first 4 mL of filtered water released from the bottom of each burette. This target subsample included an average of 92.3% of found tardigrades. 90.3% of the total found tardigrades were found in subsample 1 of FSA.
INNOVATIVE RESEARCH

A core component of the UofSC School of Medicine Greenville’s mission is to improve constantly, a goal often achieved through transformative research. While learning in the heart of Prisma Health’s Greenville Memorial Hospital campus, our medical students have an extensive choice of innovative research opportunities in areas including biomedical science, clinical practice, population health, health care policy and epidemiology.

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Atheists, Theists and the Appreciation of Religious Music

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Abstract — In aesthetics, there is a debate regarding the atheist's ability to appreciate religious music. The current debate prioritizes pitting the atheist's emotional experience against the theist's and neglects to define how the theist appreciates religious music. I will be giving the theist's emotional experience some of the consideration it deserves by analyzing the debate and counterargument presented by Daniel Putnam, which is against the atheist's emotional experience. I will also be revealing some of the flaws with the counterargument through different scenarios, demonstrating the unfairness in setting the theist as the standard of appreciation.

Keywords — philosophy of music, aesthetics, atheism, religious music

Introduction

In aesthetics, there has emerged a debate regarding the atheist's appreciation of religious music. This debate, as it currently stands, is characterized by pitting the atheist against the theist, with ample consideration being given to the atheist's emotional experience. By contrast, the theist's emotional experience has been neglected. Some philosophers, such as David Pugmire (2006) compensate for the atheist's lack of belief by utilizing imagination as a way of validating the atheist's emotional experience of religious music. A rebuttal made by Daniel Putman (2008) denies that the atheist can appreciate religious music, regardless of imagination. I will be considering the implication and assumptions of this claim. Namely, the lack of specificity regarding the meaning of appreciation and the existence of only one type of theist. By providing a scenario and giving different perspectives which illustrate the flaws with these assumptions, I will show how Putman's assumptions prevent more serious consideration of the theist's perspective.

Brief Summary of the Debate

David Pugmire addresses Michael Tanner's (1976) concern regarding the atheist's appreciation of religious music. Tanner questioned whether it was possible for atheists to appreciate religious music without being sentimental. In this context, sentimental refers to the atheist wanting to appreciate religious music and justify the feelings invoked by religious music, without having to believe in the existence of God. Pugmire claims that atheists are capable of appreciating religious music without being sentimental, through the power of the imagination. By separating emotions from a religious narrative and superimposing them onto a more generic narrative, a secularist would be able to feel the emotions invoked by religious music without falling prey to sentimentality.

Daniel Putman rebukes Pugmire's claim of atheists being able to appreciate religious music. He belittles Pugmire's suggestion that the atheist needs to use the imagination in order to have a similar emotional experience to the theist. In Putman's eyes atheists will never be able to feel the feelings evoked by religious music, that theists would be capable of feeling. He justifies this claim through the atheist's emotional experience being characterized by the belief that God does not exist. Putman also supports his argument by delineating the differences between atheists and religious persons. Most notably, he emphasizes the fact that atheists have nothing to take succor in, due to their lack of belief, making the emotions they feel unjustified. He also discusses how the difference between the feelings of religious music, which for the atheist would rely on imagination, are different from a religious person's which would take the feelings for truth. In conclusion, Putman believes that atheists are unable to appreciate religious music because of their utilization of the imagination.

Criticisms

I believe that Putman's opinion about Pugmire's claim is not wrong, however his justifications for his opinion are too narrow and presumptuous. Firstly, Putman implies that the atheist's lack of belief in God, would result in not having any exposure or knowledge of religion. I believe this to be not only a false, but presumptuous claim. As Tanner and Pugmire have touched upon, Western culture is heavily influenced by Christianity. Whether it be Christmas, the pledge of allegiance or even a wedding, religion is far more prevalent than Putman acknowledges. There are also many atheists who grew up in religious families and have been exposed to religion by going to church on a regular basis.
While this may not be the type of religious experience that Putman meant, it is still a valid type of religious experience that could affect one’s belief.

Consider this scenario: Samantha is in church listening to the B Minor Mass. She is religious and possesses the belief that God does exist, which colors her listening experience and allows her to appreciate religious music. Let us say that the manner in which she appreciates religious music is characterized by the proposition “God exists”. As Samantha listens to Bach’s B Minor Mass she receives validation and reinforcement that God does exist from the music through the lyrics. Let us also assume, that there is someone else sitting in the Church called Jon and he is listening to the same exact performance. Jon has a religious background; his family is Christian, and he possesses knowledge of Christianity. However, if you asked Jon if he believed in God he would say no. Jon is an atheist and is at the Church for the sole purpose of listening to Bach’s B Minor Mass. When Jon is listening to the performance, he hears Bach’s B Minor Mass. While he does hear from the Mass the proposition that “God exists” and is good he instead focuses on how in sync the choir is with the orchestra, and the expressiveness of the soloists.

What is the difference in Jon and Samantha’s experience with the Bach B Minor Mass? Jon is aesthetically appreciating the music, meaning he is listening to it as music rather than Mass. Samantha, on the other hand, engages with the music in such a manner that it seems inappropriate to call it aesthetic appreciation. Samantha has a belief, that God exists, and when she hears Bach’s Mass, her belief is being parroted back to her. Samantha may or may not hear the music of the Mass in B Minor, but her appreciation of the Mass lies within the fact that it confirms her belief in God. This scenario poses a concern in terms of the appreciation of religious music for not only atheists but theists as well.

In this debate, the philosophers have glossed over what it means to appreciate religious music. In the scenario given above, Jon is aesthetically appreciating the music while Samantha seems to use the Mass as a means of reinforcing her belief in God. If this is what the debate meant when using the word succor, then the atheist will never be able to achieve that level of appreciation and for good reason. It is hard to call Samantha’s experience appreciation. What is to say that she would not have a similar experience with a different piece of religious music? Is it problematic that her experience would not change with different pieces of religious music? While Samantha has the ability to take succor from the piece it does not make her type of appreciation better than Jon’s. One could even argue that the atheist is better suited to appreciate religious music but that is not the point of this paper. I simply want to give the reader more consideration into what appreciation means and how there are different types of it.

Delving into the Theist’s Perspective

It would be a blanket statement to say that all theists are the same, particularly those who consider themselves Christians. Taking this factor into account, would it not be strange to pit someone, Samantha, who identifies as Presbyterian against another Christian, let’s call her Lucy, who is Baptist? Would you ask whose listening experience is more “right” than the other’s? Lucy or Samantha? This example illustrates how ridiculous it is to expect the atheist to “match” the theist’s listening experience, because not even theists amongst themselves have the same listening experience. I have only so far mentioned Presbyterians and Baptists, but what about Catholics and all the different types of Catholicism that exist? If one were to consider the diversity amongst theists and the different branches of Christianity that do exist, there would be multiple scenarios and concerns regarding different types of belief that could arise from this. Let me give you an example. Instead of comparing two different sects of Christianity, what would happen if we compared two different aesthetic experiences from the same sect?

Let’s compare Lucy with another Presbyterian in the same church, listening to the same performance. This other person, Kendra, believes in God but her belief is characterized differently from Lucy’s because she studies religion at the doctoral level. Lucy on the other hand, only goes to Church once a week and attends the occasional bible study. Both possess a belief in God, but that belief is characterized differently due to their differences in exposure to their religion. The same goes with their aesthetic experience, the way they aesthetically appreciate the B Minor Mass will be colored by the extent of their religious belief. When Lucy hears Bach’s B Minor Mass, she will hear a beautiful noise. Having no background knowledge on the Mass, except that it is a famous piece by Bach, it is hard to say that she will be able to appreciate the Mass for its musical qualities. Instead, would it not be easier to assume that when Lucy listens to the masterwork that she will only be able to understand it in reference to the program notes provided?

It seems a little presumptuous to assume that because Lucy is religious, she will be able to understand how every cadence or motif in the Mass is meant to glorify God. That would require knowledge characterized by formal musical study. It could be that until Lucy reads the program that she understands what the choir is singing or how this
whole Mass is focused on God. However, there is no reason to believe that Lucy would not have exposure to Mass that would allow her to at least follow the order of the service. With this loose grasp of a Mass, Lucy could understand that the Kyrie is asking for mercy from God. However, even then, it would be doubtful that she could aesthetically appreciate this Mass. If one is only able to appreciate something because someone told them what to appreciate, does it not shallow their appreciation of the thing? Lucy may be able to aesthetically appreciate the Mass with the help of program notes, however does the need of external help inhibit Lucy from taking succor from the B Minor Mass? Without program notes, Lucy could understand that the Gloria is praising God because of how happy it sounds but could an atheist not do the same thing with that sort of knowledge? In the example above, it is apparent that believing in God does not mean that you would be able to aesthetically appreciate religious music.

Conclusions

I have laid bare Putman’s assumptions concerning the atheist’s appreciation of religious music. It seems unfair to expect atheists to strive for the same type of appreciation as theists regarding religious music. In particular, this is because the religious person does not just possess one way to appreciate religious music without being sentimental. Taking into account the diversity within Christianity, it is doubtful that any of the worshippers from the same, let alone different, denominations would have the exact same experience of religious music. I have argued there is a hypocrisy in Putman’s banning of atheists from appreciating religious music. He claims that atheists lack a religious depth to their listening, but it is unclear that theists themselves possess such a dimension. As I have shown through my examples, not even theists amongst themselves possess the same experience listening to religious music. To clarify, I have not been arguing that any particular type of appreciation is better than another. I have simply argued that there are more diverse ways to appreciate religious music than the debate has currently recognized.

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References

How Social Media Influences the Use of Political Dog-Whistles

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Abstract- Political dog-whistles are a method used by politicians and the media to connect society's racial resentment to certain policy ideas. This is used to target people's racial resentment, using implicit messaging to attempt to sway the public's opinion on policies. While political dog-whistles are not a new concept, the way they are used has changed because of social media. A literature review focused on peer reviewed journals, articles, websites, and studies was conducted. The research found that dog-whistles are especially effective in the form of meme when targeted towards specific populations that harbor racial resentment. While the literature review showed that dog-whistles are not as effective when applied to specific policies, they are effective as a recruitment tool for the alt-right on social media. Keywords- Political dog-whistles, social media, hate groups, racial resentment, racial priming

Introduction and Literature Review

Dog whistle politics refers to using words, phrases or symbols that implicitly appeal to racism and give the person using them plausible deniability to the fact that they are using a racial appeal (Chyzh et al., 2019). This is predicated on racial priming theory which states that when someone is exposed to racial appeals, whether that be implicit or explicit, they will start to associate race with certain political issues (Tesler, 2017). There is conflicting evidence on whether implicit appeals are more effective than explicit appeals, however, racial priming theory is generally accepted as true (Huber & Lapinski, 2008; Valentino et al., 2018). Dog whistles are used because they provide plausible deniability of their racist undertones.

Public awareness of this tactic coincided with the Willie Horton ad that was played during the 1988 presidential campaign. This ad was criticized for “playing the race card” by imposing a threatening picture of Horton throughout the ad, who is an African American, while using him to criticize Democrat Michael Dukakis’s crime policies (Hurwitz & Peffely, 2005; Valentino et al., 2002). This tactic was also popular with Ronald Reagan, who used political dog whistles in association with welfare programs in 1986 (Wetts & Willer, 2019).

In recent years politicians, such as Donald Trump, have found more success in priming racial attitudes with using explicit racial appeals instead of dog whistles (Wetts & Willer, 2019). With the political landscape changing to a place where politicians prefer explicit racism, the use of dog whistles has declined in the politics. However, this does not mean they are obsolete, as hate groups have been found using dog whistles in the form of memes on social media (Caffier, 2017; Ward, 2018). In this study, I conducted a literature review to evaluate how social media has influenced the creation and use of dog whistles.

Methods

I conducted this literature review by searching for peer-reviewed articles through the Greenville Technical College’s library database, including EBSCO Host and Gale Power Search. I also used Google Scholar for broader results. I searched for reliable and peer reviewed sources on how anonymity on social media affects the way people act while-online. I also conducted a search for literature on dog whistles and racial priming theory. There is not much research focusing on specific memes and how they are used as dog whistles online. So, I had to rely on articles published by media sites and by Southern Poverty Law Center. I included the Southern Poverty Law Center’s article along with other articles from media sites because they provide useful examples to help understand how dog whistles are used as memes on social media even though I recognize that they are not peer reviewed.

Results

Taylor and Whittier (1994) discussed the different ways a group defines their collective identity. One of those ways is through the negotiation of symbols and actions that serve the group (Taylor & Whittier, 1994). While their paper was focused on feminist expression this idea can also be applied to the way white nationalists interact online and also describes why these groups create and use dog whistles. While dog whistles online, often used in the form of internet jokes otherwise known as memes, can symbolize that someone is a part of the white nationalist movement, they can also be used as a recruitment tool. Wetts and Willer (2019) found that white people with high racial resentment are the most susceptible to being swayed on policy opinions by implicit racial appeals. In
addition, a study conducted by Hutchings et al. (2010) which found that white men still supported and used symbols even when presented with evidence that the symbol is associated with racism. This provides an explanation for why dog whistles are an effective recruitment tool for white nationalists. Anonymity also plays a part in helping radicalize people for the alt right. Anonymity online can lead to people feeling disinhibited which allows them to explore fringe beliefs without the fear of repercussions (Bernstein et al., 2012; Caren et al., 2012). Posting offensive jokes online will not automatically radicalize someone. One white nationalist said that his anti-Semitic jokes were only “ironic at first” and he later became a holocaust denier and fascist supporter (Evans, 2018). Dog whistles in the form of memes gives people the plausible deniability of being racist, while exposing them to fringe groups through sharing memes. This can lead someone down the path of radicalization.

Conclusion

There is evidence that calls into question the effectiveness of dog-whistles used in the political sphere (Wetts & Willer, 2019). However, there is also evidence that point to the fact that dog-whistles in the form of symbols are effective, especially for white men (Hutchings et al., 2010). There is not a lot of peer-reviewed literature about the effectiveness of implicitly racist memes as a recruitment tool but there is a lot of anecdotal and observational information to be found online. The model of explicit/implicit racial appeals is still debated and needs to be researched further (Huber & Lapinski, 2008; Valentino et al., 2018). Even if the model still needs more research it offers a good understanding of why dog whistles are used and builds on racial priming theory which white nationalists take advantage of. Hate groups like white nationalists understand and deploy dog whistles effectively. White nationalism ideology is dangerous and promotes violence. More research and understanding of their tactics alongside educating the public would help deter their recruitment methods.

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I would like to thank Professor Walker, my research supervisor, for pointing me in the right direction for research and her valuable critiques on this paper.

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Kennedy’s Korner Pen Pal Program: The Effects of Electronic Communication on Special Needs Students

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Abstract - Electronic communication is a fairly common concept used in modern-day society, as we have various types of social media platforms. However, the use of electronic correspondence as used in this research project is fairly novel. Kennedy’s Korner Pen Pal Program consists of a two-step process. Step one entails email correspondence between middle school students and their college pen pal. The second step is the meet and greet where the middle schoolers visit the campus and have lunch with their pen pals. The results of the program were extremely positive. Across the board, people on both sides shared benefits; from gaining advice for the future, to being a role model for a younger generation.

Keywords - Electronic Communication, Special Needs, Advice, Support, Relationship Building

Introduction
In this day and age, schools provide technological facilities for their students at all levels. From a personal experience, students learn how to tinker with computers at a very young age. At one point or another, students become aware, or on certain occasions, be actively involved in electronic communication. By definition, electronic communication refers to “any transfer of signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic or photoptical system that affects interstate or foreign commerce (United States v. Reed, 575 F.3d 900, 9th Cir. Cal. 2009).” Therefore, electronic communication is a general term that “embraces all kinds of computer-mediated communication in which individuals exchange messages with others, either individually or in groups (IGI Global.com).” Platforms of electronic communication done through social media that are widely used are Facebook, Snapchat, Instagram, Messenger, and Texting (Wakefield, 2019). The knowledge and access to technology is so vast that in 2018, 97% of American teens used at least one social media platform while 81% reported that social media helped them feel connected, and 68% said that social media helped them feel as though they could rely on people who will support them in tough times (Anderson & Jiang, 2018).

This research is a germination of various concepts intertwining in the areas of electronic communication, connectedness, and special needs students. Community service is one of the minimum requirements for me to finish PSYC 101. Without having to drive in order to be somewhere for community service, I have designed a community service program without having to leave the campus. So, with the availability of other resources, the pen pal program for special needs students was designed. Growing up with a disability myself, this project has quickly become important to me. The Pen Pal Program is meant to connect, provide support, and offer advice to special needs students by helping them gain insights into personal issues and struggles that they encounter; issues that I have similarly gone through. As I got more involved in the program, I realized that this program can extend itself and have a bigger scope to include general education/non-special needs students as well. The whole purpose of the research is to see the effects and benefits of electronic communication on middle school and on college students.

Communicating with the Students Beginning Procedures
Kennedy’s Korner: The Pen Pal Program was launched in the spring semester of 2019 and continued in the fall. It had an extremely productive year of growth. The program originally started with me corresponding with about fifteen middle school students who were in a self-contained program. These students ranged from severe to general disabilities that affected their communication skills. However, a few visits to their school made it apparent that the students who had trouble communicating over email seemed to be friendlier and more personable in person. After a series of face-to-face meetings, email connection became a lot easier. The spring semester saw the involvement of fifteen self-contained special needs students. In the fall, however, this expanded to involve non-special needs, or general education students. All in all, the psychology students in my college engaged in an electronic communication relationship both with special needs and with general education/non-special needs students. Correspondence ballooned...
from 15 to 140 students and it involves a two-step process. First is the email correspondence between special needs/general education students and college students, and the actual meet-and-greet is the second and last step.

**Results**

The results of this two-tier program led to positive feedback from the participants. After expanding Kennedy’s Korner over the past year, substantial information and feedback were gathered that would help anyone realize the positive effects of electronic communication to special needs students. When asked, “Were you able to form a good connection with your pen pal?” eighty-eight percent (88%) responded with a “yes”. There is a good number that claimed they are able to form friendships that may be life-long. Having a “good perception of college” is a popular response from among the middle school students when asked the question, “What was helpful about this program?” The actual meet-and-greet created a window to have a glimpse of their future college life. On the other hand, the college students said that they saw the program as a wonderful opportunity to have an impact on their younger counterparts by being a friend and a good role model to them. When asked how the program can be improved, they mentioned, earlier kickstart to allow more time for correspondence and they also mentioned that this be continued throughout the years to come.

**Conclusion**

The concept of electronic communication between students is not new; but the concept of younger to older pen pal communication via email is fairly new (Foreman et al. 2014; Yssel et al. 2016). As a student with a life-long disability and has had interactions with many different types of people, I can say, from a personal standpoint, that the effects of electronic communication between students is hard to quantify. However, if it would mean behaving in class so that “I can be allowed to read my pen pal’s note” to accommodating “bursting excitement of actually receiving a pen pal note,” then the program is a success. The ability to share of oneself through connectedness and friendship via email, is a new playground, most especially for special needs children as it allows them to be bold and not shy or self-conscious (Fuchs et al. 2002). This program bridges the gap between students despite their differences and age gap.

**Acknowledgements**

First, I would like to thank my professor, Dr. Mary-Jane Farmer, for supporting and helping me develop this program. Also, thank you to all participating middle school students and their administration for supporting Kennedy’s Korner Pen Pal Program. Lastly, thank you to my mother, Mrs. Andrea Howard, for helping me think of this community service idea and for assisting to expand the program.

**References**


An Analytical Review: The American Dream and Suicide

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Abstract – Suicide is one of the top leading causes of death. The American Dream is a lofty ideal that compels pursuit for success and wealth. Feelings of disconnectedness and loss, psychological disorders, as well as the glamorization of suicide exacerbate the growing and alarming rate. Suicide and the American Dream seem to be unrelated in every way, but this paper gives a background into how closely their paths cross through analysis of literature and the interview method.

Keywords - Suicide, American Dream

Introduction

Suicide is not just a plausible topic to talk about; we all know that it is real. Suicide is one of the top leading causes of death across the world resulting in approximately one million deaths by suicide annually (World Health Organization, 2011). Studies indicate that the suicide rate in the United States has increased drastically in the past two decades (Suicide Statistics, 2019). In fact, it increased 24% from 1999 to 2014. Suicide is a topic that many would rather not discuss due to its severity and impact. However, that is the exact reason why there is a need to address this topic openly. On average, there are about 129 suicides per day in the United States. That rate translates to many grieving families; parents losing a child or children losing a parent. There is a high level of emotionality naturally enmeshed in suicide with several factors and perspectives coming into interplay. This paper brings to light the American Dream, a popular and sought-after societal as well as psychological factor, as it potentially comes into interplay with the core issue of suicide. This paper provides an analysis of literature as well as report on the results of interview conducted on the issue of suicide.

Suicide and The American Dream

Although there is no distinct uniform agreement on certain conceptualizations of what constitutes self-harm, self-injury, self-directed violence (SDV), and the suicidal process (Lester & Rogers, 2013), suicide is operationally defined here as “death caused by injuring oneself with the intent to die (Suicide Statistics, 2019).” By suicide, the act of taking one’s own life seems voluntary and intentional. It is not unique to either industrialized or poor nations. It is universal. The global suicide statistics indicate nearly 800,000 people take their lives each year, which equates to about one suicide every 40 seconds (Suicide Statistics, 2019). That is three lives lost in the span of two minutes. As for the American society, suicide is the 10th leading cause of death. To put it into perspective, suicide is responsible for more than 47,000 deaths in 2017, resulting in about one death every 11 minutes with 10.6 million American adults seriously thought of it, 3.2 million “made a plan”, and 1.4 million attempted suicide (www.cdc.gov).

Among several factors that come into interplay, one wonders whether the American Dream has ever had a hand on the issue of suicide. In his book, The Epic of America (1931), James Truslow Adams wrote about “that dream of a land in which life should be better and richer and fuller for every man, with opportunity for each according to his ability or achievement.” Adams referred to that dream as “The American Dream.” Does the American Dream have a significant effect on suicide? The pursuit of the American Dream involves the opportunity to: pursue success; personal freedom, hope, and control over decision making; enjoy fulfilling employment at a livable wage and buying a home; and, access to higher education. This also includes protection from deep poverty or access to a social safety net, health care, and a rewarding retirement (www.planetizen.com).

Fast forward to 2020, eighty-nine years later, the understanding of the American Dream remains the same. However, the pursuit and efforts to achieving it have become much more difficult and restraining due to several societal factors that have worsened through the years- cost of living, stability or instability of income and jobs, college debts (for many), psychological well-being and mental health, to name a few.

From an exterior perspective, the American Dream speaks of success and wealth. It translates to one’s inner ability to flourish, thrive and overcome challenges and difficulties which champions the feelings of success and triumph and at the same time, be perceived of as successful in the eyes of many. In modern day psychology, this is called positive psychology which involves the “scientific
study of human flourishing, with the goals of discovering and promoting strengths and virtues that help individuals and communities to thrive (Myers & DeWall, 2018, p. 12). This is good, for as long as the individual is triumphant and successful. But what happens when failures and defeat bombard and eventually overcome the human spirit?

Statistics indicate suicide from across diverse socio-demographic factors: race, income, occupation, gender, geography, place of domicile, psychological disorders, etc. It is perfectly alright to understand the advent of suicide from the perspective of several factors like income and wealth, or its lack thereof. It is highly informational to know that Montana is accounted for the highest suicide rate among states. It is disheartening to know that the suicide rate of white men has dramatically increased and that the suicide rate of Black children age 5-12 far exceed that of White youth in the same age range. And, it is heartbreaking to find out that veterans have a suicide rate twice that of non-veterans (www.cdc.gov). But these statistical rates do not delve into the very core reasons that compel and push someone to the edge of the precipice of their lives. Otherwise, fashion designer Kate Spade or CNN celebrity chef host Anthony Bourdain, and a host of countless others lost to suicide would still be around. Why do they commit suicide? What drives them to do so? The suicide rates that cut across socio-demographic factors provide a sound roadmap to understanding suicide and are not without value. Rather, they contribute to the scientific knowledge base of understanding the issue. However, these comprise only of one aspect and face of suicide. The other considered as covert and much more intrusive proves to be difficult to ascertain. This face pertains to the inner core of feelings that encumber and saddle the individual when failure and defeat constantly batter and overcome the human spirit. The overt side of the American Dream generally speaks of everything good as seen by the naked eye and is readily applauded by others. However, matters that are privately internal and covert are not. Individuals who are successful by every measure of the American Dream have every right to be happy and bask in feelings of triumph, success, and fulfillment. But what happens when such feelings are not genuine or worse, feelings of melancholia, defeat, sorrow, and madness overcome the “publicly perceived” successful individual? And what about those that are in constant struggle with such feelings? Could the feelings of defeat, loss, and darkness be exacerbated by one’s inability to live the American Dream (Watson, 2018)?

How about age and maturity, as well as the drive to pursue one’s ambitions? Emile Durkheim, the Father of Sociology, recognizes the length of time individuals are exposed to the effects of society as an important dimension to suicide. He notes that “the collective forces that drive a man to kill himself only penetrate him little by little. Other things being equal, it is as he gets older that he becomes more vulnerable, no doubt because repeated experiments are needed to make him feel the full emptiness of an egotistical existence or the utter vanity of boundless ambition (Baudelot & Establet, 2008, pp. 101-102).” In a society where one’s pursuit of boundless ambition is strong, gradual departure from a tradition of family values takeoff. Feelings of connectedness and rootedness, as well as simple joy and contentment are abandoned through the passage of time. Multiple studies point to “a strong link between suicide and forms of emancipation from traditional values (agnosticism, divorce, and so on) explain why it is that, even during periods of growth, the suicide rate remains high in developed countries, and never returns to the low levels around which it hovered prior to the industrial revolution of the nineteenth century. The rise of individualism, which is... a result of capitalistic economic development... does indeed introduce factors that lead to suicide (Baudelot & Establet, 2008, p. 76)”.

And of course, issues of psychological well-being and psychological disorders must be equally addressed. Suicidal ideation is high among the clinically depressed and anxious. Mental illness and the lack of mental health counseling and support play major roles. One school therapist and counselor recognized that “more attention and funding must be poured into mental health services, whether for the betterment of services or training of people that handle the psychologically disordered or the need for better therapy and medication to assist these people the best we can. Assisting people with suicidal thoughts as best we can, is the first step to trying to eliminate suicide. These people must know that there are others there for them. They often think that the world will be a better place without them, which is not the case whatsoever. While battling their inner demons, many are just looking for a friend. They do not need to be ignored; they need to be heard. Suicide is often a topic that is hushed quickly when it is brought up, which is the first mistake we are making. In order to address the problem, we need to first acknowledge that it is a problem at all (Personal Communication, October 2019).” On the other hand, a good number of college students who were seemingly adjusting well with GPAs ranging from 3.5 to 4.0, observed that there is a strong
unnecessary glorification of suicide promoted, through the years, by TV shows, movies, and other forms of social media. These platforms glamorize suicide making it appear as the “new” normal way of handling life’s struggles and problems (Personal Communication, Sept-October, 2019). For instance, when “13 Reasons Why [aired], a thirteen-episode television series chronicling the life and death of teenager Hannah Baker, fans mention it 11 million times on the social networking platform... unfortunately, the show inspired not only suicide attempts but completed suicides (Steffens, 2019, pp. 26;28).”

Conclusions

Suicide and its ill effects are growing and affecting every facet of human society. The American Dream is a lofty ideal that fuels the pursuit of success and wealth. However, one cannot simply put the blame on it to explain the growing rate of suicide in the American society. There is a need to understand the connection between the indirect effects of a “failed” American Dream considered to be inner, and covert feelings of lostness, disconnectedness, defeat, and darkness and the extreme measures brought about by suicide. And of course, one cannot simply turn a blind eye to psychological disorders and even to the present-day glamorization of suicide on social media. Further in-depth research is highly recommended, most especially on the connection between suicide and the indirect, inner failings of the American Dream.

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“I Want to Hold Your Hand”: The Strength of Touch in Reducing Binaural Beats Induced Fear

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Abstract- Anxiety is highly prevalent in young adults of college age and makes them susceptible to various deleterious effects on their overall health. Social support in the form of human contact may play a vital role in the minimization of these negative effects, and the current study aims to investigate the ability of human contact to minimize feelings of anxiety in college students. Binaural beats of 6 Hz were used to induce anxiety in a nonspecific way prior to student receiving human contact (hand holding or proximity) with another student. Results suggest that human contact has no effect on fear/anxiety reduction. Limitations of the study and how they may have contributed to this non-significant finding are discussed.

Keywords – Anxiety, fear, binaural beats, human contact, theta

Introduction

Most adults experience anxiety, an unpleasant feeling stemming from an undefined threat, at some level. Specifically, up to 63% of young adults in college report feelings of overwhelming anxiety (LeBlanc & Marques, 2019). These feelings of anxiety toward a threat typically yield fearful emotions and a stress response, which subsequently impair multiple systems such as cardiovascular (Wiggert et al., 2016), immune (Moons & Shields, 2015), respiratory (Dimitriev et al., 2014), and sleep (Wu et al., 2019). Young adults in college who tend to seek relief from stress and anxiety by avoiding certain stressors through unhealthy methods are particularly susceptible to these deleterious responses. Moreover, college students consume high levels of alcohol (Carter et al., 2010), and show an increased history of harm to others, prevalence of mental health issues, as well as high rates of suicide and self-harm (Xiao et al., 2017). In fact, the 2nd leading cause of death in college students is suicide (Schwartz, 2006). With the previous points in mind, it is imperative that alternative and healthier methods of stress and anxiety management and treatment are explored.

In general, the presence of social support plays a vital role in an individual’s ability to navigate negative emotions. Social support is also a good mediator for relieving feelings of stress, anxiety, and depression (Gnilka & Broda, 2019). An active form of social support is physical touch, which consequently mediates perceived pain (von Mohr et al., 2018) and communicates positive feelings (Kirsch et al., 2018). Specifically, holding the hand of a close other reduces pain perception, theta power, and heart rate (Che et al., 2018). The application of physical contact may be key in reducing feelings of stress and fear in college age individuals.

Much research has been done on social support and its influence on the physiological response to fear and anxiety. What remains unclear is if fear and anxiety excited in a nonspecific manner can be reduced by the physical presence or touch of a non-close other. In the current study, binaural beats at a frequency of 6 Hz were used in an attempt to induce feelings of fear/anxiety, and the reduction of that fear was tested by having participants either hold hands, sit in close proximity, or have no form of contact. It was predicted that the hand holding condition would have the greatest physiological effect, with no contact performing the worst, and proximity being intermediate.

Method

Participants
Participants included southern university students (N = 63; M_Age = 20.11, SD = 3.85; 12 Male, 49 Female, 2 Non-binary; 18 Black/African Americans, 32 White/Caucasians, 6 Asians, 5 Other).

Measures
Participants were asked directly if they had ever been exposed to binaural beats and answered either “0-yes”, “1-no”, or “2-unsure”. To assess participants’ feelings towards physical contact with others, participants were asked to rate 6 statements on a scale of 0 (“Disagree”) to 3 (“Agree”). An example statement would be “I usually feel uncomfortable when I’m in close proximity with people I do not know”. Scores across items were averaged and higher scores indicate a higher aversion to human contact.

Procedures
Participants were recruited in couples when possible and each pair was randomly assigned to one of two conditions (Proximity or Hand Holding).
If only one participant was recruited, they were placed in the no contact condition. All participants gave written consent prior to participating in the study, then EEG (BIOPAC Systems Inc. v. 4) electrodes were attached to participants’ scalp. Throughout the study, EEG data was collected in continuous segments (baseline, fear inducing - theta wave of 6 Hz binaural beats, study condition position with fear inducing binaural beats, and calm inducing original position – alpha waves of 12 Hz binaural beats). Soundwaves in the theta range via binaural beats are particularly significant because they excite fear in a non-specific way (Pluck & López-Águila, 2019). Participants then completed the set of questionnaires and were debriefed before leaving.

Statistical Analysis

A multivariate analysis of covariance (general linear model) was performed to examine the effect of human contact on physiological fear response. Previous exposure to binaural beats and their feelings toward human touch were included as covariates. Based on similar research (Pluck & López-Águila, 2019), we expected an effect of 0.26 and thus our sample size allows us approximately 50% power.

Results & Discussion

Contrary to the hypothesis, there was no interaction between human contact condition and physiological fear response $F(4,108) = 1.37, MSE = 4.80, p = 0.248$, see Figure 1. Human contact had no effect on the reduction of fear/anxiety. However, in Figure 1, a trend is observed between timepoint 1 (no binaural beat) & 2 (after 6 minutes of theta wave exposure) suggesting theta waves were being produced. As expected, after 6 minutes of contact the two contact groups (Proximity and Hand Holding) also seem to have an increase in brain frequency; however, the no contact group, also seemed to exhibit an increase in frequency, which was contrary to expectations. The transition to the second phase (i.e., contact condition) produced a mild interruption in attention to the binaural beats and thus it is possible that the attention shift present for all groups played a larger role than expected. López-Caballero and Escera (2017) had similar non-significant findings when binaural beats were interrupted by pink noise exposure prior to measuring mood, suggesting the effect of binaural beats may be exceptionally sensitive.

One alternative explanation for our non-significant findings is that the experiment was underpowered, meaning that there were simply not enough participants, and thus it is possible the effect was missed. Aside from sample size, there are reasons specific to binaural beats that may have also affected our findings. Binaural beats has been shown to be effective at producing theta waves (4-8Hz) with as little as 3 minutes of exposure (Jirakittayakorn & Wongsawat, 2017). However, other research suggests that for fear induction and neuronal synchronization to occur the binaural beat must be at a frequency of 4 Hz (Kalari et al., 2016) and be played for at least 30 minutes (Pluck & López-Águila, 2019). Therefore, it is possible our study could have been overshooting the target wavelength and needed longer binaural beat exposure. Additionally, the participants in our study were students at the same University, but likely strangers. Thus, the contact is impersonal, which means participants may not have been able to benefit from the human contact fully. And indeed, Che et al. (2018) found that a reduction in theta frequencies was only significant with physical contact from a close other compared to no-contact or a stranger. This is especially pertinent given that contact occurred simultaneously with theta wave exposure in our study, so competing forces were present. The issue of human contact quality could be remedied by either changing the type of contact to something more personal (e.g. hugging) or by having participants receive contact from a close other, such as a significant other, close friend, or family member.
Conclusions

In summation, it is unclear whether binaural beats can/should be used to induce emotions. Our current findings add to the limited body of binaural beat research to provide insight on methodological procedures. Additionally, our research may raise questions about the use of binaural beats for therapeutic effects. Binaural beats of different frequencies have already been used for various therapeutic reasons such as increased relaxation (Lee-Harris et al., 2018), enhanced mood & recall (Jirakittayakorn & Wongsawat, 2017), and to modify concentration/focus (Colzato et al., 2017). However, research has not shown how long lasting these effects are. Binaural beat therapy may be a good option, but may also not be beneficial outside of the time they are utilized.

References


BACHELOR'S DEGREES
Advanced Manufacturing Management
Art Education
Art Studio (Graphic Design)
Biology
Business Administration and Economics
Chemistry
Child Development and Family Studies
Commercial Music
Communications
Computer Information Systems
Computer Science
Criminal Justice
Early Childhood Education
Elementary Education
Engineering Technology Management
English
Exercise and Sport Science
Health Informatics
History
Information Management and Systems
Interdisciplinary Studies
Mathematics
Middle Level Education
Nursing
Physical Education
Political Science
Psychology (Experimental)
Secondary Education
Sociology
Spanish
Special Education: Learning Disabilities
Theatre

MASTER'S DEGREES
Applied Learning and Instruction
Business Analytics
Nursing (Clinical Nurse Leader)
Special Education: Visual Impairment
Informatics

CERTIFICATION
Child Advocacy Studies
Early Childhood Education

Elementary Education
Middle Level Education
Physical Education
Secondary Education
Special Education: Learning Disabilities
Teaching English to Speakers of Other Languages

PRE-PROFESSIONAL PROGRAMS
Pre-Chiropractic
Pre-Dental
Pre-Engineering
Pre-Law
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Pre-Occupational Therapy
Pre-Optometry
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Human Cognitive Augmentation in Human/Cog Synthetic Expertise Ensembles

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Abstract — In the coming cognitive systems era, we will be surrounded by artificial systems capable of cognitive performance rivaling or exceeding a human expert in specific domains of discourse. Humans will work in collaboration with these “cogs” and together will achieve expert-level performance as an ensemble—synthetic expertise. The human cognitive performance is therefore augmented by working with the cog. As the capability of cogs increases, the balance of cognitive processing in a human/cog ensemble will shift toward more artificial thinking and less biological thinking. This paper introduces six Levels of Cognitive Augmentation to describe the balance of cognitive processing in human/cog ensembles. The future belongs to those best able to communicate, coordinate, and collaborate with cogs.

Keywords — synthetic expertise, artificial expertise, cognitive systems, artificial intelligence, human cognitive augmentation

Introduction

The idea of enhancing human performance with technology is not new. Humans have always created new technology ranging from wheels, hammers, axes, and shovels to the printing press, automobiles, electric motors, telephones, radios, and televisions; to computers, software, the Internet, online shopping, voice-controlled digital assistants, and social media. Each technological advance makes it possible for humans to do things never before possible. However, until lately, humans have had to do all of the thinking. Current computers, software, and electronic devices make the humans better at thinking, but none perform high-level cognitive processing (thinking) on their own. This is about to change.

Cognitive systems have already demonstrated the ability to equal and surpass human ability in a number of strategy games such as: chess/DeepBlue (IBM, 2018), Jeopardy!/Watson (Ferrucci et al., 2010; Jackson, 2015), Go/AlphaGo (DeepMind, 2018a; Silver et al., 2016). Furthermore, in 2017, AlphaGo Zero learned how to play Go by playing games with itself and not relying on any data from human games (DeepMind, 2018b). AlphaGo Zero exceeded the capabilities of AlphaGo in only three days. Also in 2017, a generalized version of the learning algorithm called AlphaZero was developed capable of learning any game. While Watson required many person-years of engineering effort to program and teach the craft of Jeopardy, AlphaZero achieved expert-level performance in the games of Chess, Go, and Shogi after only a few hours of unsupervised self-training (Chessbase, 2018).

Beyond playing games, artificial systems are now better than human doctors at predicting mortality (Wehner, 2019), detecting signs of child depression through speech (Lavars, 2019), and detecting lung cancer in X-Rays (Sandoiu, 2019; Towers-Clark, 2019). Systems find discoveries in old scientific papers missed by humans (Gregory, 2019). Many more examples exist.

Empowered by deep learning, these recent achievements herald a new type of artificial entity, one able to achieve, in a short amount of time, expert-level performance in a domain without special knowledge engineering or human input (Isaacson, 2014; Wladawsky-Berger, 2015). Cognitive systems can now learn on their own how to perform better than human experts faster than humans could possibly train them! John Kelly, Senior Vice President and Director of Research at IBM describes the coming revolution in cognitive augmentation as follows (Kelly & Hamm, 2013):

“The goal isn’t to replace human thinking with machine thinking. Rather humans and machines will collaborate to produce better results—each bringing their own superior skills to the partnership.”

We call our future artificial collaborators “cogs”: an intelligent agent, device, or algorithm able to perform, mimic, or replace one or more cognitive processes performed by a human or a cognitive process needed to achieve a goal. The future will see the rise of a mass-market of intelligent apps and devices able to perform high-level cognitive processing. By the end of the decade, hundreds of millions of people around the world will daily work with, collaborate with, and be cognitively augmented by cogs.
Synthetic Expertise and Human Cognitive Augmentation

As shown in Figure 1, a human/cog ensemble transforms inputs ($S_i$) and produces outputs ($S_o$). The human performs some of the cognitive processing ($W_H$) and the cog performs some ($W_C$). Together, the ensemble performs a total amount of cognitive processing ($W^*$). When $W^*$ exceeds that of an expert in the domain of discourse ($W^* > W_{expert}$), the human/cog ensemble has achieved synthetic expertise.

A human working with a cog is able to do more than by working alone, therefore, $W^* > W_H$. From the viewpoint of an outside observer, it appears as if the human is performing at a higher level than should be expected—something we call human cognitive augmentation. The amount of cognitive augmentation ($A^*$) is calculated as: $A^* = W^*/W_{alone}$ (Fulbright, 2016-2019). Biological systems performing at an expert level are human experts. Non-biological systems capable of the same are artificial experts. It will be many years before fully artificial experts become available to the mass market.

In the meantime, human/cog ensembles will achieve varying amounts of cognitive augmentation. As the capabilities of cogs grow, the balance of human/artificial thinking will shift toward the artificial. To characterize this shift, we introduce the Levels of Cognitive Augmentation shown in Figure 2 ranging from no augmentation (all human thinking) to fully artificial intelligence (no human thinking).

Until now, our computers, devices, and software represent Level 1 cognitive augmentation (assistive tools). Current cognitive systems are producing Level 2 cognitive augmentation. In the next few years, we will see Level 3 and Level 4 cognitive augmentation leading eventually to Level 5 augmentation in which no human cognitive processing will be required.

![Figure 2. Levels of Cognitive Augmentation](image)

References


The Expertise Level and the Model of Expertise

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Abstract — In the coming cognitive systems era, we will be surrounded by artificial systems capable of cognitive performance rivaling or exceeding a human expert in specific domains of discourse. Humans will work in collaboration with these “cogs” and together will achieve expert-level performance as an ensemble—synthetic expertise. The human cognitive performance is augmented by working with the cog. As the capability of cogs increases, the balance of cognitive processing in a human/cog ensemble will shift toward more artificial thinking and less biological thinking. This paper introduces the Expertise Level describing the skills needed for expertise and introduces the Model of Expertise facilitating the development of human/cog ensemble architectures.

Keywords — synthetic expertise, artificial expertise, cognitive systems, artificial intelligence, human cognitive augmentation

Introduction

In 1982, Allen Newell, one of the pioneers of the field of artificial intelligence, identified the Knowledge Level as an abstract way to represent the knowledge involved in a computer system independent of implementation details such as program statements, data structures, symbols, registers, and electronic circuits (Newell, 1982). In 1990, Luc Steels extended Newell’s levels by adding the Knowledge-Use Level between the Knowledge Level and the Program Level to address design and implementation issues like task decomposition, execution, scheduling, software architecture, and data structure design (Steels, 1990).

However, one needs more than just knowledge to describe expertise. Simon, Newell, Chase, and deGroot identified major components of expertise to be: the ability to acquire a large amount of deep domain knowledge, perceive a current situation and recognize cues, and the ability to retrieve from memory information about what to do when those particular cues are noticed (Newell, 1982; Chase & Simon, 1973; Simon, 1956; Simon & Gilmartin, 1973; deGroot, 1965).

Steels (1990) identified problem-solving methods (how to solve problems) and task methods (how to perform activities) as important components. DeGroot (1965) experimentally showed the importance of perception. Simon, Minsky, and Gobet identified the ability to build, maintain, and reason about representations of reality as key to expertise (Gobet, 2016; Gobet & Chassy 2009; Gobet & Simon, 2000; Minsky, 1977). Pervasive in expertise research is the ability to learn. These components go beyond knowledge and describe skills required of an expert.

However, there is no abstract mechanism for representing skills in artificial intelligence and cognitive architecture research. This paper introduces the Expertise Level to accomplish this.

The Expertise Level

As shown in Fig. 1, we extend the Newell/Steels levels by adding a new level called the Expertise Level above the Knowledge Level to represent skills an expert must possess. At the Expertise Level, we talk about what an expert does—the skills—and not worry about the details of the knowledge required to perform these skills. Therefore, the medium of the Expertise Level is skills.

Fulbright (2020a) identifies 12 fundamental skills needed by an expert resulting in the expertise-level description shown in Fig. 2. By including contributions from Newell, Simon, Steels, Gobet, and others, Fulbright (2020a) also creates the knowledge-level description of expertise shown in Fig. 2. Combining the knowledge-level and expertise-level descriptions yields the Model of Expertise as shown in Fig. 2.

![Figure 1. The Expertise Level](image-url)
Defining the Model of Expertise enables researchers to design architectures for future cognitive systems able to perform high-level cognitive processing yet also collaborate with humans to form a human/cog ensemble capable of synthetic expertise (Fulbright, 2020b). Fulbright has introduced architectures for: Sy (a synthetic friend/companion), Synthia (a synthetic teacher), Synclair (a synthetic research colleague), Ashe (a synthetic scientific hypothesis explorer), and Lois (a synthetic elderly companion. Since systems like these are intended to work with humans in a collegial manner, the skill **collaborate** is added to make the 13th fundamental skill.

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**References**


Synthetic Expertise: Dialoging with a Cognitive System in Mixed Reality

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Abstract — We are entering the cognitive systems era in which humans will increasingly work in partnership and collaboration with semi-intelligent artificial entities called cognitive systems (cogs). The interaction between human and cogs will not be limited to text and spoken language but instead will involve mixed reality—the combination of physical and digital entities in natural environments. We envision a cog, called Di, with the skills of a personal diet coach and then imagine how a human would interact with the cog using a mixture of voice commands, gestures, motions, actions, and an interactive mirror/display screen. The interactive mirror is a particularly attractive medium for human/computer interaction and several future cogs are proposed.

Keywords — synthetic expertise, human cognitive augmentation, cognitive systems, cognitive computing, human-computer interaction

Introduction

With recent advances in artificial intelligence (AI) and cognitive systems (cogs), we are at the beginning of a new era in human history in which humans will work in partnership with artificial entities capable of performing high-level cognition rivaling or surpassing human cognition. This paper explores ways humans will interact with these cogs. Today, it is common practice to use a voice command to activate apps on our smartphones, tablets, and virtual assistants. However, in the future, interaction with cogs will be much more robust and utilize many different kinds of information conveyance such as gestures, facial expressions, and body language. Likewise, cogs will project and display information into our normal, everyday environments (mixed reality) and detect and recognize our motions and behaviors by watching and sensing us.

Mixed reality and augmented reality involve the merging of physical and digital objects to coexist and interact in real time within our normal environments (Milgram and Kishino, 1994; Isberto, 2018). Instead of viewing computer-generated information displayed on a two-dimensional computer screen as we are accustomed to, in mixed reality computers project or display information into our normal three-dimensional world. The information flow is bi-directional. In addition to computers receiving information from humans via mouse actions, keyboard entry, and touchscreen interaction, in mixed reality, computers are able to detect gestures, actions, and behaviors by observing humans through an array of various kinds of sensors. We feel it is very important for interaction with future cogs to be as natural and as close to interaction with other humans as possible. As cogs gain human-like skills, we will expect human-like interaction. Also, mass-market adoption of cog technology will not happen unless interacting with cogs is easy and natural.

In September 2018, a new product called “Mirror” was introduced. Mirror is a normal full-length mirror when turned off, however, when turned on, the Mirror becomes an interactive personal trainer with the reflected image of the user superimposed with computer-generated information (Mirror, 2020). A person uses the Mirror by watching video of a trainer displayed on the screen/mirror while they also watch their own reflection. In this way, the person can insure they are using the proper movements for the exercise. The Mirror is a two-way reflective surface with a rear-mounted computer display screen along with microphones, cameras, and speakers. Brynn Putnam, the founder and CEO of Mirror maintains the Mirror represents a new category of technology in human/computer interaction. “We’re looking to be the next screen in people’s lives,” says Putnam. (Warren, 2018). As such, the Mirror represents a new platform on which to launch a host of different virtual experts.

In this paper, we imagine the existence of a cog, we call Di, possessing the skills and knowledge of a personal diet coach. Physically, Di will be embedded in the full-length Mirror device hanging on the wall or door in a client’s home. Sensors within the Mirror give Di the ability to observe the client’s face (including eye-tracking and facial expressions), hands, arms, and body language. Di can speak to the client and hear the voice of the client through microphones and speakers in the rear-mounted computer. Di can also perform 3D
volumetric measuring of the customer’s body and obtain the customer’s weight when the customer steps on a mat lying in front of the mirror. Di, can wirelessly communicate with an arm band device worn by the user. The arm band tracks physical activity similar to a “Fit Bit” or “Apple Watch” tracking heart rate, calories, movement, etc. The Mirror is also the computer-driven screen onto which Di can place information, graphics, and other media content (e.g. pictures and videos). This information can “take over” the mirror surface and act very much like a television or computer screen, or can be overlayed onto the reflected image of the customer creating a mixed reality environment.

This paper explores the ways in which the customer can interact with Di. While some interactions described here are certainly specific to the diet coach domain, other domains will require similar kinds of interactions so what we describe here could be adapted to other domains.

**Interactions with Di**

Di facilitates a one-on-one interaction between the client and an artificial expert in health and wellness. The client interacts with Di through voice and facial recognition along with hand, arm and body gestures. When the client stands in front of the Mirror, Di will recognize the client, extend a greeting in a pleasant manner, display client’s current information, and show Di’s features on the Mirror. Some features available to the client on the screen/mirror are: weight, measurements, workouts, meal plan, goals, etc. In addition to tapping the Mirror/screen and observing information displayed by Di, the client can speak to Di via natural language. Being a narrow-domain conversational chatbot, Di is able to sustain a lengthy conversation about the client’s diet and exercise plan specifically but also about health and diet in general.

For example, let’s assume the client tells Di they want to burn 600 calories over the next hour and a half. Di then plans an exercise routine, based on knowledge of, and past experience with, the client and previous workouts, and tells/shows the client what exercise to do. Di then launches one or more Mirror-based routines with which the client participates. The client’s armband transmits data to Di used to monitor and track the calorie-burn amount. Once 600 calories are burned, Di will then inform the user they are done, terminate the Mirror routine, and give them a summary of the workout.

Di is able to detect and interpret the meaning of the client’s body language and gestures. For example, if the client makes a face while going over the week’s menu and dietary plan, Di will understand the client is unsatisfied with something and alter the menu and dialog accordingly. While engaged in a Mirror-based exercise routine, Di watches the client and is able to detect lackluster execution of movements suggesting fatigue, loss of interest, or possible physical difficulties. When engaging with the client over progress and goals, Di watches the client’s face for signs of worry, stress, and displeasure and intercedes with motivational dialog.

Di also sends a weekly meal plan and grocery list to the client as well as weekly workouts able to be done at home (via the Mirror) or in the gym. Di will perform and track weekly body measurements and weights. Body measurements include arms, chest, waist, and thighs. The client and Di will set a weekly goal which the client wants to obtain. If for some reason the client does not reach the weekly goal, Di will engage with words of encouragement and motivation to get the client back on the right path to reach their goal.

Motivation is important to any diet/exercise program. Enabling the client to see the end result can be an important motivational factor. Accordingly, Di is able to display on the Mirror/display an altered image of the client to show what they will look like after losing weight and/or toning certain body parts (e.g. arms, legs, tummy, buttocks). Di can also show the client how they used to look at the beginning of the program to accentuate the progress attained so far. By reminding the client where they started, how far they have come, and showing what benefits lie ahead, Di motivates the client and strengthens their willpower and desire to continue.
**Future Synthetic Experts**

Di is an example of a synthetic expert—an artificial system able to perform at or above the level of a human expert—based on Fulbright’s Model of Expertise. Fulbright introduced the Expertise Level as an abstract way to identify and represent the skills required of a general expert in any domain (Fulbright, 2020a). Combining this with a Knowledge Level description of expertise forms the Model of Expertise (Fulbright, 2020b). The Model of Expertise can be used as the basic architecture for synthetic experts in other domains. As stated previously, the Mirror represents a new platform in the home for such synthetic experts. Other synthetic experts we have envisioned include:

- **Style** a synthetic expert/personal advisor for fashion
- **Colette** a synthetic expert/personal advisor for makeup
- **Synthia** a synthetic teacher
- **Lois** a synthetic companion/caretaker for the elderly
- **Sy** a synthetic friend/therapist

These synthetic experts, like Di, can make particular good use of the Mirror user interface. For example, one can imagine Colette superimposing makeup suggestions over the user’s reflection in the Mirror so the user would be able to see how they will look. One can also envision a version of Synthia teaching a user to play the violin and using the Mirror to allow the student to correctly follow instruction on form and technique.

**References**


**Abstract** — A cognitive companion for the elderly is an artificial system built for the purpose of keeping a person needing assistance company, tending to their needs, and in general just ‘being there’ for them. As humans age, vision, hearing, and mobility decreases yet the elderly still want to maintain a sense of independence. We envision using a synthetic elderly companion, named Lois, to accommodate the elder by recognizing and determining overall well-being and progress. Lois is a cognitive system composed of displays, sensors, and cameras placed throughout the elder’s home, a sensor-embedded ring, and one or more interactive mirrors. The elder converses with Lois via natural spoken language. Lois is tailored specifically to the elder, knowing their schedule, reminding and assisting with medicines, and assisting with activities. Requirements of elder care are extensive. Building a synthetic expertise for elder care pushes and tests the state of the art in cognitive systems and artificial intelligence.

**Keywords** — synthetic expertise, artificial expertise, cognitive systems, artificial intelligence, human cognitive augmentation

**Introduction**

It is common for an elderly person to move in with younger family members or to hire a caregiver to visit on a daily basis. However, as the number of elders grows, there is tremendous need for artificial and synthetic caregivers for the elderly. In the United States alone, elder care is projected to be worth over $400 billion with in-home healthcare services the second largest and fastest growing segment (Buitron, 2017). Some virtual home assistants are on the market now or are in development, however, they are limited in ability and robustness. Catalia Health’s Mabu is designed to be a personal healthcare companion with the ability to socially interact and assist patients with the medication portion of their treatment (Kidd, 2015; Catalia Health, 2019). Intuition Robotics’ ElliQ is aimed at keeping older adults active and engaged by connecting them to their families and the outside world (Elliq, 2019). ElliQ is a friendly, intelligent, inquisitive presence in the elder’s daily life able to offer tips and advice, respond to questions, and surprise with suggestions. Asia Robotics’ Dinsow is a service robot designed for elderly care service (Dinsow, 2019). Among other systems in various stages of development are: Pillo, Aido, Jibo, and Olly (Inventions World, 2018). Like Mabu, these are physically small, partially mobile, semi-robotic figures with an expressive human-like face and some sort of small display screen (e.g. a tablet or smartphone) for interaction. All of these systems feature natural language speech recognition and speech synthesis.

![Diagram of Synthetic Elderly Companion](image)

Figure 1. Synthetic Elderly Companion

While each of these systems performs a task, they are not comprehensive elderly caregivers. This paper presents a design architecture for a personal elderly companion called Lois, short for Loved One’s Information System. In addition to the overall architecture, the paper discusses particular interactions between an elderly human, called
Henry, and Lois. We describe how Lois collects and maintains data relating to the overall well-being of the elder and also how Lois communicates to the elder via an interactive accessory worn on the elder’s finger.

**Lois**

As shown in Figure 1, Lois is an intelligent agent based on Fulbright’s Model of Expertise (Fulbright, 2020a). Physically, Lois is embodied in a number of display screens, microphones, speakers, and cameras located throughout the home of the elder. Logically, Lois is a cognitive system (“cog”) with which the elder works with and relies on as an assistant. Together, the elder and Lois form a human/cog ensemble—a synthetic elderly companion (Fulbright, 2020b). As with a human caretaker, critical for Lois is to maintain situational awareness and contextual awareness of the elder throughout the day and over extended periods of time (weeks, months, years). Lois must be able to determine when the elder is sleeping, napping, eating, exercising, etc. and monitor the elder’s overall well-being. Lois achieves this by maintaining several models of the Elder each containing information about a certain aspect of the elder’s well-being.

**Communicating with Lois**

A primary interface with Lois is an interactive mirror (Mirror, 2019). Mirrors in the elder’s bathroom and bedroom are outfitted with two-way glass and rear-mounted display screen and camera. When Henry looks in the mirror, Lois uses facial recognition to identify Henry and superimposes information over Henry’s image in the mirror giving an overall status and localizing information by displaying it near the relevant body part. For example, heart rate and blood pressure would be displayed near Henry’s heart. Lois is able to track the progress of various complaints and conditions such as pain in the left shoulder, or the healing of a recent abrasion. By asking Henry, and also by directly imaging the relevant body part, Lois updates her continuously evolving health models. When an authorized person, such as a family member stands in front of the mirror, Lois recognizes them too, and if authorized, displays Henry’s overall status as shown in Figure 2. This information can also be accessed remotely by family members via an app running on a smartphone, tablet, or computer. When finished, the display turns off and the mirror returns to just being a mirror avoiding having to place a number of intrusive computer displays/cameras in the home.

Another primary interface is an interactive ring worn by the elder (similar to the Echo Loop currently available for Amazon’s Alexa) (Loop, 2019). The ring monitors Henry’s movements, updates his location, and takes his vitals periodically. This gives Henry the freedom to move about normally and even be away from home without constantly being wired to monitoring devices. All information gathered by the ring is transmitted to Lois wirelessly. Henry is able to speak with Lois via the ring as well. To get Henry’s attention and to facilitate easy-to-understand communication, the ring vibrates and displays different colors according to the urgency of the information.

Yellow alert is a cautious alert for situations where a vital sign is above or below a threshold value but does not represent an emergency situation. During a yellow alert, the ring will vibrate and turn yellow. Lois will audibly alarm yellow alert and display the relevant information. Lois will automatically verbally address Henry offering advice and assistance. This interaction allows for Henry to decide to contact family or medical help.

Red is a critical alert for emergency situations. The red alert immediately triggers a verbal alert to Henry, a call to 911, and automatically sends vital information to the hospital or emergency first-responders. A red alert is sent through the Lois app and contacts the family, or other authorized personnel, by phone or text message.
1. **Health** — overall health including vital statistics
2. **Mood** — emotional state
3. **Cognitive** — mental state/acuity, clarity, coherence, attention
4. **Sleep** — quality, duration
5. **Meals** — food/beverage intake, calories, fat, sugar, carbohydrates
6. **Meds** — type, time, quantity
7. **Hygiene** — grooming, bathing
8. **Activity** — general activity level, kinetics, movement, excursions
9. **Social** — interaction with friends/others, online, visitors
10. **Exercise** — structured physical therapy, type, quantity/duration

**Figure 2.** Lois’ Overall Well-Being Screen. Tapping an icon leads to screens with detailed information.

**References**


Superhuman Diagnostic Capability in a Synthetic Elderly Companion

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Abstract — We will soon be surrounded by intelligent devices, applications, and services capable of performing at or exceeding the level of a human expert in a particular domain. When we infuse our virtual elderly cognitive companion, called Lois, with superhuman diagnostic capabilities, we can revolutionize elder care. In a few years, Lois will be able to detect and diagnose mental, emotional, and physical degradation of an elderly person requiring live-in assistance better than any human doctor or caregiver.

Keywords — synthetic expertise, artificial expertise, human cognitive augmentation, cognitive systems, cognitive computing, human-computer interaction

Introduction

With recent advances in artificial intelligence (AI) and cognitive systems (cogs), we are at the beginning of a new era in human history in which humans will work in partnership with artificial entities capable of performing high-level cognition rivaling or surpassing human ability. Already, there are artificial systems and algorithms outperforming humans and achieving expert-level results. For example, a deep-learning algorithm has learned to detect lung cancers better than human doctors (Sandoiu, 2019). The algorithm outperforms humans in recognizing problem areas reducing false positives by 11% and false negatives by 5%. Google’s convolutional neural network, Inception v4, was trained and outperformed a group of 58 human dermatologists using dermoscopic images and corresponding diagnoses of melanoma (Haenssle et al., 2018). In the field of diabetic retinopathy, a study evaluated the diagnostic performance of a cognitive system for the automated detection of diabetic retinopathy (DR) and Diabetic Macular Edema (DME) (Abrámoff et al., 2018). The cog exceeded all pre-specified superiority goals. At the University of California San Francisco and the University of California Berkeley, an algorithm running on a convolutional neural network is better than experts at finding tiny brain hemorrhages in scans of patients’ heads (Kurtzman, 2019). The cog is able to complete a diagnosis in only one second, something a human would take many minutes to do—superhuman performance. Cognitive systems are already better than humans at diagnosing childhood depression (Lavars, 2019) and predicting mortality (Steptoe et al., 2013).

Cognitive systems are able to do things humans cannot. For example, the FIND FH machine learning model analyzed the clinical data of over 170 million people and discovered 1.3 million of them were previously undiagnosed as being likely to have familial hypercholesterolemia (Myers et al., 2019). Follow-on studies of the individual cases flagged by the cog have shown over 80% of the cases do in fact have a high enough clinical suspicion to warrant evaluation and treatment. This means on the order of 800,000 people could receive life-extending treatment who otherwise would not. This represents achievement by the cog not possible by a human. While impressive, these systems are primitive when compared to what will be developed over the next several years. These systems are preforming a low-level cognitive process known as pattern recognition. However, there are several more levels of cognition humans can do easily currently beyond the capability of cogs. What we will see over the next few years is cogs developed able to perform these higher-level cognitive processes.

According to the World Health Organization the proportion of the world’s population over 60 years of age will nearly double from 900 million to 2 billion by the year 2050 (WHO, 2017). And approximately 15% of those aged 60 and over will suffer from a mental disorder. These mental or neurological disorders include dementia and depression as the most common at 5% and 7% respectively. Anxiety disorders affect another 3.8% and nearly 1% of seniors have problems with substance abuse. As older adults age they face many challenges to both their physical and mental health. Aside from Alzheimer’s and dementia, aging adults often contend with other chronic health conditions such as diabetes, high blood pressure, depression and high cholesterol (NIH, 2017). Their struggles are further complicated with declining vision, hearing and motor skills. And because many of these conditions occur gradually, they can go
unnoticed by caregivers. Previously, we have envisioned a cognitive system, called Lois, with the capabilities of an elderly caregiver. Lois is physically embodied by a collection of computer displays, cameras, and various sensors located throughout the elder’s home. This paper explores new ideas involving incorporating diagnostic capabilities into Lois. As a virtual live-in companion, Lois is in constant contact with the elder continuously collecting data on, and making observations about, the elder’s condition and performance. Thus, Lois is in position to be the best at detecting and diagnosing serious medical conditions. Like the systems described earlier, Lois will rapidly evolve to perform at a level exceeding any human live-in caregiver.

Diagnostic Chatbots

Among other things, Lois is a conversational chatbot, meaning it can carry on a natural-language conversation with the elder. As a result, Lois can detect emotional and cognitive problems by engaging the elder in dialog-based tests. Such cognitive and neuropsychological tests are often used to diagnose dementia. These tests measure attention span, concentration, ability to learn and remember, perception, problem-solving, decision-making, verbal abilities, etc. (WebMD, 2019). While the elder is looking at displayed images, Lois can track eye movement which can be used to measure attention span and mental state (Mancas, 2015). Various computer games and images based on the Frankfurter Adaptive concentration test could be used to test the elder’s ability to stay focused on a task (Mentalup, 2019). Lois could engage the elder in cognition and perception tests by asking the elder to explain how two displayed items are alike. Those items could be from previous interactions between the elder and Lois. Verbal communication can be tested by Lois asking the elder questions about their surroundings or family members. The elder’s feedback to these type questions could also be added to Lois’ machine learning routine and used in later tests to reinforce visual perception and memory. Questions about the subject’s family members or past experiences could also be learned by Lois and used to generate idle conversations with the elder. This “reminiscing” might help the subject recall family member names and memorable experiences. These sort of conversations and word games could improve the elder’s memory and maintain other cognitive skills (Senior Living, 2019).

Detailed instructions on how to develop variations of these tests are found in: (Newson, 2018; Psychology Today, 2019; Uekermann & Daum, 2001). There are also numerous apps already designed for these tests able to be integrated into a Lois’ chatbot feature (CogniFit, 2019). Lois locally stores historical data from these tests for its own statistical analysis and also stores data in cloud-based storage (“health clouds”) for offline analysis by the elder’s doctors and others. Tracking results from these tests over time can determine whether the elder’s cognitive abilities are improving or declining. These results could also be used to adjust the elder’s medication and treatment plan.

Presently there is no definitive cure or prevention for dementia but there are measures able to help. Keeping the mind active with activities such as reading, puzzles, word games and memory training might delay the onset of dementia or reduce its effects (Mayo Clinic, 2019). Exercise and social interaction are also beneficial. Maintaining a healthy diet and supporting cardiovascular health can further reduce the risk of developing dementia. Current chatbot technology can already support these activities along with helping the elder manage their diet.

References


Activity Recognition in a Synthetic Elderly Cognitive Companion

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Abstract — A cognitive companion for the elderly is an artificial system built for the purpose of keeping an elderly person needing assistance company, tending to their needs, and in general just 'being there' for them. As humans age, vision, hearing, and mobility decreases yet the elderly still want to maintain a sense of independence. We envision the use of a synthetic elderly companion, named Lois, to accommodate an elder by monitoring, recognizing, and determining the overall well-being of the elder and assisting in daily activities. By observing the elder's movements, Lois is able to recognize what the elder is doing, what the elder is trying to achieve, diagnose emerging problems, and even determine the elder's mood and emotional state.

Keywords — synthetic expertise, artificial expertise, cognitive systems, artificial intelligence, human cognitive augmentation

Introduction

Caring for an elderly family member is a demanding task. One of the main concerns of many older people is being able to remain in their own home and living independently. For many families, there are difficult decisions to make to keep their elderly family member at home. They have to decide if they need to hire a person to come in and help if they do not have the time. The search for in-home care is a difficult process; determining what level of care they need, coming up with a price range to pay the caretaker, meeting with companies, and scheduling helpers. Many families have a hard time finding a company or individual they trust in the home of their loved one.

Previously, we have envisioned a synthetic elderly caregiver, named Lois. Lois is an intelligent synthetic agent based on Fulbright's Model of Expertise (Fulbright, 2020a). Physically, Lois is embodied in a number of display screens, microphones, speakers, and cameras located throughout the home of the elder. Logically, Lois is a cognitive system ("cog") with which the elder works with and relies on as an assistant. Together, the elder and Lois form a human/cog ensemble—a synthetic elderly companion (Fulbright, 2020b). As with a human caretaker, critical for Lois is to maintain situational awareness and contextual awareness of the elder throughout the day and over extended periods of time (weeks, months, years). Lois must be able to determine what the elder is doing at any time of the day and also be able to track and detect departures from normal behavior over time and at any point in time. This paper discusses activity recognition capabilities in Lois.

Activity recognition involves determining the intentions and goals of a human, along with the condition of the environment, by making a series of observations through various types of sensors and cameras. Activity recognition is a complex topic but can be reduced to three areas: types of sensors or cameras used to collect data on human activity, ways the sensors or cameras are used to capture or detect activity, and different approaches or methods used to analyze and make conclusions about the human activity. There are three different approaches to interpreting information collected by the sensors. The first approach is a logic-based way of observing and interpreting actions. In this approach, also known as plan recognition, a goal recognizer looks at what the user's goal is and interacts to help achieve the goal (Lesh & Etzioni, 1995). The original work for this approach was by Henry Kautz, and published in his doctoral dissertation in 1987, creating a framework for interpreting the user's goal (Kautz, 1987). Kautz's work was built on by Lesh & Etzioni. The second approach uses probabilistic reasoning and statistical learning models. Some of the important research in this area has been to help understand the probability and uncertainty in human behavior (Hodges & Pollack, 2007). A third approach using data mining has been more recently introduced. In this approach activity recognition is looked at as a pattern recognition problem by focusing on sequential, interleaved and concurrent activities. (Gu et al., 2009).

Gait analysis generally refers to assessing the state of a human by observing how they move when walking or running. Existing gait recognition software can identify people and help solve crimes. Forensic gait analysis is similar to using a criminal's fingerprint to connect them to a crime. While not completely accurate, it helps authorities “point the finger in the right direction” (Ahaskar, 2018). Gait analysis is a complex study of how someone moves and current technology goes further than just studying the simple motion of walking. “It involves a frame by frame examination of a person’s body (when they are moving) to identify a pattern called...
gait signature. To generate this signature, analysts take into account the person’s posture, length of strides, movement of hands, head tilt, distribution of weight and angle of feet during movement” (Ahaskar, 2018). A gait analysis system in place in several Chinese cities already has the ability to identify individuals and detect if a person has fallen (Kang, 2018).

**Activity Recognition in Lois**

Through its sensors and camera, Lois will receive a continuous stream of information about the elder in different forms such as video, images, audio, and parametric. Lois will use the more recent data mining approach to analyzing and interpreting the data. When Lois is first placed in the elder’s home it will be configured to accommodate the level of care the elder needs based on an initial assessment. Over time, Lois will learn and adapt its analysis and services to the needs of the elder. Health and safety are major concerns for elderly people living at home. The activity recognition component of Lois is vital to this aspect of in-home care. Often, it is not an option to hire a helper for 24/7 care as it would be far too expensive. Also, if a live-in caretaker is found, there will be times the human caretaker may be distracted by other duties. For example, many accidents or falls happen at night when a human caretaker may not be present or would be asleep. However, Lois is attentive 24 hours a day.

Lois could help prevent falls by sensing an impending fall before it happens. If a fall happens, Lois can immediately intercede. Many falls happen when an elder is trying to get up for something at night. For example, one of the author’s grandmother fell and laid there until the next day before help arrived. Even though she had a necklace with a panic button to press in case of a fall, she also suffered from dementia and could not remember to press the button. Lois could have detected the situation immediately and contacted emergency responders, a neighbor, or family as necessary.

Over time, through gait analysis, Lois will determine a baseline for the elder’s “normal” behavior, range of motion, and mobility. Being able to detect and analyze departures from the norm is an important skill of an elderly caretaker. For example, an elder developing a shuffle or experiencing freezing when walking is characteristic of Parkinson’s disease. Often these symptoms first present are not recognizable by human companions as the changes are small. However, a Lois can detect and diagnose this earlier than even human doctors. Lois will share its observations and conclusions with the elder’s human medical team so that changes in the care plan can be done if needed.

Another major issue with the elderly is administering medications. Often, elders miss taking medicines, fail to take the correct medicines, or fail to take the correct dosage and these errors are not detected by human companions or family members until much later. Making sure the elderly person is taking the right medications at the specified times is one of the primary roles of any live-in caretaker. Lois is equipped with sensors paired with activity recognition software similar to gait analysis to detect and interpret the elder’s movements related to medication. Lois will track motions as the elder is taking his or her medications. In addition to reminding the elder, Lois will ensure the elder actually took the medication and be able to stop them if they start to take the wrong medication.

For the elderly person needing to have a feeling of not being alone there are several ways Lois can provide comfort. Gait analysis and body language can be used to determine the mood of the elder. For example, if the elder appears to be slouching, expressing outward emotion, or experiencing pain Lois will recognize it. If in pain, Lois can suggest and assist in administering pain medication. If sad or bored, Lois can engage verbally with the elder perhaps suggesting an activity or conversing with the elder in general. Recently, a group of researchers from the University of North Carolina at Chapel Hill published their research on the connection between a person’s emotions and the way they walk (Randhavane et al., 2019). They developed a way of determining ‘discrete emotions;’ anger, fear, stress, sadness, boredom, calm, contentment, happy, elation, etc. The model they created uses human configuration of 16 joints and uses positions of the joints to extract posture features. They used several metrics for posture features; volume, area, distance and angle. These metrics measure movements such as; degree of head tilt, position of hands, length of stride, and angles extended by different joints in the neck. They then used gait visualization of the individual walking and assigned a value to the motions based on an algorithm they created. The measurements taken from the postures are named valence and arousal. Once a valence and arousal number are assigned or rated, the researchers can them label the perceived emotion. Using this technique, Lois will be able to determine the elder’s mood and emotional state at any time and establish a baseline for trends and departures from the elder’s normal mood.
**Conclusion**

Having a synthetic companion, such as Lois, will take away much of the stress placed on families with aging loved ones. The family will have peace of mind knowing their elderly family member is taken care of in the times they cannot be there. The goal of the synthetic elderly companion is to be there when no one else can and provide a consistent environment for the elderly individuals in their home.

**References**


Augmented, Mixed, and Enhanced Reality with an Elderly Cognitive Companion

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Abstract — A cognitive companion for the elderly is an artificial system built for the purpose of keeping a person needing assistance company and/or tending to their needs and in general just ‘being there’ for them. As humans age, vision, hearing, and mobility decreases yet the elderly still want to maintain a sense of independence. We envision the use of an elderly companion, named Lois, to accommodate the human by recognizing and determining the overall well-being of the human. Our idea of an elderly companion is a cognitive system composed of a cog, sensors and cameras placed throughout the home able to AR, MR and ER.

Keywords — cognitive systems, synthetic expertise, artificial intelligence, human cognitive augmentation, augmented reality, mixed reality, enhanced reality

Introduction

The elderly are dependent on the aid of others. Imagine if an elderly person’s home was more than just a home. What if their home was not only their dwelling place, but also a constant companion and responsive environment with the ability to assist them in their daily lives. A companion in the form of a “cognitive home,” with the ability to intelligently interact with its elderly occupant would be a revolutionary step forward in the care of our senior citizen population. Maintaining, or even regaining, some level of one’s independence could be achieved with the assistance of the cognitive home companion. Previously, we have envisioned a synthetic elderly caretaker and companion named Lois, based on Fulbright’s Model of Expertise (Fulbright, 2020a). Physically, Lois is embodied in a number of display screens, microphones, speakers, and cameras located throughout the home of the elder. Logically, Lois is a cognitive system (“cog”) with which the elder works with and relies on as an assistant. Together, the elder and Lois form a human/cog ensemble—a synthetic elderly companion (Fulbright, 2020b).

Augmented reality (AR) refers to superimposing computer-generated information onto a human’s view of the real world (Caudell & Mitzell, 1992; Schueffel, 2017). AR requires the use of viewing technology such as a heads-up display (HUD) in aircraft, Google Glass, or Microsoft Hololens. AR data is meant to add to the real-world view rather than alter it. Mixed reality (MR) is the blending of computer-generated information with the real world (Kishino & Milgram, 1994). An example of MR is a person seeing computer-generated and animated characters embedded in the view when looking at the real world through a smartphone’s camera. MR seeks to alter reality by embedding artificial objects into the field of view. Here, we define enhanced reality (ER) as referring to the placement of computer-generated information directly into the environment where a human can view it without the use of special viewing technology. In ER, information is usually projected into the real world and viewed with the unaided human eye. The work of (Fuchs et al., 1998) focused on Spatially Augmented Reality (SAR), a form of enhanced reality (ER), involving the concept of virtual objects displayed directly into the real world. AR, MR, and ER should not be confused with virtual reality (VR), sometimes called artificial reality, in which the entire field of view is computer-generated as in immersive 3-D games (Krueger, 1977; Sutherland, 1968).

This paper describes Lois’ use of AR, MR, and ER to assist the elder in the execution of routine tasks and also as a way to intercede in situations where the elder’s safety might be in danger.

AR, MR, and ER with Lois

Simple tasks, such as using the restroom in the middle of the night, can be very difficult for the elderly without assistance. Lois can help an elder accomplish this task independently. When the elder awakes in the middle of the night, Lois, by observing the elder’s actions via cameras and other sensors, can determine the elder’s objective to get up and go to the bathroom. To assist, Lois can project a path onto the floor from a structured light source, an example of enhanced reality (ER). In addition to the floor path, handrails, doorknobs, and floor transitions can be illuminated to help the elder find support.

Cooking becomes increasingly difficult for the elderly as they age. Finding the appropriate
any other type of figure, the elder responds of a person (perhaps a lost loved one), cat, dog, or MR/ER projection could provide a visual rendition ability to keep the elder engaged and entertained. A capable of providing an artificial companion with the elder, Lois can verify the item using a camera to the handle of the pot to illuminate. Once selected for reference, or causing an indicator light attached right pot or pan to use by displaying an image of it at a volume the elder can hear. Lois can indicate the displayed and relayed by speech synthesized by Lois provide assistance. Step by step instructions can be mobilities and failing memory. When Lois realizes the can be a troublesome task for someone with limited cookware, ingredients, correct stove settings, etc. This would recognize the medication, relayed from the aid could provide a visual overlay with a warning. Some medications come with special instructions, such as the time of day to take the medication or if it be relayed to the occupant in many different ways. Lois could provide an auditory warning, or the visual aid could provide a visual overlay with a warning. The companion home would recognize the medication, relayed from the visual aid, and provide the proper instructions.

Lois can project the image (or 3D hologram) of an assistant directly into the home. The assistant can provide step by step instructions and assist with tasks such as changing air filters, changing light bulbs, washing clothes, washing dishes, etc. This would be especially helpful to occupants afflicted with Alzheimer's and Dementia who are physically able to complete these tasks but no longer remember how to. One of the biggest issues facing our senior citizen population is loneliness. Unfortunately, it is all too often for the elderly to grow old alone. The impact this has on their mental health cannot be denied. Depression is common among the elderly population. By combining AR, MR, and ER, Lois is capable of providing an artificial companion with the ability to keep the elder engaged and entertained. A MR/ER projection could provide a visual rendition of a person (perhaps a lost loved one), cat, dog, or any other type of figure the elder responds emotionally to. For example, assume the elder is a Frank Sinatra fan, the projection could take the shape of Sinatra giving a personal concert for the elder.

In other examples of mental stimulation, almost any surface in the home could display a gameboard (e.g. a chessboard/checkerboard) and, optionally, a player could be projected on the other side to play against the elder. In many cases, the elder may just want someone to talk to. Lois, with and/or without the aid of a projected artificial companion, can engage in rich conversation about any topic of the elder's choosing.

**Conclusion**

This paper has explored how AR, MR, and ER, together with a cognitive companion, Lois, can turn an elderly person’s home into a responsive environment facilitating the elder being able to live independently in their home longer. Advances in augmented, mixed, and enhanced reality are rapidly approaching, or have already exceeded, the capabilities described in this paper. The recent release of commercially-viable “smart glasses” has moved the field of augmented reality closer to being mainstream technology. Google Glass and Microsoft Hololens represent a new generation in wearable technology. These devices are part of the fifth generation of media, also known as wearable augmented reality devices (Brem et. al., 2015). We will soon see AR embedded into otherwise normal eyeglasses and contact lenses providing a tremendously valuable platform for the technology in many domains other than elder care. In the near future, it is very likely our elderly population will be aided by a virtual cognitive companion. The topics explored in this paper are just a brief glimpse of what will be possible to improve the quality of life of our senior citizen population.

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Where thought leads.

TO RESEARCH in robotics

TO EXPLORATION in Morocco

TO PROFICIENCY in civil debate
Abstract — Since the colonization of the Americas five hundred years ago and long before, rights to land have been an integral part of human conflict. The transatlantic slave trade and indigenous genocide increased property rights for colonizers in the Americas, yet they also exacerbated human conflict. By the 1790s, this conflict took on a distinctly racialized depiction and, particularly in the case of narratives about the Haitian Revolution, succeeded in convincing much of the “Western” world that white people were the victims of racial violence and oppression. A similar phenomena took place after the Civil War in the United States, in the late nineteenth century. Visual culture interacted with forms of narrative to depict an idyllic “Old South” as a white space that insurgent blacks violated. Now, in the twenty-first century, images and rhetoric from the Republic of South Africa, the former home of the Apartheid system, depict white landowners as victims of racism once again. This project investigates how colonizers have succeeded in depicting themselves as victims by drawing from distinct patterns of rhetoric and visual images that promote specific definitions of race, land, and identity.

Keywords — race, land rights, South Africa, Americas

Introduction: Centuries of Conflict

How could French citizens living in the colony of Saint Domingue (now Haiti) in the late eighteenth century create a pattern for white supremacist rhetoric that survives to this day? Considering that they lost the war with black revolutionaries, it seems unlikely that Haiti’s colonizers could have invented such a long-standing and successful strategy for dominating African and indigenous populations in the Western hemisphere and even in Africa. Nonetheless, this project traces influential stories and images from the Haitian Revolution through the proslavery and abolitionist rhetoric of the United States in the nineteenth century and onward into the twentieth and twenty-first centuries, expanding the geographic lens to South Africa. Because United States foreign policy targeted insurgent organizations seeking land reallocation, the US supported the apartheid regime in South Africa throughout the twentieth century. In the past few years, various US media outlets and even the President have expressed concern that white landowners are again facing racist violence, this time in South Africa. This project explains how Thomas Jefferson’s alarm that “convulsions, which will probably never end but in the extermination of the one or the other race” (Jefferson, 1832, p. 144) continues to sound among the privileged and powerful in 2020.

Saint Domingue in the Oval Office

Consider, first, an image that links Haiti to Washington, D.C., a late nineteenth century example from *The Cosmopolitan*. German-born Confederate sympathizer Adalbert Volck created the sketch in 1863; it was not mass-produced in The Cosmopolitan until the end of the century. Rather than memorialize the pastoral South, as many literary and periodical pieces did in the late nineteenth century, the accompanying magazine story registers surprise that the United States was ever divided along the Mason Dixon line. It claims that while “the generations of the last quarter of a century will be startled to find . . . so concentrated a record of the fierce animosities, . . . the frenzy and the ferocity of the war as it was and as it appeared within the lines of the Confederacy” it is important to study them now because they “relate to a state of things that has passed away” (Halsted, 1890, p. 502). In other words, the United States, by 1890, had reunited and settled all the internal problems of the War of Northern Aggression.

Titled, “Writing the Emancipation Proclamation,” Figure 1 features a disheveled Abraham Lincoln in the Oval Office with one foot resting on the Constitution. John Brown—the infamous freedom fighter of 1850s Bleeding Kansas who died a martyr after his failed multiracial raid on Harpers Ferry in 1859— “looks with cranky benignity from a frame” and “a picture showing the massacres of St. Domingo, the murder of children and the desolation of homes” a century before looms even larger (Halsted, 1890).
Much like revolutionaries destroyed colonial Saint Domingue and John Brown attacked slavery, this image depicts Abraham Lincoln as the dissolute corrupter or the United States, particularly the South. As Jeremy Wells (2011), Mark Elliot (2006), and others have so ably demonstrated, the "Old South" as a pastoral Eden and repository of chivalric values and harmoniously hierarchical race relations was a popular trope in the novels and stage shows of the late 1880s and 1890s, culminating in the early twentieth century with film incarnations like D.W. Griffith’s infamous Birth of a Nation, a film that Woodrow Wilson screened in the White House four months before the United States invaded Haiti. In contrast to this corrupt Lincoln, Southern ideals of paternalism, economic and cultural, that were connected to Jim Crow and segregation shaped a new nationalist ideal—a concept of the United States as white space. By the 1880s, most Americans forgot sectional animosity, and, I argue, Southern values stood at the center of the “reconstructed” nation.

**Post-Apartheid South Africa**

In current news and propaganda about South Africa, Nelson Mandela and the pro-democracy African National Congress figure much like Abraham Lincoln and the Haitian revolutionaries do in Volck’s late-nineteenth century images.
Figure 2. “White Genocide in South Africa”

Figure 2, created by an American and former illustrator for *Sesame Street*, photoshops space and time to depict an ANC member as a murderer who has set fire to a farmhouse that has the grandeur of a plantation in St. Domingue. The African man’s weapon of choice, a machete, harkens to the Haitian Revolution as well, when sugar-cane cutters who rose up against slavery could only arm themselves with the tools of their trade.

Conclusions

The United States’ infatuation with the myth of white genocide in South Africa in this decade compares to the ways white Americans retold tales of the Haitian Revolution 250 years ago. Midway between those moments, the historical timeline shows us the American Civil War, when the same types of imagery and narratives of rebellious, violent, and retributive blacks perpetrating mindless acts of torture and murder. On the other hand, we know that people of African descent in all three of these historical moments have demanded rights to the land—to the “white space” that colonizers and their descendants have marked as their birthright after centuries of factual genocide.

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References


Abstract - When the Spanish invaded what is now Colombia, they enslaved and exploited the native people until they were no longer useful. Hundreds of years later, Colombia is still being used to further an agenda by the United States. This paper details the rights granted to indigenous people in the 1991 Constitution of Colombia as well as how those land rights are being violated in favor of profit. This land exploitation has also resulted in increased deforestation and an increase in carbon emissions, contributing to global climate change. The Colombian government has been sued for its land exploitation and for favoring profit over the environmental rights of its citizens, however, deforestation rates have yet to be reduced.

Keywords — land exploitation, indigenous peoples, indigenous rights, deforestation

Introduction

Colombian natives have a long history of having their land taken and exploited without consent, this first started with the Spanish in the 14th century and has continued to present day at the hands of their own government (Hristov, 2005). Despite the numerous laws in place protecting indigenous autonomy and land rights, many native people are being pushed from their land by paramilitary groups funded by corporations (Grajales, 2011). The Colombian government has been sitting idly by and allowing this to happen for profit and therefore becoming complicit in the advancement of climate change (Grajales, 2011). This is directly related to the growing concern over climate change on a global scale as well as the push for better treatment of native people. The complacency of the Colombian government in the mistreatment of its indigenous people, despite legislature in place addressing these issues, is a common issue on a global scale (Sarkin & Cook, 2009). The government has a duty to the indigenous people to protect their land rights and recognize their human rights. The objective of this avenue of research was to investigate the various indigenous land rights violations occurring as well as what is preventing the government from protecting indigenous lands.

Findings

According to census data available, 3.4% of Colombia’s population is comprised of indigenous people, which equates to 1.5 million people (IWGIA, 2019). This population is dispersed across Colombia’s 32 departments and they are largely concentrated in the Amazon region (Chapter XI: The Rights of Indigenous People in Colombia, n.d.). Under the 1991 Constitution, indigenous people are entitled to various land rights, such as article 63 stating that reservation lands and communal lands of ethnic groups cannot be taken away (Chapter XI: The Rights of Indigenous People in Colombia, n.d.). The Constitution also places an obligation on the State to protect those rights. Under article 96 indigenous people are recognized as Colombian nationals (Chapter XI: The Rights of Indigenous People in Colombia, n.d.) and therefore the government has an obligation to protect and serve them, however, this is not the case. Instead, the government has stood aside and allowed companies to use paramilitary groups to force native people off their land in exchange for profit (Grajales, 2015).

Land-grabbing is a growing issue that the government is aware of yet refuses to do anything about it. The Biofuel company, Poligrow Ltd., has been accused of land-grabbing in Mapiripan in the indigenous communities of Jiw and Sikuani. Poligrow has been accused of using a paramilitary group to force the native people away by using the threat of burning their houses down if they did not leave in three days (Entertainment, 2015). When this happens, the communities affected face legal and violent opposition when they attempt to get their land back and if they attempt to go through the court systems it can take years before anything happens (Grajales, 2015). Continued actions by corporations like Poligrow have led to the fragmentation of natural ecosystems and a drastic decrease in biodiversity in Colombian Amazonia (Armenteras et al., 2006).

Around 7.7 million (United Nations, 2018) Colombians have been displaced to other areas of the country due to the government’s negligence, a disproportionate amount of them have been Afro-Colombians and indigenous people (Mooney, 2005). Multiple human rights organizations, like the IWGIA, as well as indigenous people themselves, have been campaigning and protesting the human rights violations, like arbitrary killings, violence and threats against human rights protestors, and forced
displacement (Department of Justice, 2018). In addition to land and human rights violations, 97 members of indigenous communities have been assassinated and more than 80 indigenous groups are at risk of extinction due to forced displacement and systematic denial of their rights (Peoples Dispatch, 2019).

Conclusions

The research conducted highlights some of the environmental and human rights turmoil occurring in Colombia in the past decade. These occurrences also hold a global relevance in that indigenous people have been facing systematic discrimination and human rights violations for centuries. In addition to the neglect, the Colombian government has facilitated the progression of climate change by allowing corporations to displace native people and exploit the land (Gedicks, 2003). Since most of the indigenous population is located in the Amazon region, which holds Colombia’s portion of the Amazon forest, much of the land being cleared is part of that forest. This mass deforestation is eliminating one of the world’s largest standing forests, which will affect the rest of the world (Codato et al., 2019). If the land rights of indigenous people in Colombia is not enforced, deforestation and forced displacement will continue until the extinction of numerous tribes and climate change is irreversible.

Acknowledgments

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Nnedi Okorafor and the Technological Future of Black Humanism

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Abstract — We often think of humanism and technology as different categories in a postmodern world where phones and social media can replace human interaction and where STEM dominates the options for college majors within the minds of parents who are paying at least part of university tuition. This technology/humanity dichotomy, or the STEM/humanistic studies binary, is of course false. With the help of imagination, today’s college students can write code and perceive a world where community and human relationships are equally valid pursuits of knowledge. To this end, I draw your attention to the work of Nigerian-American novelist Nnedi Okorafor, who also writes for Marvel’s Black Panther comic series. In Okorafor’s science fiction world, young women of African descent in particular merge the imperatives of technology and humanism to envision a future that embraces progress in science as well as traditions that honor human beings, families, and peaceful coexistence among people of different races and ethnicities. This presentation focuses on Okorafor’s Binti novel series as well as her depictions of a technologically advanced yet organic and peaceful natural world led by black women in Black Panther comics to initiate a conversation about inclusive and non-binary world-making in theory and practice.

Keywords — Technology, black women writers, Afrofuturism

Introduction: Afrofuturism Challenges Dichotomous Thinking

On a simple, foundational level, Afrofuturism envisions a future that includes and recognizes the black individual. However, there is far more depth in this genre and aesthetic trend than that; it rethinks history, culture, and technology to accommodate the present and future black individual. Mark Dery, who coined the term Afrofuturism, defines it as “speculative fiction that treats African-American themes and addresses African-American concerns in the context of twentieth-century technoculture” (Dery, 1994, p. 182). Outside of speculative fiction and artistic applications, Lisa Yaszek suggests that “Afrofuturism has evolved into a coherent mode not only aesthetically but also in terms of its political mission” and that “in its broadest dimensions Afrofuturism is an extension of the historical recovery projects that black Atlantic intellectuals have engaged in for well over 200 years” (Yaszek, 2006, p. 47). As Rucker (2018) explain, those black Atlantic intellectuals referred to are intellectuals from the Atlantic Africa, Europe, and American connected historically and geographically to the Black Diaspora. Thus, Afrofuturism has many uses and has evolved over time to suit the needs and purposes of the artists or black individuals who utilize it and call themselves Afrofuturists.

Binti, Shuri, and the Inclusive Afrofuture

Afrofuturism and Afrofuturists include the likes of Janelle Monae’s movie digital film/album, Dirty Computer, or the popular comic and movie adaption Black Panther. Novelist Nalo Hopkinson believes of Afrofuturistic imagination that it is “important to make and claim space in that envisioning, space for the ways in which marginalized people experience the world and hope for the future” (Hopkinson, 2005, p. 103). Here space could mean both literally outer space—the final frontier—and figuratively the demand that artists make for marginalized creators to have room to share their perspectives.

Binti’s story reimagines colonization or other past injustices to African people. Yet within Dery’s definition of Afrofuturism, Okorafor also expresses a possibility for technoculture to include blacks because “only within a certain ideological field is black experience the opposite of technoculture” (Dery, 1994, p. 182). What changes the perception of black people and technology is representation such as that which we see in Okorafor’s work.

Rich white men, such as Jeff Bezos or Elon Musk, represent the dominant present day face of technology and advancement. Binti, alternately, is a village girl from Namibia who excels at mathematics and builds technological devices that make iPhones look like megaphones. Her status as a “master harmonizer,” furthermore, connects her humanistic skill in communication and negotiation with her mathematical and scientific expertise because she accomplishes her humanistic and technological feats, in part, through channeling electrical currents into mathematical equations.

Having explained Afrofuturism and a bit of context for its significance to black political activism, I suggest that Binti provides a useful model to
understand the potential role of science and technology education among marginalized people as well as the contributions marginalized people have made to a modern humanistic culture. Binti becomes the first Himba to leave Earth and matriculate in a prestigious galactic university, Oomza Uni, but tragedy occurs before she can arrive. The other people who inhabit the Earth, the Khoush, have enemies in a species called the Meduse, who attack Binti's ship to leave only her and the pilot alive. A mysterious artifact called an edan saves her, and, in order to survive, she becomes an ambassador for the Meduse who are on a mission to reclaim stolen property from the same university she plans to attend. Joshua Burnett discusses how the Himba “are no technophobes” and describes how they construct technologically advanced personal devices called astrolabes —interstellar smartphones described as having various voice command, holographic, and physical capabilities—to point out how Okorafor “refuses to reify the traditionalist/futurist binary” (Burnett, 2019, p. 25). Thus, Okorafor has imagined a tribe that remains technologically advanced without forsaking their humanism or sacrificing any of their cultural traditions, such as the Himba women’s use of otjize (a clay and oil mixture) which symbolizes their physical and emotional connection to the environment. Instead Binti’s synthesis of tradition and technology expands beyond the idea that tradition must be sacrificed to achieve advancement, or that only one culture can and should dominate the future.

At times it seems only fitting to use technological analogies to explain how Binti functions; for example, the way that the book’s world-building is laid out is much like that of how many video game maps are designed, and you gradually uncover pieces of information about the world so that the map gains more detail and color the further along in the book you go. Or, you can view the world-building as developing as a plant grows, one branch at a time leaves unfurling and flowers blossoming slowly and consistently. Just as Okorafor has connected tradition and technology, the organizational structure of Binti is very organic although part of a genre, science fiction, that is usually detail-oriented and dense from the first page.

My poster presentation uses illustrations from the Marvel comic Shuri, whose text Okorafor also wrote, to map out and explain the ways Okorafor’s science fiction, a distinctly feminist Afrofuturism, plays out much like Binti’s novelistic narrative. Shuri’s character is known as a warrior, hero, and princess, but also for being a highly intelligent and breaking binaries within Nnedi Okorafor’s iteration of the character because of how her identity is constructed and how she uses her skills and knowledge, both technical and ancestral, to save the day. The images of a woman of color, specifically an African one, filling the hero’s role and doing so mixing traditional, environmental elements alongside that of technology found in Shuri reiterates Okorafor’s powerful Afrofuturistic and feminist approach. Also noteworthy is how both Shuri and Binti’s proximity to technology is not only present but places them at the forefront of its advancement.

**Conclusions**

Much like her novel writing, Nnedi Okorafor’s comic debut in Shuri constructs a futuristic black scientist and heroine who invokes her natural environment and her maternal ancestors to solve the conflicts that threaten her homeland. Binti places a black woman in space, saving the day without giving up on her traditional values, advancing technological and humanistic culture but still retaining a deep kinship with the land...all of which step outside the dominant trends of the science fiction genre. Like Shuri, Binti is multi-purpose, a story that truly keeps expanding, whether the expansion happens to the reader, the science fiction genre, our understanding of identity or simply the plot. And it encourages us, as we exist in this universe, which is continually expanding, to expand
ourselves as we move forward in life. Following Shuri and Binti’s examples, we must expand our thinking to realize that a synthesis of technology and the humanities is not only possible but necessary in order to achieve a more whole world and better educational experience. Characters like Binti and Shuri are great representations to encounter not only for their exciting adventures but also for what they can teach, a reality that is not rooted or limited to binaries such as technology/humanities and the assumption that one or the other must be chosen instead of the possibility of both. These books feature women of color at the forefront of technology without sacrificing their culture, tradition, or emotion. Involving humanities education alongside that of STEM education in a way that is symbiotic would perhaps allow more ethical development and distribution of technology or more diversity of those studying and choosing something within that field as a career.

References


Barriers to Students Using Health-Related Student Support Services on a Small Southeastern College Campus

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Abstract - Research has shown that there are many barriers that are keeping college students from utilizing on-campus support services. This study focused specifically on the barriers that are keeping students from utilizing health-related student support services at the University of South Carolina Upstate, including Counseling Services and Health Services. The researchers aimed to accomplish three goals: 1) to gain an understanding of how familiar students at USC Upstate are with the services provided by these resources, 2) to gain an understanding of students’ use of these resources, and 3) to examine why students are under-utilizing these resources. The results indicated that students were more familiar with Health Services but utilized Counseling Services more. However, these results were impacted by the student’s race. Whether or not a student was an underclassman or upperclassman and living on or off campus also contributed to familiarity with services and use of services. The implications of this study can be used to identify and potentially eradicate barriers that are keeping college students from utilizing health-related student support services, which may ultimately improve the quality of college students’ lives.

Keywords – counseling services, mental health, campus health center, barriers, college students

Introduction

Research has shown that college students are not seeking assistance from on campus health-related student support services for a variety of reasons (Davies et al., 2000; Perrault, 2018a; Perrault 2018b, & Yorgason et al., 2008). The researchers in the current study were looking to explore why students at their small southeastern university are not seeking the health-related support services that they may need. For the purpose of this study, “health-related student support services” refers to the offices of Counseling Services and Health Services – both residing under the department of Student Affairs at the University of South Carolina Upstate.

Counseling Services exists to support students that may be struggling with their mental health as they work to achieve personal, educational, and career goals. Unfortunately, students in need of mental health services are usually reluctant to seek out help from their institution’s mental health provider. Previous studies have found that students’ self-reported reasons for not seeking counseling services (despite being in need) have included: not having enough time in their schedule, feeling embarrassed, lacking knowledge about the services being offered, and not perceiving their problems to be severe enough (Yorgason et al., 2008). Whether or not a student lives on campus and how many years they’ve been in college have also contributed to the use of campus mental health services (Yorgason et al., 2008).

Health Services exist to provide students convenient access to basic medical care at a discounted rate. Past research has revealed that one major reason students do not utilize their on-campus health center is due to a lack of knowledge about the services provided (Perrault, 2018a). Specifically, campus’ health centers may not provide enough information about the staff and services offered, which may deter students from using the health center (Perrault, 2018a; Perrault, 2018b). This previous research has also indicated that students may not utilize their on-campus health center because they feel they could manage their sickness on their own and they fear not being able to afford the cost of the service or treatment needed. Race, gender, and sexuality have also been found to have an impact on whether an individual seeks medical care. For example, gay black males are least likely to seek medical care for fear of how they will be perceived by the medical provider(s) at the health center (Davies et al., 2000).

In the current study, the researchers aimed to examine how familiar students on their campus were with Counseling Services and Health Services. More specifically, we wanted to examine if a lack of knowledge was contributing to the under-utilization of these services. The researchers also hoped to uncover more barriers to students seeking out health-related support. The researchers hypothesized that students were only somewhat familiar with Counseling and Health Services. It was predicted that familiarity with services and use of services would be impacted by race, classification, and housing status.
Method

Participants
The participants consisted of 313 undergraduate students studying at the University of South Carolina Upstate. There were 61 males, 250 females, and two non-binary participants. The average age of the participants was 20 years old. The sample was ethnically diverse; 48% of the participants were Caucasian while 52% belonged to a minority group. Forty-four percent reported living on campus while 56% reported living off campus. Underclassmen made up 66% of the participants while upperclassmen made up 34%. The participants received one research credit for their participation.

Materials
The materials that were distributed to the participants consisted of a survey initiated through Qualtrics, an online survey building software. The survey asked participants about their past and current use of Counseling Services and Health Services, why they had never been or stopped going, as well as their demographic information.

Procedure
Participants signed up for the study through the Psychology subject pool (SONA) system. The link to the survey was emailed to them, and they were asked to complete the survey by a specified deadline.

Results
A paired samples t-test indicated that participants reported significantly more familiarity with Health Services ($M = 2.32, SD = .94$) compared to Counseling Services ($M = 2.16, SD = .90$); $t(312) = -2.60, p = .010$. An independent samples t-test indicated that non-whites ($M = 2.30, SD = .92$) were more familiar with Counseling Services than whites ($M = 2.01, SD = .85$); $t(311) = -2.87, p = .004$. Similarly, non-whites ($M = 2.51, SD = .96$) reported being more familiar with Health Services than whites ($M = 2.11, SD = .86$); $t(311) = -3.88, p = .001$. Those who lived on-campus ($M = 2.36, SD = .87$) reported being more familiar with Counseling Services than those who lived off-campus ($M = 1.91, SD = .81$); $t(265) = 4.28, p < .001$.

A paired samples t-test indicated that participants reported having used (i.e., in the past) Counseling Services ($M = 1.81, SD = .39$) more than Health Services ($M = 1.65, SD = .48$); $t(313) = 5.10, p < .001$. An independent samples t-test indicated that underclassman ($M = 1.85, SD = .36$) reported having used (i.e., in the past) Counseling Services more than upperclassman ($M = 1.75, SD = .43$); $t(309) = 2.04, p = .04$. Likewise, underclassman ($M = 1.71, SD = .45$) reported having used (i.e., in the past) Health Services more than upperclassman ($M = 1.53, SD = .51$); $t(309) = 3.27, p = .001$. Those who lived off-campus ($M = 1.89, SD = .32$) reported having used (i.e., in the past) Counseling Services more than those who lived on-campus ($M = 1.77, SD = .42$); $t(265) = -2.53, p = .012$.

When the participants that had used (i.e., in the past) Counseling Services or Health Services were asked about current use, results indicated that Health Services ($M = 1.75, SD = .44$) is currently being used more than Counseling Services ($M = 1.53, SD = .51$); $t(31) = -2.03, p = .05$.

Conclusion
Overall, the students were more familiar with the services provided by Health Services than Counseling Services. Those belonging to a racial minority group were more familiar with Counseling Services and Health Services than white participants. Perhaps this finding may be attributed to health care access. It has been found that racial minority groups don’t have the same (i.e., equal) access to health care when compared to their white counterparts (Andersen et al., 2007). If students belonging to a racial minority group have not been accustomed to having access to mental health care and medical care, they may be more apt to seek out information on how they can access these services once on campus. Consequently, they may become more familiar with on-campus health services in comparison to white students. The results of the current study also found that students living on campus were more familiar with Counseling Services. This finding may have emerged because the majority of students that reside on campus are freshmen that may be struggling with the transition to college.

When students were asked about their past use of Counseling Services and Health Services, more students reported having used Counseling Services more than Health Services. The top reason (30%) why students reported that they had never used Health Services was due to them already having a local medical provider. Other reasons for not using Health Services included: not perceiving themselves to be sick enough (27%), not having enough knowledge about the services Health Services offers (16%), and the location of the office being inconvenient for them to access (8%). Underclassmen reported having used both Counseling Services and Health Services more than upperclassmen. Students living off campus reported more past use of Counseling Services than students living on campus.

When students that had reported previous use of Counseling Services or Health Services were asked if
they were currently using the service(s), more students reported currently using Health Services than Counseling Services. The top reason (34%) why students reported that they had stopped using Counseling Services was that they had learned how to better cope with their mental health on their own. Other reasons students reported not using Counseling Services included: not having enough time in their schedule (32%), having something going on that was too severe to be handled by on-campus staff (8%), and having had a previous bad experience with a counselor in the office (5%).

While the findings reported above provide some insight into potential barriers that students may face when utilizing health services on campus, it is important to note some limitations that may have affected the results. Limitations of this study included the accuracy of students' health perceptions, the study only being available to students enrolled in a psychology class, the study only focusing on one university, and low demographic variability. The implications of this study can be used to improve the quality of and access to health-related student support services on campus. Future research should examine the accuracy of college students' perceptions of health services and extend this research scope to multiple university campuses with diverse student populations.

References


Perceptions of Resources for Distressed College Students: Are Professors Seen as a Viable Resource?

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Abstract — During the transition from high school to college, it is common to face problems such as depression and anxiety, or feelings of loneliness. Loneliness is a psychosocial problem that is related to inadequate social support and has been linked to increased depression. When students are going through these difficult times, it is always good to have social support to pick you up, or just be there to listen to. But who will be that person? Using a scenario methodology, results indicated that participants would be most likely to contact a counselor and least likely to contact a faculty member for help. Implications were discussed.

Keywords — help-seeking, mental health resources, college resources, social support

Introduction

As a college student, it is very common for students to get overwhelmed due to the big transition from high school. Some students go from smaller high schools to bigger colleges, and some students go from bigger high schools to smaller colleges but the level of overwhelms is about the same compared to both. During this transition, it is common to face problems such as depression and anxiety, or feelings of loneliness. Loneliness is a psychosocial problem that is related to inadequate social support and has been linked to increased depression (Wright et al., 2014). When having feelings of loneliness, individuals don’t just automatically think that they have depression. Depression is a serious health concern among college students and peaks largely in adolescence because it is a time of social stress and transition (Wright et al, 2014). When students are going through these difficult times, it is always good to have social support to pick you up, or just be there to listen to. But who will be that person? Most individuals go to their parents or friends for support during tough times. Friends would be the easiest person to go to because they are mostly together at school and can be there for the individual. Two scenarios were presented with a difference in the gender to see who individuals would rather go to when they had similar problems to the scenario presented. It has been shown that social support can reduce stress and depression, and it has been found to be key in terms of increasing perceptions of social integration and reducing feelings of loneliness. There was also a question about the resources around the university for the students if they had these issues and needed help. We looked at the likeliness of how effective students thought online advertisement and flyers being advertised around the University. We hypothesized that students would find those advertisements effective to wanted to know to which extent.

Method

Participants consisted of 55 (73% female, 27% male) students (37 freshmen, 10 sophomores, 3 juniors, 5 not listed) enrolled in an introduction to psychology class at a small southeastern university who completed the study for class credit. Participants read a short scenario that described a target individual, Chris (see Figure 1). Gender was manipulated so that half the participants read a scenario where Chris was male and half where Chris was female (the pronouns “he/him” were used since the hypothesis predicted that participants would rate Chris-male as being more sensitive about going to counseling). Chris, a student at a local university, was described as having symptoms of depressive anxiety disorder. Chris tries to tell his friends about the way he feels, but Chris’s friends brush it off saying he is just “playing.” After reading this initial information, participants indicated how likely Chris would be to go to others for help and how likely others would be to take Chris’s problem seriously. The two sets of ratings were made on 7-point Likert scales, where 1 = very unlikely and 7 = likely.
Scenario 1: Chris is a student at his local university. Chris has symptoms of depressive anxiety disorder. Chris tries to tell his friends about the way he feels. His friends think he is “playing” and brushes it off. He wants to tell someone what has happened with his friends and about his problem, but he thinks that no one will help him.

Follow-up: Chris is still having symptoms of depressive anxiety disorder. Chris sees a flyer for the counseling center on a bulletin board outside of one of his classes. The flyer lists commonly treated concerns with two of those including depression and anxiety. Chris takes advantage of the information in the flyer and goes to see a counselor. While he is going inside the office, he sees a couple of his friends. This made Chris change his mind.

Figure 1. Stimuli material.

Participants read follow-up information that described Chris as still having symptoms of depressive anxiety disorder. However, he sees a flyer for the counseling center and goes there for help; while walking inside, Chris sees his friends and changes his mind about staying. Participants made six ratings on 7-point Likert scales where 1 equaled a low rating and 7 equaled a high rating. Finally, participants completed a demographic questionnaire that include two final questions, “how satisfied are you with your life so far?” and “how often do you get social and emotional support when you need it?” Both questions were rated on a 5-point Likert scales (1 = low rating and 5 = high rating). While designing this study, we discovered that the counseling center on the first author's campus did not post flyers around campus advertising what the symptoms were for common disorders and where students could go to get help. Therefore, questions about the effectiveness of online and flyer information about where to go get help were included.

Results

Scenario Questions

The two sets of questions were analyzed using a mixed ANOVA with gender being a between-subjects variable and question type being a within-subjects variable. There were no significant effects for gender on any measure in the study. This was an exploratory study, therefore we wanted to be conservative in concluding a significant finding. A Bonferroni correction was used to correct the criteria for significance; for the first scenario, the corrected criteria were (.05/5 and .05/7) $p < .01$ and $.005$, respectively. All results were significant at the $p < .001$ level and post hoc comparisons were significant at the $p < .05$ level. As can be seen in Figure 2, results indicated that the order from most to least likely to be contacted for help was counseling services and a parent, followed by advisor and health center, and least likely to be contacted for help was Chris’s professor. Participants then indicated, if contacted, how likely was it that the person would take Chris’s problem seriously. A similar descending order was found: counselor and counseling center, followed by parents, then advisor and grandparents, followed by professors and lowest was friends (this served as a manipulation check to make sure participants read the scenario).

Correlational Results

The follow-up information indicated that Chris started to go into the counseling center, saw his friends, changed his mind and left. Our interest in this section of the study was to investigate the relationships between our various measures. Figure 3 presents the results from the correlation analyses.
Average Seek Help Ratings | Average Taken Seriously | You Change Mind | Friends Supportive of Feelings | Know Where go on Campus | Flyers Effective | Online Effective | See Flyer go to Counseling | Satisfied with Life | Get Emotional Support
---|---|---|---|---|---|---|---|---|---
Average Seek Help Ratings | 1 | | | | | | | | |
Average Taken Seriously | **.51** | 1 | | | | | | | |
You Change Mind | -.06 | .14 | 1 | | | | | | |
Friends Supportive of Feelings | .14 | .17 | .07 | 1 | | | | | |
Know Where to go on Campus | .15 | .19 | -.21 | .17 | 1 | | | | |
Flyers Effective | .33† | .26 | -.06 | .40* | .31* | 1 | | | |
Online Effective | .27* | .36* | -.05 | .24 | .49* | .41** | 1 | | |
See Flyer go to Counseling | **.55** | **.50** | -.04 | .33† | .24† | .78** | .46** | 1 | | |
Satisfied with Life | .23 | .25 | -.01 | .185 | .52** | .20 | .28† | .28† | 1 | |
Get Emotional Support | .22 | .42** | .04 | .37** | .34* | .07 | .22 | .28† | .49** | 1 |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

**Figure 3. Correlational matrix.**

Selected correlations that accounted for at least 25% of the variance ($r > = .5$) were discussed. There was a significant correlation (.51) between flyers and online information in terms of providing information about where to go to get help. There were positive correlations between how likely the participants were to seek help (.55) and think the person would take it seriously (.50) and getting help after seeing a flyer. The strongest correlation (.78) was between seeing a flyer and going to counseling and thinking flyers are an effective way to advertise the counseling center services.

**Conclusions**

The original purpose of this research was to see if gender affected being negatively influenced by friends to think that depressive anxiety symptoms were not serious (it did not). However, an interesting finding did emerge. Surprisingly, our participants indicated that their professor would be the last person they would contact for help and that if they did contact them, they believed that they would not take their problems seriously. This is disturbing as research suggests that a student having a strong relationship with just one professor can make a difference in their college career (Komarraju et al., 2010). This finding needs further investigation.

**References**


Abstract - This paper, as part of CRJU U484/WGST U398 “Service Learning: Dating/Sexual Violence” and in partnership with SAFE Homes-Rape Crisis Coalition, examines experiences of sexual assault and dating violence among USC Upstate students. Three hundred and fifty students completed an online survey that contained questions about bystander intervention, stalking, sexual violence and alcohol, and intimate partner abuse. The survey utilized non-random, convenience sampling and as a result, the findings are not generalizable to the student body as a whole. Most respondents did not attend parties on campus and reported low levels of drinking which may contribute to low reported rates of non-consensual sexual behavior on campus. About 21% of female respondents had been stalked, but only 3.4% had been stalked while enrolled at USC Upstate. Nearly 35% of all students had been touched against their will while sober compared to 16% while under the influence of alcohol or other drugs. Respondents generally believed they would intervene if they saw someone in a vulnerable position but would be more likely to do so if the victim were female. Finally, women were more likely than men to experience all forms of intimate partner abuse examined in this survey.

Introduction

In an attempt to examine experiences of dating and sexual violence among USC Upstate students, as a part of CRJU U484/WGST U398 and in partnership with SAFE Homes-Rape Crisis Coalition, I, along with my classmates, conducted and distributed an online survey. This survey consisted of open- and close-ended questions concerning four major topics: bystander intervention, intimate partner abuse (IPA), stalking, and sexual assault. Three hundred and fifty USC Upstate students completed the survey. The results are very important as they can be utilized by USC Upstate in order to get a sense of their students' experiences with dating and sexual violence and to develop ways to remedy any issues presented by students.

Methodology

The goal of this survey was to examine the prevalence of dating and sexual violence among USC Upstate students, including their experiences while on campus. The survey consisted of 97 total questions regarding demographics, bystander intervention, intimate partner abuse, stalking, sexual assault, and substance use. Respondents were recruited by posting fliers around campus, sending emails to students and faculty, and visiting classrooms to talk about the survey. A total of three hundred fifty USC Upstate students completed the survey. Non-random, convenience sampling was used, meaning that not every student had an equal chance to be recruited to participate in this survey. Underrepresented groups could include online students and students primarily taking classes at the George or in Greenville. Thus, the results cannot be generalized to the entire USC Upstate student body.

Results

Bystander Intervention

College campuses around the country are promoting bystander intervention to prevent sexual assault; students are increasingly asked to watch over each other at parties and to intervene when another person has consumed too much alcohol or is receiving potentially dangerous sexual attention from other party-goers (Oesterle et al., 2018). Previous literature has suggested that parties and alcohol consumption can impact bystander intervention as alcohol can make bystanders more likely to intervene due to “liquid courage” (Fleming & Wiersma-Mosely, 2015; Oesterle et al., 2018). However, 59% of our respondents reported never going to parties on campus. Thus, it is unlikely that many of our respondents ever had an opportunity to intervene in such a situation, at least not on our campus, so our result should be interpreted with caution.

Respondents were given various potentially dangerous scenarios and were asked if they would intervene and, if they would, how they would intervene. Examples of scenarios include, “a female who was too drunk at a party” or “a male who was passed out alone at a party”. Methods of intervention ranged from “ignore it” to “call campus police”. Respondents could pick multiple methods of intervention for a given scenario since in the “real world”, a bystander is not limited to only utilizing one method of intervention. Across all scenarios, respondents indicated that they would intervene...
(Figure 1). Respondents also indicated they were more likely to intervene themselves than get others to intervene or call campus police across all scenarios. Seeing “a female passed out alone at a party” recorded the highest percentage (83%) of respondents who would intervene themselves and “try to stop behavior/help victim”. The scenario with the second highest percentage (77%) of respondents who would intervene themselves and “try to stop behavior/help victim” is “a female who was too drunk at a party”, followed by “a female who was being sexually assaulted at a party” at 76% of respondents. Overall, respondents generally believed they would intervene in a situation in which they saw someone in a vulnerable position. However, the results also indicate that respondents were more likely to intervene if the potential victim were female.

Intimate Partner Abuse

Some questions in the survey concerned respondents’ experiences with IPA. These questions covered sexual, physical, and emotional IPA and asked respondents if they had ever experienced the IPA, experienced the IPA as an Upstate student, and experienced the IPA on campus. Overall, the form of IPA experienced by the highest percentage of respondents was emotional abuse with 42% ever experiencing it, 17% experiencing it as a student, and 6% experiencing it while on campus. Physical abuse was the second most frequent form of IPA experienced by respondents with 17% ever experiencing it, 6% experiencing it as a student, and 3% experiencing it while on campus. Finally, 15% of respondents had ever experienced sexual abuse, 5% had experienced it as a student, and 1% had experienced it while on campus. The results suggest a need for counseling and other services for victims, while also demonstrating that IPA is relatively rare on our campus.

Stalking

Respondents answered questions concerning their experiences with stalking, both in general and while enrolled at USC Upstate. Overall, 21% of female respondents said they had been stalked compared to 13% of male respondents. In terms of stalking experiences while enrolled at USC Upstate, 9.4% of female respondents said they had been stalked while enrolled at USC Upstate, compared to 8.9% of male respondents. There is a much smaller gender gap in the percentage of students stalked while enrolled at USC Upstate, with only 5% more women than men reporting victimization, compared to an 8.5% gap in total percent of students stalked.

Sexual Assault

Finally, the survey included questions regarding sexual assault while at USC Upstate, both while under the influence of drugs or alcohol and while sober. Respondents were asked if they have ever been touched against their will while under drunk/high or while sober, and if they have sexually assaulted someone while drunk/high. Thirty-nine percent of female had experienced sexual assault while sober and 27% had been assaulted while drunk/high. Comparatively, 15% of male respondents reported sexual assault while sober and 10% while under the influence of drugs or alcohol. The disparity between rates of sexual assault while sober and while under the influence may be attributed to respondents not attending parties on campus and reporting low levels of drinking when they do go to parties. In terms of respondents sexually assaulting someone, the results were the same while sober and while under the influence. About 7% of male respondents and 1% of female respondents had touched someone without their consent while sober and while under the influence. Clearly, USC Upstate women (and to a lesser extent men) experience high levels of sexual assault while enrolled, and men make up far more perpetrators than women.

Conclusions

We examined USC Upstate students’ experiences of dating and sexual violence. The majority of students did not go to parties and did not consume alcohol, yet they believed they would intervene in a situation where a woman was too drunk or the subject of unwanted sexual attention. Unfortunately, respondents believed they would be less likely to help a man in a similar situation, suggesting the need for more bystander intervention training. Emotional abuse was the most common form of abuse suffered by respondents and women were more likely than men to experience all forms of IPA. Approximately 9% of both female and male respondents had been stalked while enrolled at USC Upstate. Upstate women are at a much higher risk of sexual assault than men, both while sober and while drinking or using drugs.

Overall, the majority of respondents believed USC Upstate was safe, though, half of the respondents felt “neutral” about USC Upstate’s ability to prevent and respond to dating and sexual violence. Our findings suggest that while students are at a fairly low risk of experiencing IPA or stalking while enrolled at USC Upstate, the University needs to do more to educate students about sexual assault and bystander intervention practices. More lighting,
police presence, and rape prevention courses would benefit all Upstate students. As students did not feel comfortable reporting incidents of sexual assault, nor did they know of local resources such as SAFE Homes-Rape Crisis Coalition, the University needs to improve efforts to address students’ unwillingness to report or seek out support.

**Acknowledgments**

We would like to acknowledge the hard work of all students enrolled in the course and especially acknowledge Mr. Jamie Hughes and SAFE Homes-Rape Crisis Coalition for collaborating with us to complete this meaningful research.

**References**


**Figures**

<table>
<thead>
<tr>
<th>Scenario “What would you do if you saw...”</th>
<th>Ignore it</th>
<th>Tell others what you saw</th>
<th>Try to stop behavior/help victim</th>
<th>Call Campus police</th>
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<td>A female who was too drunk at a party?</td>
<td>11%</td>
<td>24%</td>
<td>77%</td>
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<td>A male who was too drunk at a party?</td>
<td>16%</td>
<td>29%</td>
<td>64%</td>
<td>13%</td>
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<td>A female who was passed out alone at a party?</td>
<td>4%</td>
<td>15%</td>
<td>83%</td>
<td>28%</td>
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<tr>
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<td>23%</td>
<td>70%</td>
<td>27%</td>
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<tr>
<td>A female who was being sexually assaulted at party?</td>
<td>1%</td>
<td>23%</td>
<td>76%</td>
<td>74%</td>
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<tr>
<td>A male who was being sexually assaulted at a party?</td>
<td>3%</td>
<td>28%</td>
<td>71%</td>
<td>69%</td>
</tr>
</tbody>
</table>

*Figure 1. Bystander Intervention Scenarios*
Development and Validation of an Instrument Measuring Determinants of Drinking Behaviors Among College Students Using an Integrated Behavioral Model

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Abstract - Introduction: Binge drinking is a major public health issue among college students due to its heightened social and physiological risk. Binge drinking is also complex in nature, which warrants the need of a theoretical model. This study proposed application of Integrated Behavioral Model (IBM) to predict stopping binge drinking behavior among college students by considering various multifaceted and interrelated theoretical constructs of IBM. Purpose: The purpose of the study is to evaluate psychometric properties of an IBM based instrument. Methods: The study used a prospective design and participants were undergraduate students' (n=161) at a large southwestern university. A new instrument was developed and its internal consistency and construct validity were assessed. Results and conclusions: Assessment of the instrument revealed a good model fit. Similarly, most of the IBM scales reported Cronbach’s Alpha above 0.7, which suggested most of the instrument items were related to each other and were measuring the single construct. This study provided evidence for reliability and validity of the instrument to predict stopping binge drinking behavior among college students which can inform future intervention to be more effective.

Keywords — Integrated Behavioral Model, IBM, Alcohol, Binge drinking, College students

Introduction

Alcohol use among youth is related to the three top causes of youth death: accidents, homicides, and suicides. Due to its heightened risk for serious social and physiological consequences binge drinking is considered one of the major preventable public health crises among college students. The National Institute of Alcohol Abuse and Alcoholism (NIAAA) defines binge drinking as “a pattern of drinking that brings alcohol blood concentration levels to 0.08 g/dl” within 2 hours, which generally occurs after 5 or more drinks for men and 4 or more drinks for women (NIAAA, 2004). Even though binge drinking might also occur among other populations, both the number of drinks (9.3 drinks on each occasion) and prevalence (40%) of binge drinking are highest among the college-aged population (age 18-24) (CDC, 2012). This drinking pattern puts them at a high risk of impaired motor performance, injuries and fatalities due to accidents and violence, sexual assaults, as well as alcohol poisoning (Bennett et al., 1999). In the past, there have been numerous efforts (e.g., underage drinking laws) to decrease binge drinking in college students, but the prevalence of binge drinking is still near 40% within the college student population and available data on its negative consequences suggest it is still a substantial problem. Also, the current interventions do not seem to be effective, as drinking behavior among college students has not improved substantially in past two decades (Schulenberg et al., 2001).

Preventing binge drinking behavior among college students is complex in nature, as multiple factors contribute to the behavioral pattern (e.g., age, class year, and membership in fraternities) (Grenier et al., 1998). There is a need for studies that examine multiple factors as predictive variables for binge drinking behavior. Theoretical models like the Integrated Behavior Model (IBM) were developed to integrate these multifaceted and interrelated variables in one model to best explain health behaviors. The IBM proposed behavior is predicted by the intention, where intention is defined as an individual’s indication towards the decision or readiness to conduct the behaviors. Further, intention is predicted by attitudes, perceived norms, and perceived behavioral control (DiClemente et al., 2009) (Figure 1). Even though the IBM was developed more than 25 years ago, the IBM has not been adequately applied to assess factors impacting patterns in binge drinking behaviors (Head & Noar, 2014). This study is designed to develop an instrument using the IBM framework that predicts factors to predict stopping binge drinking behavior among college students in next 30 days. The study will evaluate psychometric properties of instrument, which may inform future intervention in reducing binge drinking and its negative consequences among college students.

Figure 1. Integrated Behavior Model
Methods

Research Design, Participants, and Data collection

A prospective design was utilized for this study and the study was conducted with the approval of the sponsored University Institutional Review Board. A mass email was sent to all undergraduate students at a large southwestern university; the email contained a link to an online survey and a consent form (https://oucas.qualtrics.com/jfe/form/SV_2o4HutnPeRs6g73). To incentivize taking the survey, the participants were allowed to enroll in a raffle to win one of four gift cards worth $50. At Time 1 (T1), the instrument collected a participant’s demographic data and assessed their intent to stop binge drinking within the next 30 days based on IBM constructs. In total 625 students participated in the study at T1. After 30 days, at Time 2 (T2), another email was sent to the students who participated in T1 and reported as being binge drinkers (https://ousurvey.qualtrics.com/jfe/form/SV_3atAh5honW70k2Jn?Q_JFE=qdg). Only 388 students who participated in T1 participated in T2. Of the 388 T2 participants, 155 were classified as abstainers and 72 were classified as social drinkers. Abstainers and social drinkers were excluded from further analyses. Thus, 161 students were included in the final assessment.

Measurement and Data Analysis

A new instrument “Alcohol Behavior Scale for College Students” (available in Bhochhibhoya, 2017) was developed following the sixteen steps of the instrument development process recommended by Sharma and Petosa (2014). A literature review was conducted to determine if any preexisting instruments were available to serve the purpose. The review did not identify any preexisting instrument that fulfills the purpose of the study; however the literature review helped to guide some of the items in the new instrument (Bhochhibhoya, 2017). After a first draft of the questionnaire was developed it was sent to a panel of eight experts with expertise in alcohol, the instrument development process, IBM, and college students to establish face and content validity. The draft instrument approved by the panel of experts was then utilized to conduct a pilot testing from the target population, and the survey was revised based on their feedback (Bhochhibhoya, 2017). After data collection, exploratory factor analysis was conducted for establishing construct validity and the internal consistency reliability of the instrument. Descriptive statistics were used to report demographic characteristics of the sample.

Results

A majority of the participants were female (64%), in the age group of 22-24 (61%), Caucasian (85%), and seniors (36%). Details on the demographic variables are presented in Table 1.

Table 1. A Summary of Demographics.

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>n=161</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>34%</td>
</tr>
<tr>
<td>Female</td>
<td>64%</td>
</tr>
<tr>
<td>Transgender</td>
<td>1%</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>1%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>18-20</td>
<td>33%</td>
</tr>
<tr>
<td>22-24</td>
<td>61%</td>
</tr>
<tr>
<td>More than 24</td>
<td>6%</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>85%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>3%</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>3%</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>3%</td>
</tr>
<tr>
<td>American Indian, Alaska Native or Native Hawaiian</td>
<td>1%</td>
</tr>
<tr>
<td>Biracial or Multiracial</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
</tr>
<tr>
<td>Year in School</td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>19%</td>
</tr>
<tr>
<td>Sophomore</td>
<td>21%</td>
</tr>
<tr>
<td>Junior</td>
<td>26%</td>
</tr>
<tr>
<td>Senior</td>
<td>36%</td>
</tr>
</tbody>
</table>

Upon examining the model fit indices using criteria Confirmatory Fit Index (CFI) ≥0.95, instruments reported good model fit (Figure 2). Similarly, the lower limit of acceptability for internal consistency was set at 0.7 to ensure moderate correlation between items (Streiner et al., 2014). Most of the IBM scales reported Cronbach’s Alpha above 0.7 suggesting most of the items were related...
to each other and were measuring the single construct [behavioral intention (α=0.969), attitude (α=0.910), perceived norms (α=0.762), and perceived behavioral control (α=0.809)].

Conclusions

The current study provides strong evidence of the reliability and validity of the current instrument. The study suggests promising application of IBM in predicting and explaining binge drinking behavior among college students. Also, the instrument featured a comprehensive list of items to measure when evaluating binge drinking behaviors using the IBM framework. This study also provides a draft of an instrument that future researchers may modify as per their need for other health behaviors.

References


Communication Methods: Does Technology Limit Peer Interaction?

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Abstract — College is often a time where students form relationships with new friends. Technology allows friends to be in almost constant contact with one another and with their group. However, in some cases, a friend may stop responding for a period of time, and the question becomes, “is there something wrong, and if so, what, if anything, should be done about it?” Using a multi-scenario design, results indicated that participants said they would be equally likely to text or contact a non-responsive friend in person, however they also indicated that they preferred communication via text message over in-person contact. Implications were discussed.

Keywords — Depression, texting, technology, friendship, peer interactions

Introduction

College is often a time where students form relationships with new friends. These relationships build a bond between friends that allow them to learn about one another through different kinds of communication and shared experiences. However, the amount of time a person commits to a relationship may not be limitless, but rather, may be determined by the level of commitment from the other person. Technology allows friends to be in almost constant contact with each other and with their friendship groups, however, sometimes, a friend may stop responding for a period of time and the question becomes, “is there something wrong, and if so, what, if anything, should I do about it?” Previous research found that in certain circumstances participants chose to use text messaging rather than in-person contact to reach out to a friend who had stopped responding to a group message (Turnage et al., 2019). There were two interesting aspects from this study that merit further investigation. First, participants rated text messaging higher than in-person contact, choosing to text the friend, even when the friend was described as being nonresponsive to the group text message. Second, providing participants with an initial description of the friend having depressive symptoms, made no difference in participants rating texting higher than in person contact. The irony in these findings is that individuals diagnosed with depression benefit from in-person contact with others, which was not the type of contact participants rated as most likely to be given. Previous research has not found that individuals reap the same benefits from text messaging. However, Holtzman, DeClerck, Turcotte, Lisi, and Woodworth (2017) did find that in a stressful situation, in-person contact elevated positive affect more than text contact. The main purpose of the current research was to modify and extend Turnage et al. (2019) to see if we could create a situation where participants would choose in-person contact over text messaging as a method of communicating with a nonresponsive friend. There were two main modifications. Rather than use unrelated scenarios, we choose to use a series of related scenarios, where the friend becomes increasingly nonresponsive to communication, to see if after a series of times where the friend is still not communicating, would they choose to continue to contact the friend by text message? Second, Turnage et al. (2019) found that initially describing the friend as depressed did not affect the mode of contact selected. Perhaps, it was not clear that the “depressed person” really suffered from depression; therefore the initial paragraph information was modified. A 2 (paragraph: depressed vs. typical) x 3 (response: in-person, text and group message) mixed factorial design was used. First, it was hypothesized that there would be a main effect for the beginning paragraph, where participants would be more likely to communicate with the friend in person, if they knew the friend was diagnosed with depression. Second, it was hypothesized that overall, participants would be more likely to communicate by text messaging, either by text or group text, than by in-person contact. Third, we hypothesized an interaction between initial paragraph and message type that would occur only after things became increasingly dire for the friend (i.e., Scenario E).

Method

Participants consisted of 48 (71% female, 29% male) undergraduate students (36 freshmen, 9 sophomores, and 3 juniors), enrolled in the introductory psychology course at a southeastern university, who completed a questionnaire for extra
credit. The average age of the participants was 19 (range 18-22), and the racial breakdown was 42% African American, 42% Caucasian, 8% Multiracial, 8% Hispanic/Latino. Participants read one of two scenario paragraphs (see Figure 1) describing a target individual that had either been diagnosed with depression or not and was a student at a local college. Pilot testing insured that the initial paragraphs were rated as being equally negative except for whether the target student was described as suffering from depression. Participants next read five escalating scenarios that described the student as a friend in the participants’ message group who becomes increasingly unresponsive to the group messages (see Figure 2). The descriptions ranged from a friend who does not respond within the group messages to one who expresses that things are extremely difficult and hard to manage. For each scenario, participants were asked how likely they would be to contact the friend in person, by text, and by group message. Two additional questions were included to try to help explain potential results. First, participants were asked to indicate how comfortable they were in communicating using text, group message, speaking on the phone or talking to someone in person, and second, they were asked to indicate the level of social interaction they experienced. All ratings were made on 9-point Likert-type scales where 1 equaled a negative rating and 9 equaled a positive rating. All participants completed a final demographic questionnaire.

Results

Separate 2 x 3 mixed analyses of variance were conducted for each scenario; since there were five vignettes and three question types, a Bonferroni correction (.05/15 = .003) was applied and only ANOVA results significant at the \( p < .003 \) level were discussed. Hypotheses 1 and 3 were not supported in that there were no significant main or interaction effects for paragraph type. However, Hypothesis 2 was supported in that all the results for the within-subjects variable (response type exceeded this criterion and were significant at the \( p < .001 \) level. All post hoc comparisons were significant at the \( p < .003 \) level. There were two patterns of results. As can be seen in Figure 2, where Corey has (A) not responded in the group text for several days; (B) displayed nonverbal behavior of being withdrawn; (C) been visibly upset, but dismisses it; and (E) stated in the group message that things are becoming extremely difficult and hard to manage, participants indicated they would be equally likely to contact Corey by text or in-person, which were significantly higher than contact by the group message. As can be seen in Figure 2, (D) after becoming friends, Corey withdraws, rejecting invites, and does not respond to text, participants indicated they would be most likely to contact Corey by text, followed by in-person contact, and least likely to contact by the group message. Separate 2 x 3 mixed analyses of variance were also conducted for the two additional questions (Bonferroni correction \( p < .025 \)). Both were significant at the \( p < .001 \) level and post hoc differences were significant at the \( p < .005 \) level. For the question relating to the participants’ level of comfort with communicating via different methods, the main effect for the within-subjects comparison indicated participants were most comfortable communicating by text (\( M = 8.56, SD = .92 \)), least comfortable communicating in a group message format (\( M = 6.86, SD = 2.37 \)), and the other three methods falling in-between. For the questions relating to the level of social interaction participants experienced, the significant main effect for the within-subjects comparison indicated that participants were most likely to socialize with an intimate group a couple of times per week (\( M = 6.77, SD = 2.47 \)), a few friends (\( M = 6.23, SD = 2.71 \)), an intimate group every day (\( M = 6.08, SD = 2.96 \)), or only occasionally (\( M = 5.81, SD = 2.33 \)), which did not differ from each other, than with multiple groups a couple of times per week (\( M = 4.10, SD = 2.89 \)) or multiple groups every day (\( M = 3.90, SD = 2.79 \)), which did not differ from each.

Conclusions

Technology plays a role in how individuals communicate in relationships which in turn could change the way individuals learn social cues and how they learn to communicate with a nonresponsive friend. This scenario study evaluated communication between the participant and a friend, when the friend displayed negative social cues. Interestingly, the initial paragraph describing the individual as experiencing depression or not, did not make a difference in ratings. The results suggest that even when the cues displayed increasing levels of distress, communicating with the friend in person or by text messaging were evaluated as equally likely. Perhaps participants’ answer to the question about preferred mode of communication can help understand this finding: participants’ preferred mode of communication is text messaging. It has been suggested that this constant preference for technology can limit an understanding of interpersonal social cues and nonverbal communication and delay of empathy development (Turkle, 2015). However, it was not clear if this is the reason that participants did not
select in-person contact or if they thought responding by text would be as effective in helping their friend as in-person contact. Future research should address this concern. To answer our question “Does Technology Limit Peer Interaction?” Our results would suggest, “somewhat,” in that although participants rated contact by text or in-person the same, their later rating on preferred mode of communication indicated that text message is the most preferred.

References


Figures

Typical paragraph: Corey is a 20-year-old student who has enrolled at USC Upstate for the fall semester. Throughout the semester, Corey has attempted to make friends, however, sometimes feels uncertain and is shy in social situations. Corey sometimes experiences pressure and nervousness over assignments and tests which can cause Corey to have trouble sleeping. This in turn can cause Corey to behave in an irritable and distant manner the next day. Corey can complete assignments, however, sometimes tends to be a perfectionist on class assignments. Corey often experiences feelings of being homesick and at times worries about grades, however, Corey has learned to mask or overcome these feelings for a short period of time. Corey is a typical college student and attempts to balance work, school and a social life.

Depressed paragraph: Corey is a 20-year-old student who has enrolled at USC Upstate for the fall semester. Throughout the semester, Corey has attempted to make friends, however, sometimes feels insecure and has a need to withdraw in social situations. Corey sometimes experiences insomnia and restlessness, which can causes Corey to have trouble sleeping. This in turn can cause Corey to behave in an irritable and distant manner the next day. Corey can complete assignments, however, sometimes finds it difficult to stay focused on one task. Corey often experiences feelings of sadness or at times anxiety, however, Corey has learned to mask or overcome these feelings for a short period of time. Corey has been diagnosed with depression and attempts to balance work, school, and a social life.

Figure 1. Two stimulus paragraphs.

Figure 2. Five scenarios and results.
Finding the Need to Exchange
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Abstract — Every year, thousands of Lander University students move. Most move either into campus housing or somewhere close to the campus. Others are doing the opposite, where they are moving away from campus for various reasons, including graduation or transferring to a different university. Those who are moving in typically spend a significant amount of time searching for items like furniture, dishes, seating, etc., and those who move out often find themselves throwing away quality items the ‘moving in’ people could have used. There are multiple existing services that can bridge this gap, but many of them have serious safety issues, so an alternative tailored to Lander students and graduates needs to be explored.

Keywords — Safe Exchanges, Dorms, College Experience

Introduction
Moving while starting or ending a college semester often involves some form of an exchange of furniture and other household items. However, this process lacks a formal, safe, and efficient means of facilitation. The goal of this study is to determine if such a need exists for Lander University students, design a web application to meet this need, and then obtain feedback to check if the website is able to meet the facilitation need successfully. The results of the interest check indicated that a majority of respondents would likely be interested in a mean to exchange household items with other students or alumni. These results are as expected, since there are very few similar services that are available and reasonably safe for Lander students to use. To fulfill this need, a prototype web application, named “School-Time YardSale,” is developed.

Competitive Marketplace
As mentioned before, there are few other applications similar to STYS. Potential competitors for STYS may include Letgo (Letgo, 2020), Facebook’s Marketplace (Facebook Marketplace, 2020), Craigslist (Craigslist, n.d.), and Vezzy (Vezzy, n.d.). Letgo and Craigslist offer platforms for item exchanges within local communities all across several countries around the globe. Craigslist also offers options for the user to list other services like housing or financial. Facebook’s Marketplace allows Facebook users to buy and sell goods both locally and globally from each other. Vezzy, a phone application made by a team of undergraduates, facilitates consumer to consumer item sales and purchases on one college campus.

While having various “potential” competitors may make it seem as though STYS has stiff competition, each of the above services have at least one issue affecting Lander students that STYS would be able to address. Vezzy is presumably restricted to its launch location of Emory University’s campus and is not available publicly. STYS avoids this problem by being marketable directly to Lander’s students.

Facebook’s Marketplace and Craiglist both provide convenient destinations to buy and sell items but require an account and expect the involved parties to arrange item exchange. STYS web app is intended to facilitate exchanges on campus, which assures student safety. Also, to paraphrase Greg Allen, the chief of Lander University Police Department (LUPD), “If students want to exchange items safely, they are welcome to do so at the LUPD office,” thus indicating there is an even safer option for completing exchanges.

Letgo is likely the largest potential competitor for STYS, as it is already widely available. Letgo claims that it facilitates safe exchanges by working “closely with local law enforcement.” However, upon further research on the Letgo website, it was revealed that Letgo offers a paid subscription for users to have their listings appear first on searches, making results biased and potentially unrelated to the original search filters. Such bias would not be a problem in STYS, since it is a tool solely designed for the benefit of Lander students.

Interest Gathering and Feedback
Concurrent with the development of the website prototype, I conducted a survey directed towards students to gauge potential interest levels. After the prototype site was completed, and made temporarily public, I conducted another survey to check if users would find the site useful in terms of its goal of item exchange facilitation. Approximately 84% of the 19 respondents to the first survey indicated they would be interested.
Other questions posed by the survey to measure the average level of difficulty students have when either offloading or obtaining items revealed that while only 31% spend several days or more searching for items, nearly half of responses stated they have spent several days or more (10% of which stating they have spent at least a few weeks) trying to offload their unwanted items. Such results showed strong support for the desire of a service like STYS as they indicated a void in the marketplace for an item exchange web app. The feedback survey found that while the prototype was lacking in aesthetic quality, it was able to facilitate item exchanges per its goal: 33% of respondents indicated they could find the service to be useful in the future as it is, 50% said it would be useful with improvements, and the remaining 17% respondents specified they did not know yet if STYS would be relevant to them. The above data has been visualized in figures 1 and 2.

The Design Process

The prototype of STYS website was designed and coded during the Fall 2019 semester. The programming languages PHP and JavaScript were used to handle backend functions like data storage and retrieval, MySQL server was used to store the database, and the markup language HTML was used to create the visual aspects of STYS. In the initial phases of design, the website was hosted locally within a single computer, but as the project progressed STYS was moved online to smartappweb.com domain. The focus of creating the website was primarily on the site’s functionality versus its aesthetics. However, there were several changes of STYS's appearance, the most notable of which occurring when the contents of pages were switched from floating to lying flat against the background. In the future, the site will be updated to be more attractive prior to being released openly to the Lander student body. A survey was conducted to gauge student’s opinion about the site’s functionality and aesthetics. Figure 3 summarizes the survey results.

Conclusions

To conclude, there is indeed a need for a service that aids Lander University students in connecting with each other for item exchanges. The interest gathering survey found a strong desire for such a facility, and the prototype website School-Time YardSale was designed to test if said desire could be met. Despite respondents in a review survey rating the site’s aesthetic as being mostly low quality, STYS was found to be able to achieve its goal in terms of functionality and ease of use. Furthermore, as the service is updated, it will not face the main issues, most of which concern security that direct competitors currently face.

References


Figures

**Figure 1.** Interest Survey Results

**Figure 2.** Feedback Survey Results

**Figure 3.** Feedback Survey Results
“Keeps Them Coming Back for More” An In-Depth Inquiry About How Lander University Students Choose Fast Food Restaurants

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Abstract - This project examines fast food marketing strategies and consumer decisions that college students make when grabbing a quick meal. Specifically, how do Lander University students choose to spend their money in Greenwood, South Carolina’s glutted fast food market? This research investigated that question, beginning with the hypothesis that Lander students would opt for less expensive and more convenient food. A combination of secondary research, two focus groups, and a campus-wide survey revealed that food quality won out over cost or convenience as the most influential factor in students’ decision-making. Lander students are willing to sacrifice almost any other factor of a fast food experience out of “food loyalty,” a principle that should impact the priorities of businesses within this market.

Keywords – fast, food, college, students

Introduction

Fast food is a multibillion-dollar industry in the United States of America. A town of just 25,000 people, Greenwood, South Carolina is home to 22 different fast-food and fast-casual dining establishments. While that may not be good news for the health of its citizens, clearly fast food is an important part of the local economy. So too is Lander University, home of 3,000 young consumers in the heart of Greenwood. In order to lure those students, local restaurants need a better understanding of the consumer behavior of the college demographic. This study contributes to that understanding by gathering students’ perspectives on their fast food choices.

Secondary Research

The first step in this project was conducting secondary research centered on why businesses target college students. The college-age demographic is often overlooked by big businesses that assume that college students do not spend as much as other demographics. However, Matt Alderton, author of “Marketing to College Students”, states that “more than fifteen million college students spend more than $200 billion annually” (Alderton, 2010). Additionally, Skalleberg emphasizes that this demographic group is almost constantly spending time with other people while also looking to spend money, and represent a ripe marketing audience for businesses (Skalleberg Fellow, n.d.). Younger generations show a higher trend of online presence, so companies seeking college-age consumers are investing in online marketing. At the same time, students also show high levels of appreciation and interest in companies when they sponsor university events, give free samples, or offer student discounts. Steve Olenski, author of “10 Tips for Marketing Your Startup to College Students”, theorizes that if a business considers the budget of a college student, as well as offers a discount for being a student, that this will attract more business from this demographic (Olenski, 2015).

Another study named “College Students’ Eating Habits and Knowledge of Nutritional Requirements” reports on a survey of eating habits on a small college campus. The students that conducted the survey suggested that the reason 18 to 24-year-olds eat more fast food is that, “college students face a new environment for meal preparation, planning, and eating as they transition into their college life.” Fast food is simply easier to get and more convenient than cooking for a lot of students, especially ones that live in residence halls. After conducting their survey, they found that many of their students that took the survey relied on their taste preference to choose where to eat. Because of this, they concluded that, “choosing food according to taste preference seems to be the hallmark of college students” (Abraham et al, n.d.).

This research revealed two main points: 1) college students haven't developed much brand loyalty yet and 2) to win their loyalty, brands should be present on campus (student media, sports teams’ sponsorships, student discounts etc.) and tech-savvy (have an app, use digital marketing, etc.). In short, students are not loyal to certain restaurants, but instead focus more on the meal discounts they can have, as well as which brands place themselves in front of students more. These observations led to the hypothesis that Lander students would opt for less expensive and more convenient food.
Methodology

The data from this project was conducted using two methods: 1) focus groups and 2) surveys. Two separate, 60-minute focus groups were held in October 2019, each group containing 7 participants. In order to identify any correlation between holding a job (and thus having an additional income stream) and differences in the amount students will spend on a meal, we made this one of our demographic questions. Out of all of our participants, a total of 11 out of the 14 held jobs while also attending school, which was considered while analyzing data. Each participant was asked to list the top three reasons they liked their favorite restaurant and the top three reasons they disliked their least favorite restaurant, and then used these answers to build their “perfect fast-food restaurant”. We also asked them how they would spend $10 of food money offered to them at that moment.

The focus group results shaped the descriptive survey. Factors measured were taste, price, frequency, brand loyalty, the influence of a friend or friend group, customer service, convenience, proximity, student discounts, school spirit, coupons, and percent of meals eaten on campus or at home. The survey was conducted through Qualtrics (an online survey tool) and had 10 questions that took no longer than 10 minutes to complete. A total of 101 Lander students completed it.

Key findings

Within the focus groups, the most frequently mentioned factor by far (36 out of 101) was the taste of the food. No other factor (price, quality, customer service, ads on campus etc.) was mentioned more than 15 times. This aligns with the findings of Abraham et al. (n.d.).

The survey underscored the trends shown in focus groups. First, it revealed the value of the college market to local fast food establishments: 39.60% of people ate fast food 5–8 times a month (once or twice a week), and 7.92% ate fast food 17+ times a month (four or more times a week). The results also revealed that food quality is the most enticing factor. Price and convenience played a minor role, but 100% of participants said there was at least a 50% chance they would order the same meal next time they visited their favorite fast food restaurant. Lander students have a lot of food loyalty.

Counter to predictions, whether or not a participant held a job while also attending college did not seem to have a significant impact on the amount they spent on their meal at their chosen restaurants. The participants without jobs said they would spend the same amount as those with a job. Another interesting finding was that student discounts, coupons, school spirit, delivery/Doordash, and customer service do not seem to have much influence. Throughout our research project, price was predicted to be a bigger factor than it was. This could be because students who live on campus always have access to “free” (pre-paid) food through their meal plans. If they decide to leave campus for fast food, they’ve already considered that it will be more expensive than eating on campus. At that point, they seem willing to pay more for food they particularly like.

Conclusion

The overwhelming food loyalty among students at Lander University was the most valuable finding. This research indicates that perhaps fast food businesses should consider saving their marketing money and focus on what they do best: making the delicious food that has Lander students coming back for more. To succeed in Greenwood, restaurant owners and chains should invest in quality product and continue this research to gain a deeper understanding of Lander students’ tastes.

Acknowledgements

This project came together with guidance and editorial help from faculty sponsor Dr. Lillian Craton. I would like to thank my Marketing Research professor, Dr. Cherie Rains, who guided this research project. I would also like to thank my classmates who contributed greatly to this project: Madison Copeland, Jackson Norrell, and Sarah Floyd.

References

Abstract -- The Serial Position Effect (Murdock, 1962) describes the tendency to best recall words at the beginning and end of a list, compared to words presented in the middle of a list. The present study is a replication of Murdock's earlier work with the addition of exploring the interaction of word length on the serial position curve. The Word Length Effect (Baddeley et al., 1984) describes that lists of shorter words lead to better recall than lists of longer words. Three word lists will be used: one-syllable, two-syllable, and three-syllable words and each word list will be read aloud and then participants will be prompt to recall as many words as they can. The design is between subject and participants will be undergraduates of Presbyterian College. We hypothesize that evidence of the serial position effect will be found in all three conditions, but to varying degrees. We think the list with the shortest words will produce the deepest serial position curve, the longest words will have the shallowest serial position curve, and we further hypothesize that the word list with the two-syllable words will be less severe than the one-syllable curve, but more pronounced than the three-syllable curve.

Keywords — Primacy, Recency, Word Length

Introduction

Memory was previously seen as a simple three step process known as the Multi-Store Model in which memory was seen as a unitary system (Atkinson & Shiffrin, 1968). Baddeley & Hitch (1974) recognized that memory is much more dynamic than this and specifically dove into the short term memory to further understand the complexity that lines within the stage. Short term memory, also known as the working memory, is actually not a unitary store and possesses two components known as the visuospatial sketchpad and the phonological loop. The visuospatial sketchpad assists in visual processing and helps answer the questions of "where?" and "what?" (Baddeley, 1986). This component of the working memory helps one navigate through daily life. The phonological loop consists of two parts known as the phonological store and articulatory control process. The role of the phonological store is to act as an inner ear in which spoken words can enter your short term memory. On the other hand, the articulatory control process acts as an inner voice that rehearses what we just heard in order to keep it in short term memory (Baddeley & Hitch, 1974). Both the visuospatial sketchpad and the phonological loop work together to allow short term memory to work successfully.

The Serial Position Effect

The Serial Position Effect (Murdock, 1962) is the tendency to remember the first and last words of a list better than words in the middle of the list (Figure 1). The overall effect is governed by two sub-effects: the primacy effect and the recency effect. The primacy effect states that words at the beginning of a list have a greater opportunity to be rehearsed in the articulatory control process and thus make it more often into long term memory. On the other hand, the recency effect states that words at the end of a list are still present in short term memory, and thus are recalled more successfully than words in the middle of a list (Murdock, 1962).

Figure 1. Idealized serial position curve for 24-word list.

The Word Length Effect

The Word Length Effect (Baddeley et al., 1984) is the effect that shows fewer syllable words are better remembered than longer syllable words. This effect is due to the capacity of the phonological loop and that memory is inversely related to word length (Baddeley, 1986). Longer words fill the phonological loop faster, and as such one can fit fewer words in the mental rehearsal space compared to shorter words. The present study is a replication of Murdock’s work on The Serial Position Effect with the addition of exploring the interaction of word length on the serial position curve.
Hypothesis

In this experiment, three word lists are used: one-syllable, two-syllable, and three-syllable words. The word lists have been controlled for by subject matter so that each word list contains exactly the same variety of topics. For instance, fruit is represented on each list as plum (one syllable), cherry (two syllables), and banana (three syllables). Using the same method as Murdock, we will read each word list aloud and then prompt the participants to recall as many words as they can. The design is between subject, so each participant will only hear one-word list. We hope to have at least 40 participants for each word list. The participants will be undergraduates of Presbyterian College and some will receive extra credit for their participation.

We hypothesize that we will find evidence of the serial position effect in all three conditions, but to varying degrees. We think that the list with the shortest words will produce the deepest serial position curve, with a stark contrast to the middle words on the list, and the best recall in the primacy and recency portions of the curve. We think that the list with the longest words will have the shallowest serial position curve, with the least difference between primacy, recency, and middle words. We further hypothesize that the word list with the two-syllable words will be less severe than the one-syllable curve, but more pronounced than the three-syllable curve. All three of these outcomes should be governed by the capacity of the phonological loop, as a greater number of one syllable words will fit for both rehearsal (enhancing the primacy effect) and short term memory retrieval (enhancing the recency effect). The effect should be less pronounced in two-syllable words, and still less in three-syllable words.

References


Doodling, Attention, and Shading Oh My!

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Abstract
—Previous research has shown that doodling has had a positive effect on attention. One area of concern with these studies, however, is in how they define doodling. These studies used the term “doodling” when they had their participants shade in a predetermined shape. This then raised the question, would actual doodling result in the same positive effects as shading? The current study hopes to answer this question by having participants either shade in predetermined shapes or doodle participant generated images while engaging in a task. It is hypothesized that of the two different presentation conditions, participants will retain more information for the audio only condition than they would with the visual only condition. It is further hypothesized that the group who were shading predetermined shapes will also retain more information than the group who were doodling because shading does not require as much attention or cognitive resources. With doodling you must first decide what to draw and then concentrate on bringing that image to reality, while shading does not require much attention, leaving cognitive resources left over to focus on new information.

Keywords — Attention, Doodling, Shading, Memory

Introduction

Doodling while attending to another task has not been extensively studied in psychology. However, there have been a few studies that have focused on this subject. One such study was done by Andrade (2009) where she had her participants shade in various shapes while listening to an audio clip of a conversation. After listening to the clip, participants engaged in a distractor task before being asked to answer questions about the conversation they just heard. She found that the students who doodled were better able to concentrate on the conversation and were able to answer more of the questions correctly. Other studies have built on and extended Andrade’s research. Singh and Kashyap (2014) built on Andrade’s results by examining the benefits of doodling across differing retrieval strategies, recall and recognition. As in Andrade’s study, participants were asked to shade in various shapes while listening to an audio clip of a conversation. After engaging in a distractor task, the participants’ memories of the audio clip were tested using either a recall task or a recognition task. Though no difference was found between recall and recognition groups, Singh and Kashyap did find a significant effect of doodling. Regardless of the retrieval strategies used, doodling benefitted the participants’ memories.

Based on Andrade’s (2009) and Singh and Kashyap’s (2014) research, the current study will examine the impact of doodling on memory. However, previous researchers used “doodling” to indicate shading in of shapes rather then aimlessly drawing while one’s mind is otherwise occupied (Schott, 2011). It is unclear if it is the simple act of shading in shapes that contributes to the improved recall of information, or if this improvement in recall can be extended to actual doodling. The current study will not just examine the effect of doodling on recall, it will also attempt to determine if the two different types of doodling—shading in of shapes or actual drawing images—will have the same memory effects.

Previous researchers presented audio stimuli only to their participants. The current study will also examine what effects doodling, a visual task, has on the remembrance of visual information. In other words, participants in the current study will be presented with either audio stimuli or visual stimuli while engaging in a doodling or shading task. It is predicted that students who doodle will have better recall of the presented stimuli (either audio or visual) than students who do not doodle. Furthermore, it is predicted that students who actually doodle (i.e., draw various designs) will have better recall than the students who simply shade in shapes. Since doodling is a visual task, it is also predicted that students will have better recall for audio information than visual information.

Methods

Participants
Participants consisted of 60 college students from the University of South Carolina Upstate who received course credit for participating in the experiment. Of the sample, 72% of the participants were female and the ages ranged from 16-42 years of age.

Materials
A PowerPoint presentation was created by the researcher for this experiment. The presentation was comprised of various psychological terms and their definitions. Participants would either just see the
PowerPoint slides (visual presentation) with no audio component, or the PowerPoint slides would be read to the participants (audio presentation) with no visual component.

The shading sheet consisted of an A4 sheet of paper with various symbols (e.g., star, heart, arrow) on it that were about 1.5” in height. The doodling sheet consisted of squares approximately 2” in size where the participants were encouraged to draw what they liked. The squares were provided to try and insure that both the shading and doodling groups were working in an area of similar size.

**Procedures**

Participants were randomly assigned to one of three conditions: doodling, shading, or control. Each group was further divided into either the visual presentation or the audio presentation. Participants were shown a short PowerPoint presentation with either no audio or no visual (roughly 4 minutes in length). They were then asked to complete a distractor task for five minutes. After completing the distractor task, the participants were asked to answer 10 questions about the presentation. They were then thanked for their participation and dismissed.

**Results**

A 2 Presentation (Audio, Visual) x 3 Condition (Control, Shading, Doodling) Between-subjects Analysis of Variance (ANOVA) was conducted on the data. The main effect of Presentation ($F(1,54) = .024$, $p = .878$) and Condition ($F(2,54) = .704$, $p = .499$) did not reach significance. The Presentation x Condition interaction was trending towards significance ($F(2,54) = 1.643$, $p = .203$; see Figure 1). No other results were significant.

**Discussion**

The current study wanted to expand on findings reported by Andrade (2009) and Singh and Kashyap (2014) who found that doodling while listening to an audio conversation improved the recall of information. The current study first expanded on what previous researchers were defining as doodling. In their studies, Andrade and Singh and Kashyap had their participants shade in various shapes, and they referred to this activity as doodling. The current study not only looked at the effects of shading in shapes while attending to a message, it also looked at the effects of actual doodling—the drawing of shapes and figures by the participant—on the retention of information. The current study also looked at whether the type of presentation—audio or visual—would be differently impacted by doodling.

It was hypothesized that participants who either doodled or shaded in shapes during a memory task would recall more information than participants who did not doodle or shade during the memory task. It was further hypothesized that participants would recall more information from the audio presentation than the visual presentation. Unfortunately, neither of these hypotheses were supported. No difference was found between shading, doodling or the control conditions for memory recall, nor was a difference found between the visual or audio presentations for memory recall. The silver lining came from the interaction between the doodling conditions and the presentation types, which was trending towards significant. This interaction revealed that, even though participants in the control condition and the shading condition recalled about the same amount of information for both the visual and audio presentation, a difference was found in the doodling condition. In this condition, participants in the audio presentation recalled more information than did participants in the visual condition.

There are several possible reasons for why the results of the current study were not consistent with Andrade’s (2009) and Singh and Kashyap’s (2014) findings. One possible reason that current study failed to find the predicted results could be the fact that the subject matter for the audio and visual presentations was comprised of psychology terms and most of the participants were psychology students. In future studies, one might want to use a different or more generic topic when running mostly psychology students. Another possible reason the current study failed to find the predicted results could be not only was the topic a familiar one for the participants, but that the doodling condition was more difficult to complete for the participants. In Andrade’s (2009) and Singh and Kashyap’s (2014) studies they found an increase in retention when participants were shading. When looking at actual doodling, it makes sense that participants had more trouble with recall during the visual presentation than the audio presentation. Participants in the shading condition simply had to shade in shapes, and this did not take up much of their cognitive resources. They had some left over to process both the audio and visual presentations and be able to recall information later. Participants in the doodling condition had to think about what they wanted to doodle and then draw it. This thought process took up more cognitive resources such that they had fewer left over for retention of information. With the audio presentation, they could listen and draw, but with the visual presentation they had to choose between doodling and paying attention. Participants were...
unable then to perform well in this condition because of lack of cognitive resources.

**Conclusion**

While looking for an increase in recall for participants while they engaged in doodling or shading during a visual or audio presentation, we found that for the most part there was no significant difference. Andrade (2009) and Singh and Kashyap (2014) found significant positive effects of “doodling” (i.e., shading) in a recall task. The current study did not find such definitive results. At most a trend was observed indicating that participants in the doodling condition recalled more information with the audio presentation than with the visual presentation. No such results were observed in the shading or control conditions. In the future, efforts should be made to present a more generic topic to the participants, rather than one that was related to their field of study. Hopefully, then we will be able to see if there is really a difference between the impact of shading and doodling on the recall of information.

**Acknowledgements**

We would like to thank the University of South Carolina Upstate’s Office of Sponsored Awards and Research Support (SARS) for financial support. We would also like to thank the students at USC Upstate for participating in this study.

**References**


**Figures**

**Figure 1.** Mean values representing Control, Shading, and Doodling for each presentation type, Visual and Audio. Only the Doodling condition had a difference that was approaching significance.
How Tattoos Impact Perceived Job Performance: A Generational Study

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Abstract— Previous literature has shown that many people still hold prejudices against individuals with tattoos. This prejudice tends to hold particularly true for older individuals, while younger individuals tend to be more accepting, according to the research. The current research sought to address the assumptions that older individuals (65+) still hold more negative views of tattoos as compared to young adults and examine how the presence of a visible tattoo effects perceived job performance (pink, blue, and white collar jobs) across these age groups. Participants were randomly assigned to tattoo or no-tattoo condition and asked to rate three different men based on a picture and a job description. Most of the results were inconsistent with the literature. It was found that the elderly tend to be more accepting of tattoos while younger individuals rate them harsher, and blue collar workers with tattoos were rated as more unprofessional that pink and white collar workers across the board. However, it was found that tattooed individuals were rated lower than non-tattooed individuals, which is consistent with the literature.

Keywords— tattoos, job performance, generational, age

Introduction

Throughout history, prejudice has always been an issue. While most would agree that prejudices have diminished quite a bit from what they used to be, many people still do hold prejudices against many things. Some of those things being race/ethnicity, religion, gender, body type, and political affiliations. The current study focuses in on prejudice against people with body modifications, specifically, people with tattoos. Tattoos have been around for hundreds of years and have gained a particularly negative stigma over time. A possible explanation for this negativity could be due to the fact that the earliest forms of tattoos were used to identify slaves and criminals (Foltz, 2014). Therefore, some people, particularly the older generations, in today’s society may still hold the belief that people with tattoos are “bad” people. But, tattoos are no longer used in the same manner that they used to be. Today, people get tattoos for a plethora of reasons—to commemorate an event, to express their own uniqueness and individuality, or because they simply like the design of the tattoo.

Even with more and more individuals being accepting of tattoos, for the most part that negative stigma has stuck with the concept of tattoos. This negative stigma causes many people to still hold personal prejudices against individuals with tattoos (Burgess & Clark, 2010). There have been several studies to support this claim. Dean (2010) found that the general public thought tattooed individuals to be dishonest and less intelligent than individuals without tattoos. The older individuals seem to hold more of these negative views when compared to the younger generations, who seem to view tattoos as an art form or a way to express themselves in a manner that is unique to them and their personality. These observations might lead one to the conclusion that the negative bias towards tattoos may not be as prevalent in younger individuals as it is with older individuals. The lessening of this bias leads to more acceptability of tattoos in our society today. As a result, making individuals with tattoos more prevalent in the workplace as well.

Having tattoos is a personal decision, and while they are more accepted today than in the past, many people still do hold prejudice against tattoos when it comes to professional work. There are certain professions in which most people would feel more comfortable if the worker did not have visible tattoos, regardless of the age of the customer. Some of these jobs may include doctors, bankers, and more professional positions. Dean (2010, 2011) argued that while white collar workers with visible tattoos are viewed as inappropriate, blue and pink collar workers having visible tattoos are viewed as more appropriate. Pink collar jobs cover any job within the service industry, such as waiters/waitresses and customer service (US Legal, Inc., n.d.).

The current study’s purpose was to contribute to the concept that the older generations may be more prejudice against tattoos when compared to younger generations. Just as Dean (2011) found, it is also hypothesized that the individuals with visible tattoos in white collar positions will be judged more harshly than the individuals with visible tattoos in blue and pink collar positions.

Methods

Participants

Participants consisted of 82 people: 24 young adults (ages 18-35) from various psychology classes
at USC Upstate, 20 middle aged adults (ages 36-65) and 38 elderly adults (ages 65+) recruited from various churches in the area. There were 59 female participants and 23 male participants.

Materials

Each participant received two packets. One packet was the pictures, male-tattoo and male-no tattoo, with the job description, one picture and one job description on each page. The second packet was the correlating 10 questions about the pictures. The demographics information was also on the second packet.

Procedure

The college participants were brought into a classroom setting and told they were participating in a study about how people perceive different individuals. They were given two packets, some groups had the picture of the men with no visible tattoos and some groups had the pictures of the men with visible tattoos. They were told to look at each picture, read the job description, and carefully answer the corresponding questions about each of the three people on the questionnaire. They were also reminded to fill out the demographic information on the back. Participants were told to turn in their papers to the researchers when they were finished. The elderly and middle age participants were conducted in the same manner, just in a Sunday School room setting instead of the classroom setting.

Results

A series of 2 Tattoo (tattoo, no tattoo) x 3 Age (young adults, middle age, and elderly) x 3 Job Type (pink, blue, and white collar) mixed factor ANOVAs were conducted on the data in which Tattoo and Age were between subjects variables and Job Type was a within subjects variable. For works well with others, a significant main effect was found for Age (F(2, 76) = 3.147, p = .049), Tattoo (F(1, 76) = 9.723, p = .003), and Job Type (F(2, 152) = 6.565, p = .002), and the Age x Tattoo interaction was approaching significance (F(2, 76) = 2.519, p = .087). For uses his time responsibly while at work, a significant main effect was found for Age (F(2, 77) = 3.397, p = .039) and Job Type (F(2, 154) = 4.334, p = .015), while the main effect of Tattoo (F(1, 77) = 2.801, p = .098) and the Age x Tattoo interaction was approaching significance (F(2, 77) = 1.738, p = .183). For handles his job in a professional manner, a significant main effect was found for Age (F(2, 77) = 4.467, p = .015), Tattoo (F(1, 77) = 6.714, p = .011), and Job Type (F(2, 154) = 9.794, p < .001), and the Age x Job Type interaction was approaching significance (F(4, 154) = 1.848, p = .122). Lastly, for communicates with others in a respectful way, a significant main effect was found for Age (F(2, 72) = 3.906, p = .025), Tattoo (F(1, 72) = 6.802, p = .011), and Job Type (F(2, 144) = 6.03, p = .003), and the Age x Tattoo (F(1, 72) = 1.657, p = .198 and Job Type x Tattoo (F(2, 144) = 2.388, p = .095) interactions were approaching significance. See Figure 1 for a depiction of the averaged scores of the questions across the age and tattoo conditions.

Discussion

The purpose of the current study was to shed light on the idea that older generations tend to hold more prejudice against people with tattoos, particularly in the workplace. Based on previous literature, it was believed that the older generations would rate individuals with tattoos much harsher than the younger generations. Older people were expected to rate the tattooed individual lower because of the extreme negative stigma that surrounded tattoos while they were growing up. It was also believed that the white collar workers with visible tattoos would be rated as more unprofessional, as the literature points to the idea that people do not like workers with professional jobs having visible tattoos. It was also thought that individuals with visible tattoos would be rated as more unprofessional than the individuals without visible tattoos due to the stigma that has surrounded tattoos for generations.

The results of the current study were inconsistent and strange in many ways from the previous literature. Several intriguing patterns emerged from the data collected. First, instead of the young adults being the most accepting of visible tattoos in the workplace, it was actually the elderly that were more accepting than the young adults and the middle age group. Meaning, that the young adult and middle aged participants rated visible tattoos as more unprofessional than the elderly did. This result could be due to several factors. The most obvious one being that the elderly participants’ data were collected at a church. It is possible that their faith makes them less likely to pass judgement despite what their own opinions might be. Social conformity pressure in a church setting might have also contributed to the study’s findings. The young adults who participated in the study did not have that same social and environmental pressure as the elderly to rate higher than they might have. The students may have been more honest in the study.

The second strange pattern was that blue collar workers were consistently rated as the most unprofessional across all questions and age groups. Which is inconsistent with what Dean (2011) found.
within his study. Dean found white collar workers with visible tattoos were rated more unprofessional compared to blue collar workers. This inconsistency could be due to the fact that the participants possibly viewed themselves as blue collar workers and therefore rated blue collar workers more harshly. Finally, consistent with the literature, the third result supported Zestcott et al. (2017) that individuals with visible tattoos are still rated lower than individuals with no visible tattoos.

**Conclusion**

The goal of this research was to elaborate on the idea that older individuals typically hold more prejudice against visible tattoos than do younger individuals. Originally, it was hypothesized that the elderly would rate the individuals with visible tattoos the lowest, but it was actually the young adults who gave the worst ratings. It was also found that blue collar workers were rated most unprofessional across the board. It was found that tattooed individuals were rated lower than non-tattooed individuals, which is consistent with the literature. Future studies may want to consider having a more controlled environment for all age groups to avoid environmental differences.

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**References**


**Figures**

![Figure 1](image-url). The figure depicts the averaged score calculated from works well with others, uses time responsibly, and communicates in a respectful way across age groups and tattoo condition.
Job Performance Prejudice Across Gender

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Abstract—The current literature points to the idea that society still holds a prejudice against individuals who go against the social norms. The current study focused on the perception of tattoos and their impact on one's perceived job performance. We looked at three different job types—pink collar, blue collar, and white collar—to determine if the presence of visible tattoos combined with type of job would impact job performance ratings for that individual. We further wanted to examine what impact gender of the employee would have on the perception of job performance. To this end, our study had four experimental conditions: male-tattoo, male-no tattoo, female-tattoo, female-no tattoo. Participants were randomly assigned to one of the experimental conditions and asked to rate how well they felt each individual would perform their job based on a picture of the individual and a brief explanation of the job. The results concluded that there was no difference in the rating of males and females. Also, it was found that visible tattoos were rated as unprofessional only in the male condition, while in the female condition the individuals with visible tattoos were rated more favorably.

Keywords—tattoos, job performance, gender

Introduction

For hundreds of years, people passing judgement on one another has been an issue in every culture. Whether race/ethnicity, political or religious affiliations, body type, or gender, such prejudices have held people back. The current study seeks to address gender inequality in the workplace, focusing on body modifications, particularly, tattoos. The current study will look at perceived job performance of men with and without visible tattoos compared to women with and without visible tattoos.

It is no secret that women have had many struggles in the workplace (Stamarski & Son Hing, 2015). Women face the gender wage gap, a lack of female leadership and representation, and it typically takes a longer amount of time for a woman to make advancements in her career field as compared to a man in the same field (Stamarski & Son Hing, 2015). While some still women face this type of prejudice every day, others have made good strides in taking leadership roles and have gained much respect in doing so.

Another impediment to advancement in the workplace could be the presence of visible tattoos.

Dean (2010) conducted a study and found that the general public viewed visible tattoos on white collar workers, such as bankers, doctors, and more professional positions, as inappropriate. Whereas with blue collar workers, such as mechanics and line workers, the same tattoos that were seen as appropriate. Dean (2011) conducted a follow up study that found even while people today are more accepting of tattoos, visible tattoos are still viewed as inappropriate on people with white collar professions.

The researchers of the current study were interested not only in the perception of job performance between white (doctors, bankers, etc.) and blue-collar workers (line workers, mechanics, construction, etc.), but pink-collar workers as well. Pink collar jobs are those in the service industry (US Legal). They can include waiters/waitresses and any customer service position. It is hypothesized that males will be rated higher in their positions than females. It is also hypothesized that individuals with visible tattoos will be rated worse, or not as professional, than individuals without visible tattoos. Further, it is hypothesized that white collar workers with visible tattoos will be rated as more unprofessional than blue- and pink-collar workers with visible tattoos.

Methods

Participants

Participants consisted of 70 college students from the University of South Carolina Upstate who received course credit for participating in the experiment. Of the sample, 77% of the participants were female and 66% of the participants did not have visible tattoos.

Materials

Each participant received two packets. One packet contained either male-tattoo, male-no tattoo, female-tattoo, female-no tattoo pictures with one job description and one picture per page. The second packet consisted of six work related questions and four questions related to the individual's character. The demographic information was also in the second packet.
Procedure

The participants were brought into a classroom setting and told they were participating in a study about how people perceive different individuals. The two packets were handed out, some groups had pictures without visible tattoos and some groups had pictures with visible tattoos. They were told to look at each picture, read the job description, and carefully answer the corresponding questions about each of the three people on the questionnaire. They were also reminded to fill out the demographic information on the back. Participants were told they could leave when they were finished.

Results

A series of 2 Gender (male, female) x 2 Tattoo (tattoo, no tattoo) x 3 Job Type (pink, blue, white) mixed factor ANOVAs were conducted on the data in which Tattoo and Gender were between subjects variables and Job Type was a within subjects variable. For strives to meet deadlines at work, a significant main effect was found for Job Type (F(2, 132) = 11.819, p < .001) and the Job Type x Tattoo (F(2, 132) = 4.073, p = .019) interaction was significant, while the Gender x Tattoo (F(1, 66) = 2.362, p = .129) and Job Type x Gender (F(2, 132) = 2.584, p = .079) interactions were approaching significance. For works well with others, a significant main effect was found for Job Type (F(2, 130) = 7.507, p = .001) and the Gender x Tattoo (F(1, 65) = 5.421, p = .023) interaction was significant, while the Job Type x Tattoo (F(2, 130) = 2.337, p = .101) interaction was approaching significance. For uses his time responsibly while at work, a significant main effect was found for Job Type (F(2, 132) = 10.344, p < .001), and the Gender x Tattoo interaction was approaching significance (F(1, 66) = 3.055, p = .085). For handles his job in a professional manner, a significant main effect was found for Job Type (F(2, 132) = 8.701, p < .001), and the Gender x Tattoo (F(1, 66) = 6.192, p = .015) interaction was significant. Lastly, for communicates with others in a respectful way, a significant main effect was found for Job Type (F(2, 130) = 7.302, p = .001). See Figure 1

Discussion

The current study sought to expand on the concept of the perception of individuals with tattoos in the workplace depending on the type of job the individual has (pink, blue, or white collar) as well as the gender of the individual (male or female). Based on past research, it was hypothesized that the females would be rated worse than the males and that individuals with visible tattoos would be rated as more unprofessional than individuals without tattoos. Also, based on the literature, it was hypothesized that individuals with visible tattoos holding white collar jobs would be rated as more unprofessional than individuals with blue- or pink-collar jobs due to the nature of their profession.

The results of the current experiment were inconsistent with previous literature in several ways. First, the results comparing men to women did not reach significance as hypothesized. The participants rated the men and the women in the same manner. This may be due to the fact that the majority of participants in this study were female college students, and college students in general seem to be more open minded when it comes to women in the workplace.

Second, in the male condition, males with visible tattoos were rated as less professional than males with no visible tattoos; however, the opposite was found for in the female condition. Females with visible tattoos were seen as more professional as compared to females with no visible tattoos. This was a particularly interesting find. It was believed that the females with visible tattoos would be rated the worst out of all the conditions, but they were actually rated better than females with no visible tattoos. This strange result could be due to the fact that 77% of the participants were female, and therefore have higher opinions of females to begin with. Also, tattoos are fairly common in a college student population, so they might be less likely to have an issue with visible tattoos in the workplace. Third, there was no effect of job type in the study. Meaning the white-collar workers were rated in the same manner as the pink- and blue-collar workers.

Consistent with the current study’s findings, Ozanne et al. (2019) found that visible tattoos did not have an effect on whether or not the customer had something negative to say about the server. In fact, Arndt and Glassman (2012) found that females with visible tattoos are rated more positively than their male counterparts. It is quite possible that much of the older literature represents a population that is heavily against tattoos, while the more current literature is reaching the generations that are very open-minded towards tattoos.

Conclusions

The goal of the current research was to determine if gender and job type played a role the perception of individuals with visible tattoos in the
workplace. It was originally thought that females with visible tattoos would be rated the worst, but that was not what the current study found. Neither gender nor job type affected the perceived rating of job performance. Curiously, results did indicate that females with visible tattoos were rated more positively than females with no visible tattoos, while males with no visible tattoos were rated higher than males with visible tattoos. All of these results could be due to the fact that college students are much more accepting of women in the workplace and visible tattoos. They see individuals as equals, no matter gender, job type, or tattoos status, which is great news for the future of the workplace.

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We would like to thank the University of South Carolina Columbia’s Office of Undergraduate Research for a Magellan Scholarship and the University of South Carolina Upstate’s Office of Sponsored Awards and Research Support (SARS) for financial support. We would also like to thank the Upstate students for participating and to Dr. Ruppel for being our mentor.

**References**


**Figures**

![Figure 1](image-url)

**Figure 1.** This figure represents the averaged score across strives to meet deadlines at work, works well with others, uses his time responsible at work, and handles job in a professional manner for the Gender x Tattoo interaction.
Examining the Effects of Type of Crime and Race on Sentencing Length and Subsequent Hiring Decisions

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Abstract - A large body of research has been dedicated to finding the cause behind racial disparities that plague the criminal justice system (CJS). Most research has explored sentencing disparities between white-collar and blue-collar crimes. However, what most research fails to investigate is the possibility of interracial disparities that might exist within the CJS. The current study examined the effects of colorism (i.e., preferential treatment given to someone of a specific skin tone) and how it might affect criminal sentencing and likelihood to hire. Participants were randomly assigned to view a criminal profile consisting of a suspect who was either a light-skinned black male, dark-skinned black male, or white male. In addition, the suspect either committed a blue-collar crime (e.g., armed robbery) or white-collar crime (e.g., identity theft). After viewing the criminal profile participants were asked to make a sentencing judgment and hiring decision. The results indicated that white collar crimes were sentenced less harshly. However, the participant’s ethnicity impacted both sentencing and hiring. White participants showed a bias for sentencing, whereas, black participants showed a bias for hiring. Our findings may suggest that implicit biases may play a role when making judgements about deviant behavior and its consequences.

Keywords – Colorism, White-Collar Crime, Blue-Collar Crime, Hiring

Introduction

According to the Bureau of Justice Statistics (BJS), about 1 in 38 individuals residing in the United States are supervised by correctional institutions (Kaeble & Cowhig, 2016). While the incarceration rate has been slowly declining since 2009, a growing concern and top policy problem has been how to successfully reintegrate ex-offenders into the community. Ex-offenders often face significant barriers when looking for employment. During the hiring process, employers may incorporate an unfair risk assessment. For example, employers often assume that ex-offenders will be more likely to commit workplace crimes simply because of their criminal history. Employer apprehension over workplace misconduct is especially heightened when the position involves frequent contact with customers, interaction with children, and the handling of cash, all of which could cause an increase in legal liability (Holzer et al., 2007). Because of these concerns, ex-offenders are often relegated to less sustainable and undesirable positions (Bumiller, 2015).

When it comes to ex-offenders gaining employment, the type of crime committed may also play a pivotal role in hiring decisions. Research suggests that those who commit blue-collar crimes (e.g., armed robbery) often receive harsher sentences than those who commit white-collar crimes (e.g., identity theft) (Hurwitz & Pfeffley, 1997). Perhaps this is due to the social perception that white-collar crimes are less serious, non-life-threatening offenses (Harrison, 2010). A question that begs to be answered is whether differences in sentencing lengths—because of type of crime committed—affects the likelihood to be hired. Before we can answer this question, it is important to consider another variable such as race.

Although blacks account for 44% of those incarcerated, the crimes they commit are more likely to be blue-collar (Pizzi et al., 2004). This may be because blacks only account for 8% of white-collar jobs (Gee, 2018). Since blue-collar crimes are more likely to be committed by persons of color, blacks are at great risk of receiving harsher sentences. Consequently, this may make it even more difficult for them to gain adequate employment. The research to date has yet to explore how the presence of interracial disparities, such as colorism, contribute to our understanding of hiring decisions for those with a criminal history.

Colorism is a term often used to describe preferential treatment given to an individual (or individuals) of a specific skin tone (Harrison, 2010; Pizzi et al., 2004). One of the more prominent examples of colorism lies within the black community and what most people refer to as “light skin versus dark skin.” Studies have shown that light-skinned blacks are more likely to have higher salaries compared to dark-skinned blacks even while controlling for education level and previous job experience (Harrison,
Perhaps colorism may also play an important role when trying to uncover biases in the hiring of ex-offenders. As previously mentioned, we know that blacks are disproportionately represented within the CJS. A central question that we wanted to investigate was how interracial differences stemming from colorism may affect the harshness of sentencing and subsequent hiring decisions. Specifically, we were interested in how college students would make sentencing and hiring decisions based on the applicant’s criminal history and race.

**Methods**

**Participants**

A total of 184 undergraduate students from the University of South Carolina Upstate participated in the experiment. However, only 159 of the participants were used in data analysis because they identified as either black or white. There were 129 females and 30 males. The participants’ ages ranged from 16 to 47. The sample was ethnically diverse; 53% were white, 47% were black. All participants received research credit for their participation.

**Materials**

Participants were asked to take part in a research study via Qualtrics, a software program used to create online surveys. The actual survey itself consisted of the following two phases: (1) a criminal profile viewing and test phase, and (2) a job application viewing and test phase. Six different criminal profiles were created to manipulate the suspect’s skin tone (i.e., dark skin black male, light skin black male, and white male) and criminal offense (i.e., identify theft and armed robbery). The criminal profiles contained the following: a profile picture obtained from the Chicago face database (Ma et al., 2015), full name, race, booking number, crime committed, date of arrest, place of arrest, county, arresting officer, precinct, sex, age, birthdate, birthplace, height, weight, physical build, nationality, citizenship, gang affiliation, date of incident, residence, occupation, and a brief testimony detailing the events that led up to the arrest. The profile itself was manufactured using Microsoft Word. The dark-skin black male was identical to the light skin black male; Adobe Photoshop was used to alter the skin tone to a darker complexion. For the second phase, two fictitious job applications were created: one application for the identity theft offense and one application for the armed robbery offense. The application contained the applicant’s contact information (e.g., address and phone number), availability to work, criminal and work history, and references.

**Procedure**

After obtaining informed consent, participants were randomly assigned to one of the following six conditions: dark skin black male white-collar criminal offense, light skin black male white-collar criminal offense, white male white-collar criminal offense, dark skin black male blue-collar criminal offense, light skin black male blue-collar criminal offense, or white male blue-collar criminal offense. Participants then proceeded to phase one, where they observed a criminal profile for two minutes. Once the two minutes expired, participants were asked to answer seven memory questions and complete a brief survey about the profile. The last item in the survey asked participants to sentence the suspect in years, up to ten, if he were found guilty. Next, participants entered phase two of the study. Participants were given three minutes to view a job application, as if the offender in phase one had served his sentence, been released from prison, and now actively searching for employment. Once the three minutes expired, participants were asked whether they would hire the ex-offender. Lastly, participants were prompted to fill out a demographics survey as well as read debriefing statements.

**Results**

A 3 (light skin black male, dark skin black male, white male) x 2 (white collar crime, blue collar crime) x 2 (participant’s race: black or white) between subject’s analysis of variance (ANOVA) was performed to examine the effects of skin tone, crime, and ethnicity on criminal sentencing. There was no significant main effect of skin tone, F(2, 157) = .25, p = .78. There was a significant main effect of crime, F(1, 157) = 8.53, p = .004. Participants gave significantly lower sentencing rates for identity theft (M = 2.74, SD = 1.97) compared to armed robbery (M = 3.95, SD = 2.29). There was no significant interaction between skin tone and crime, F(2,157) = .67, p = .51 or skin tone and ethnicity, F(2,157) = 2.08, p = .13. However, there was a significant interaction between crime and ethnicity, F(1,157) = 6.31, p = .01. Follow-up analysis revealed a significant simple main effect for white collar crime such that white participants gave significantly lower sentences than black participants, F(1, 145) = 6.56, p = .01. T
he simple main effect for blue collar crime was not significant, \( F(1, 145) = 1.00, p = .32. \)

A one-way ANOVA was performed with skin tone as the independent variable and sentencing length as the dependent variable for only white participants. The results indicated that there was a marginally significant effect of skin tone, \( F(2, 84) = 2.93, p = .06. \) Regardless of crime committed, white participants gave significantly higher sentences when the suspect was a dark skin black male compared to a white male (\( p = .02 \)).

For hiring decision, significant effects were only found for black participants. A 3 x 2 ANOVA revealed that there was a marginally significant main effect of skin tone, \( F(2, 74) = 2.93, p = .06. \) Black participants were more likely to hire the light skin black male compared to the white male (\( p = .02 \)). All other effects were not significant (\( p’s > .05 \)).

**Conclusion**

The purpose of this study was to examine the effects of interracial disparities (i.e., colorism) on crime type and criminal sentencing. As expected, the blue-collar crime (i.e., armed robbery) received higher sentencing rates than the white-collar crime (i.e., identity theft), which supports previous research (Hurwitz & Peffley, 1997). Although we were primarily interested in examining the effect that skin-tone and crime type had on the suspect's features, the results suggest that the race of the participant may weigh more heavily than the suspect’s features. This finding was visible in the crime type and ethnicity interaction reported above. Even though all participants provided longer sentencing rates for blue collar crimes, white participants sentenced these same suspects significantly lower than black individuals for the white-collar crime type. An explanation for this could be because of an implicit racial bias. White collar crimes are more likely to be committed by White individuals; thus, white participants could have been showing a bias towards their own race by giving less harsh sentencing. Interestingly, a racial bias emerged for hiring decisions among back participants. When making a hiring decision, the black participants favored (i.e., were more likely to hire) the light skin black over the white male regardless of previous criminal history. Future studies should address how colorism and racial biases affect our CJS, and how those biases indirectly impact other important variables like job placement.

**Acknowledgements**

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**References**


Abstract — Social norms have played a major role in how individuals overtly express their emotions. For example, it is often more socially acceptable for females to express specific emotions such as sadness and fear. Conversely, males may be labeled as weak or sensitive if they were to express such emotions. The purpose of this study was to examine how perceptions of masculinity and femininity are affected by emotional expressions of sadness and fear. Specifically, we were interested in how this varies across gender and different racial backgrounds. Participants were randomly assigned to read six scenarios. Each scenario described either a male or female, Caucasian, African American, or Hispanic individual expressing sadness or anger. After reading each scenario, participants made a personality judgement about the person being described in the scenario by using the Personal Attributes Questionnaire (PAQ; Speence et al., 1974). The results indicated that there was significant interaction between gender and emotion expressed, and there were no effects of race. These findings indicate that when it comes to emotional expression, gender and the type of emotion may make the biggest impact on perceptions of masculinity and femininity.

Keywords — emotional expression, race, aggression, sadness, social norms.

Introduction

The way someone expresses their emotions plays a large role in the social dynamics of relationships. Emotional expression can either enhance or decrease the personal connections between two or more individuals. For example, “burying” one’s emotions is often linked to certain mental health conditions such as anxiety and depression (Marganska et al., 2013). Attachment style may be linked to differences in emotion regulation and chronic use of certain emotion regulation strategies is associated with specific psychological outcomes, such as depression and anxiety symptoms. Unfortunately, social norms have contributed to how individuals express their emotions. It is often more socially acceptable for a female to express themselves emotionally; whereas, males are often perceived as weak or sensitive if they express themselves emotionally. Emotional expression has shown some therapeutic qualities (Greenberg, 2014). Emotion-focused therapy, for example, has helped clients with regulation of their internal states.

Emotional expression is typically learned early in the development of a person. The first experiences with various emotions mainly happen within a household environment. There is some research to suggest that mothers are more expressive within the family environment than fathers (Cassidy et al., 1992; Halberstadt et al., 1995). Furthermore, this research has revealed that mothers may play an important role in the development of girls' expressivity, particularly of positive emotions (Halberstadt et al., 1995). Halberstadt et al. (1995) indicated that mothers typically express more positive emotions, whereas fathers typically express more negative emotions. These findings suggest that a child's first experiences with various emotional expressions are usually linked to those shown by his/her caregiver(s).

While interaction between parenting and gender seems to play a pivotal role in the socialization of emotional expression, one’s ethnic and/or racial background may also be equally important. Previous studies have sought to research people’s implicit attitudes towards African American and Caucasian faces displaying various emotional expressions (Steele et al., 2018). Results from Steele et al. (2018) found that participants implicitly preferred a Caucasian face that displayed a neutral expression over an African American face that displayed a positive expression. Only when categorizing the faces based on the emotional expression they displayed, did participants show an implicit preference for the African American face that displayed positive emotions. Still, it is not known whether these racial differences in emotional preferences manifest themselves in other ways beyond facial expressiveness. The goal of the current study was to further explore how race and gender affects how individuals perceive emotional expression, specifically regarding beliefs about masculinity and femininity.
Method

Participants
Participants for this study were sampled from a population of USC Upstate psychology students. Fifty females and one male participated in this study. The average age of participants was 21. Twenty-five participants identified as Caucasian, 23 identified as African American, and three identified as other. All participants received research credit for participating.

Materials
The study was initiated through the Psychology Research Participation System (SONA). This survey was created in Qualtrics, an online survey building software. For this survey, participants consent was given via an informed consent screen. Participants then were shown a demographic survey asking the participants to indicate their preferred sex, age, and ethnicity. Twelve unique scenarios were created where six described angry emotional expression and six described sad emotional expression. Participants were either shown the angry or sad scenarios. Two scenarios featured names commonly associated as Caucasian names, while two more scenarios featured names commonly associated as African American names. Finally, the remaining two scenarios were commonly associated as Hispanic names. Commonly associated names were determined through a pilot study.

For each scenario participants made a personality judgement about the person being described. Personality judgements were conducted using the PAQ (Speence et al., 1974). The questionnaire asked participants to indicate the extent to which adjectives best characterized the person in the scenario. There were eight adjectives representing the masculine scale and eight adjectives representing the feminine scale. The PAQ has a total of 24 items; however, we only used the masculinity and femininity items. The androgyny scale items were omitted.

Procedure
Participants were given an informed consent form and a demographic survey. Participants were then randomly assigned to the sadness or anger emotion condition. Each participant read six scenarios that featured three males and three females all of different races (i.e., Caucasian, African American, Hispanic). To each of these six scenarios, race was implied based on names commonly associated with that race. Following the scenarios participants made a personality judgement of the individual described in the scenario. This personality judgement was recorded based on the PAQ (Speence et al., 1974). Upon completion of the survey, participants were debriefed and informed of the true purpose of the study.

Results
To examine the effect gender, race, and emotion have on perceived masculinity and femininity a 3 (race: white, black, Hispanic) x 2(gender: male, female) x 2(emotional expression: anger, sadness) mixed-subjects factorial analysis of variance (ANOVA) was performed. The results are indicated as follows: there was a significant main effect of emotion expressed, $F(1,49) = 37.51, p < .001$. There was a significant main effect of gender, $F(1,49) = 28.32, p < .001$. Lastly, there was a significant interaction effect between gender and emotion, $F(1,49) = 95.70, p < .001$. Follow up analysis indicated that there was a significant simple main effect for anger, $F(1,49) = 9.061, p < .004$. Women were perceived as less feminine ($M = .53$, $SE = .59$), whereas men were perceived as more masculine when anger was expressed ($M = 25.4$, $SE = .59$). There was also a significant simple main effect for sadness, $F(1,49) = 126.47, p < .001$. Men were perceived as less masculine ($M = 24.81$ $SE = .53$), whereas women were perceived as more feminine ($M = 33.25$, $SE = .74$) when sadness was expressed.

Discussion and Conclusions
This study aimed to further explore how race and gender affects how individuals perceive emotional expression, specifically regarding beliefs about masculinity and femininity. This study is an extension of a previous study, which found a similar pattern of results between gender and emotions. That particular study sought to find if there was an effect of social norms on gender differences in emotional expression. Based on the results from this study, this further reconfirmed that gender impacts perceptions of emotional expression. As seen in previous research, emotional expression is a key factor in indicating what social norms might exist and even how others perceive an individual's personality. This inference served as the basis to utilize the PAQ (Speence et al., 1974) as a way to better analyze participants perceptions of the scenarios. Using the PAQ, participants clearly demonstrated negative bias against men demonstrating expressions of sadness and women demonstrating expressions of anger. These results seem congruent with established social stereotypes.
Contrary to previous research, race did not have an effect on perceived masculinity and femininity. This result is surprising, because while anger serves as a strong indicator of violating social norms across most cultures (Hareli et al., 2015), this effect is particularly strong for African American males (Graham et al., 1992). The cross-cultural literature has frequently shown that intentionality plays a role in how an emotion is perceived. For example, negative actions perceived as intentional elicit anger, causing those actions to be viewed as hostile behavior (Hareli & Hess, 2010; Hareli et al., 2015). The lack of findings associated with race could be due to a limitation of the manipulation. The use of names as an indicator of race may not have created a strong enough perception of the individual’s described in the scenarios for participants to use information in their personality judgments. Thus, potential future research in this area would likely need to use a manipulation that creates a strong impression of race, such as photos of the individuals associated with the scenarios.

References


An Empirically-Guided Reflection on Hesitancy to Label Oneself an Environmentalist

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Abstract - A group of 413 students at the University of South Carolina Upstate participated in an environmental literacy survey that measured an individual’s environmental knowledge, attitudes, values, beliefs, intentions, and behaviors. Previous data analyses revealed a disconnect within those who engage in environmentally-responsible behaviors (ERBs), such as recycling or reusing plastics, and their identification as an environmentalist, whereby there was a surprising lack of participants who identified as an environmentalist despite reporting concern for the environment and performing ERBs. In the current study, we explored this contradiction through the lens of social identity theory by investigating whether political affiliation accounted for differences in identifying as an environmentalist. Despite many predictable differences in attitudes and beliefs between political affiliations, there were some striking similarities and political affiliations did not differ meaningfully in regards to identifying as an environmentalist. Following several supplemental analyses, we comment on future research.

Keywords — Environmentalism, Political Affiliation, Self-Perception, Social Identity

Introduction

Environmental issues are at the forefront of global concern in our day and age. From climate change and pollution to resource depletion and deforestation, environmental issues have meaningful implications for our lives. Nevertheless, we may not be taking enough action to stop the environmental damage of human activity. Conserving water and energy, eating more eco-friendly food (less meat, veganism, etc.), and buying less bottled water are some of the ways individuals help reduce the destructive human footprint on the planet, while still maintaining a modern and feasible way of life. While individuals across the globe generally care about the environment, and many partake in environmentally-responsible behaviors (ERBs), there are a large number of those same people who do not identify as environmentalists. Previous analyses of the current study’s data revealed that there was a positive relationship between participants’ concern for the environment and their identification as an environmentalist ($r = .48$) and self-reported ERBs ($r = .43$). Nevertheless, descriptive statistics also revealed that more than 56% of participants disagreed with labeling themselves an environmentalist.

Following Fielding and Hornsey (2016), the authors of the current study adopted a social identity approach - a combination of social identity theory and self-categorization theory – to guide an empirical investigation into this phenomenon. Specifically, we chose to investigate the whether political affiliation may affect the likelihood that an individual identifies as an environmentalist.

Clearly, the association with the label of environmentalist goes beyond political affiliation. Drawing on Lacasse (2016), it is notable that the label of environmentalist carries negative connotation despite indicating concern and care for the environment. Neither engaging in ERBs nor having concern for the environment are considered to be negative, but previous research has indicated people still see those who consider themselves environmentalists in a negative light (Bashir et al., 2013). Nevertheless, the present study focused on how identification as an environmentalist varied based on political affiliation.

Method

Data were collected from students enrolled at a local southeastern university ($N = 444$). Data were inspected for careless responding (Meade & Craig, 2012) and 30 cases were removed on the basis of maximum longstring values that exceeded 33% of the self-report survey items. An additional case was removed on the basis of multiple inappropriate text responses. Thus, 413 cases were retained for analyses. Thirty-three percent of the sample were seniors, 91% were enrolled full-time, 70% were female, and 49% were white. Forty-two percent identified as democrats, 21% as republicans, 13% as independents, and 25% as not political.
We recruited students via word-of-mouth to participate in a survey hosted on the Qualtrics survey platform. The survey was rationally constructed by inspecting a wide variety of self-report instruments related to environmentalism, environmental literacy, and environmental knowledge. A full description of the survey’s development and content are beyond the scope of this brief report, however, many attitudes and beliefs were measured using a 4-point agreement scale (1 = Strongly disagree, 4 = Strongly agree). Agreement with the item “I am concerned about the environment” was our indicator of environmental concern. Additionally, participants responded to a 13-item environmentally-responsible behaviors scale (α = .83; “I try to conserve water and electricity,” “I recycle in my home”) using a 4-point frequency scale (1 = Never, 4 = Always). Political affiliation was recorded by respondents self-identifying as “Republican,” “Democrat,” “Independent,” or “Doesn’t Apply/Not Political.”

Results

To examine whether environmental identity varied by political affiliation, a one-way ANOVA was performed. Results indicated that there were no statistically significant differences between groups (F(3, 289) = 1.67, p = .174) and post-hoc comparisons between the each of the four groups did not reveal any meaningful differences. Thus, the data does not support political affiliation as a meaningful, direct predictor of labeling oneself an environmentalist.

Subsequently, a number of item-level means were inspected in order to compare political affiliation on more variables. This was performed in an attempt to provide either more clarity to the results or potential avenues for future research. For many attitudes and beliefs, specifically for republicans and democrats, the data showed a pattern of results that was consistent with expectations (see Table 1; “Differences”). For example, Democrats reported higher concern for the environment and global warming, less religious-based concern for the environment, and stronger agreement that humans cause climate change and that the government should be responsible for addressing environmental issues. Interestingly, independents and not political groups were generally more similar to democrats than republicans.

Alternatively, a number of issues that may be expected to show variation by political affiliation were in fact, quite congruent between affiliations (see Table 1). In particular, means across groups were highly similar for the environmentalist label, whereby no group was above the scale’s midpoint (2.5).

Table 1. Means by Political Affiliation

<table>
<thead>
<tr>
<th>Differences</th>
<th>Democrat</th>
<th>Republican</th>
<th>Independent</th>
<th>Not Political</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Concern</td>
<td>3.49</td>
<td>2.97</td>
<td>3.40</td>
<td>3.16</td>
</tr>
<tr>
<td>Global Warming Concern</td>
<td>3.52</td>
<td>2.82</td>
<td>3.14</td>
<td>3.25</td>
</tr>
<tr>
<td>Religious-based Concern</td>
<td>1.81</td>
<td>2.39</td>
<td>1.94</td>
<td>1.95</td>
</tr>
<tr>
<td>Humans Cause Climate Change</td>
<td>3.50</td>
<td>2.88</td>
<td>3.20</td>
<td>3.35</td>
</tr>
<tr>
<td>Government Should Address Environment</td>
<td>3.28</td>
<td>2.77</td>
<td>3.00</td>
<td>3.04</td>
</tr>
<tr>
<td>Religious-based Concern</td>
<td>1.81</td>
<td>2.39</td>
<td>1.94</td>
<td>1.95</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Democrat</th>
<th>Republican</th>
<th>Independent</th>
<th>Not Political</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification as Environmentalist</td>
<td>2.46</td>
<td>2.20</td>
<td>2.31</td>
<td>2.20</td>
</tr>
<tr>
<td>Our Duty to Care for Nature</td>
<td>3.71</td>
<td>3.58</td>
<td>3.72</td>
<td>3.63</td>
</tr>
<tr>
<td>Concern for Non-US Ecosystems</td>
<td>3.54</td>
<td>3.46</td>
<td>3.71</td>
<td>3.57</td>
</tr>
<tr>
<td>Environmentally-responsible Behaviors</td>
<td>2.34</td>
<td>2.13</td>
<td>2.36</td>
<td>2.19</td>
</tr>
</tbody>
</table>
Conclusions

The purpose of this study was to determine why so many students high in ERB’s and concern for the environment do not identify as environmentalists. Drawing from social identity theory, we expected that political affiliation may influence whether individuals would identify as an environmentalist. While we were not able to answer the research question with our data, we were able to tentatively rule out the direct influence of political affiliation, and raise several questions that inform future research. For example, if political affiliation in an absolute sense was not influential on labeling oneself an environmentalist, is the complexity of political identity that we were not able to capture (i.e., embedness in one’s personal identity or extreme vs. moderate ideology) masking the lack of a direct effect of party? What are the barriers to identifying as an environmentalist for those who are care about the environment and engage in ERBs? Future research into this matter should attempt to identify any physical or psychological boundaries surrounding identification as an environmentalist.

One implication of the attitude/behavior-identity disconnect is that the negative connotations of “environmentalist” could stop some from accepting the label, and as such, may inadvertently prevent others from engaging in environmental behaviors. If researchers can uncover this contradiction between attitudes/behaviors and identity, there is the opportunity to benefit our society and environment. If the majority of people are holding themselves back from identifying as an environmentalist because of a removable psychological barrier, it would benefit everyone if we could remove it. This would allow people to identify similarly, join linking social groups, and coordinate better in the social realm for more environmentally friendly policy enactment.

Post-hoc correlational analyses of the data revealed that responses “We need to stop global warming even if it means raising taxes” had the strongest correlation with labeling oneself an environmentalist ($r = .53$). This may be because those who already identify with more “extreme” positions are more comfortable with accepting the label of environmentalist. One hypothesis could be that one of the connotations of “environmentalist” aligns with that of some sort of extremism, and it overrides the positive aspects of the label, making those who would otherwise consider themselves environmentalists reject it.

Acknowledgements

The inspiration and impetus behind the data collected for this project is due to Dr. Lizabeth Zack’s sociology senior seminar class fall 2019. We are proud to acknowledge the hard work and diverse interests of these sociology students that led to the current study.

References


Where Ya From, Who Ya With? Effects of Childhood Environment and Political Affiliation on Environmentally Responsible Behaviors
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Abstract - This study examined the relationship between a person's childhood environment and political affiliation with the likelihood that they will engage in environmentally responsible behaviors (ERBs). A group of 413 students at the University of South Carolina Upstate participated in an environmental literacy survey. Information gathered from this survey measured an individual’s environmental knowledge, attitudes, values, beliefs, and intentions. Findings indicated that, after controlling for perceived knowledge, actual knowledge, and environmental concern, participants reporting more urban childhood environments also reported engaging in more ERBs than those from environments that are more rural.

Keywords – Environmental Literacy, Political Affiliation, Environmentalist, Social Identity

Introduction
The relationship between humans and the environment is a hotly debated topic, with discussions of climate change being a common example of this. As this is an election year, this topic is more salient by presidential candidates using this issue to garner votes. Thus, the intersection of these phenomena, political affiliation and environmentalism, are highly pertinent. Along with one’s political affiliation we were concerned with childhood upbringing and the impact it may have on one’s likeliness to perform Environmentally-Responsible Behaviors (ERBs), such as recycling and carpooling. Statistics have shown that the majority of conservative republicans tend to live in rural America compared to liberal democrats who typically live in more urbanized areas (Scala & Johnson, 2017). Thus, one’s childhood environment may have a significant influence on one’s values and beliefs. Further, researchers may benefit by considering the relationships between childhood environment and political affiliation.

A major feature of modern republicanism is conservatism, the commitment to traditional values and ideas with opposition to change or innovation. While Republicans do indeed value the environment, there is also a commitment to economic growth, free enterprise, and private ownership. In contemporary times, there seems to be an incompatibility between these two ideas. How can we, citizens and institutions, maximize economic success while still giving the environment the care and respect it is due? How can we claim to care for the environment while simultaneously conducting ourselves in a way that knowingly harms the environment? A major feature of the modern Democratic Party is liberalism, the willingness to respect or accept behavior or opinions different from one’s own. Like conservative republicans, many liberal democrats value economic growth, individual rights, and free markets, however they may also be thought to have the idea that welfare of society in a broad sense comes before the welfare of the individual. Democrats are typically known for speaking in favor of more environmental regulations even if at the expense of a growing economy more so than their republican counterparts. Therefore, there appears to be conflicts within both parties in regards to competing ideologies (economic prosperity and environmental stewardship).

Previous research has often adopted a social identity approach when looking at the tensions that arise between different political parties concerning environmental policies. These intergroup tensions and conflicts are reminders of the powerful influence that social contexts and the groups we belong to can have on our environmental attitudes, beliefs, and actions. Indeed, our environmental behavior and whether we support a particular environmental action or policy may be determined in large part by our group membership (Fielding & Hornsey, 2016). Another approach is the cultural cognition of risk theory, positing a collection of psychological mechanisms that dispose individuals to selectively credit or dismiss evidence of risk in patterns that fit values they share with others (Kahan et al., 2011). This theory may fit nicely alongside the notion of confirmation bias, which states that people have a tendency to search for, interpret,
favor, and recall information in a way that affirms one’s prior beliefs.

Therefore, our research question is: What is the relationship between an individual’s childhood environment (rural-urban continuum) and political affiliation with the likelihood that they will engage in environmentally-responsible behaviors?

Method

Data were collected from students enrolled at a local southeastern university (N = 444). Data were inspected for careless responding (Meade & Craig, 2012) and 30 cases were removed on the basis of maximum long string values that exceeded 33% of the self-report survey items. An additional case was removed on the basis of multiple inappropriate text responses. Thus, 413 cases were retained for analyses. Thirty-three percent of the sample were seniors, 91% were enrolled full-time, 70% were female, and 49% were white.

Students were recruited via word-of-mouth to participate in a survey hosted on the Qualtrics survey platform. The survey was rationally constructed by inspecting a wide variety of self-report instruments related to environmentalism, environmental literacy, and environmental knowledge. Portions of the survey that are relevant to the current study involved: a 12-item environmental knowledge test (the National Environmental Education & Training Foundation), a single-item perceived knowledge question (“In general, how much would you say you know about environmental issues?”), a single-item measure of environmental concern (“I am concerned about the environment”), and a 13-item environmentally-responsible behaviors scale (α = .83; “I try to conserve water and electricity,” “I recycle in my home”). Participants responded to environmental concern and ERB measures using a 4-point agreement scale, and to perceived knowledge using a 4-point scale anchored from 1 = I know nothing to 4 = I know a lot.

Political affiliation was collected but only those affiliating as Republican or Democrat were retained and dummy-coded as 1 and 0 for simplicity. Childhood environment was collected using four categories: Rural farm, Rural non-farm, Suburban, and Urban. Rural categories were collapsed and the rural-urban continuum was created by dummy-coding Rural = 1, Suburban = 2, and Urban = 3.

Results

To test the research question, hierarchical linear regression was performed whereby environmentally-responsible behaviors (ERBs) were regressed on control and predictor variables in a step-wise fashion. In the first step, concern for the environment was entered, accounting for a substantial portion of variance in ERBs (R² = .09, p < .01). To further control for reasons that may account for differences in ERBs, participants’ knowledge score and perceived environmental knowledge were entered in the second step, accounting for incremental validity in predicting ERBs (ΔR² = .049, p < .01). Finally, childhood environment and political party affiliation were entered in the final step and contributed to meaningful, albeit “nonsignificant” variance in ERBs (ΔR² = .028, p < .10; see Table 1).

In the final model, environmental concern (β = .20, p < .05), perceived knowledge (β = .24, p < .05), and childhood environment (β = .15, p < .05) were all positively related to ERBs. Specifically, more urban environments were associated with more environmentally-responsible behaviors.

Table 1. Hierarchical Regression Model Predicting Environmentally-responsible Behaviors

<table>
<thead>
<tr>
<th>Step (Predictors)</th>
<th>β</th>
<th>R²</th>
<th>ΔR²</th>
<th>F Change</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
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<td>.09</td>
<td></td>
<td>16.98</td>
<td>.01</td>
</tr>
<tr>
<td>2 (Step 1 + Knowledge Score + Perceived Knowledge)</td>
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<td></td>
<td>.14</td>
<td>.05</td>
<td>.01</td>
</tr>
<tr>
<td>3 (Step 2 + Childhood Environment + Political Affiliation)</td>
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<td></td>
<td>.17</td>
<td>.03</td>
<td>.06</td>
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<td>Environmental Concern</td>
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<td></td>
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<tr>
<td>Knowledge Score</td>
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<td></td>
<td></td>
<td></td>
<td>.01</td>
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<tr>
<td>Childhood Environment</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
<td>.03</td>
</tr>
<tr>
<td>Political Affiliation</td>
<td>-.06</td>
<td></td>
<td></td>
<td></td>
<td>.41</td>
</tr>
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</table>
Conclusions

The purpose of this study was to examine the relationships between an individual’s childhood upbringing and political affiliation with the likelihood that they engage in environmentally-responsible behaviors. Interestingly, results indicated that a more urban environment rather than a more rural environment was predictive of an individual’s likelihood to perform ERBs, while political affiliation did not appear to be a meaningful predictor beyond childhood environment, perceived knowledge, and concern.

This finding may be a result of the proximity, social visibility, and ease of access to services that encourage environmentally responsible behaviors. (For example, recycling services may not be readily available in a rural environment compared to urban environments). In a study conducted by O’Connor et al. (2010), results indicated that proximity and availability to recycling receptacles had a direct and positive impact on the probability that individuals will recycle. Support for the notion that political affiliation would be a significant predictor of ERBs’s was not found. Results from our final model revealed a stronger influence by an individual’s environmental concern and knowledge than by political affiliation. Although political affiliation and ERBs are probably related – their shared variance seemed to be explained by control variables (concern, perceived knowledge). Environmentally responsible behaviors were measured with the use of an Environmental Literacy Survey that involved questions like “I buy food that is produced in an environmentally-friendly manner” and “I use alternative forms of transportation (bus, walking, bicycling, carpooling, etc.).” Similar to recycling behaviors, buying food that is produced in an environmentally-friendly manner and using alternative forms of transportation may be easier to do in an urbanized environment than a rural environment.

Some limitations of this study related to a rather homogeneous sample (undergraduate students) may have an impact on the generalizability of this study. Future research that utilizes a more diverse sample may be able to provide clarification as to whether this effect, specifically the influence of childhood environment on ERBs, generalizes to non-college students. Further, such research may shed light on whether such influence lessens, increases, or remains consistent as individuals age.

Acknowledgements

The inspiration and impetus behind the data collected for this project is due to Dr. Lizabeth Zack’s sociology senior seminar class fall 2019. We are proud to acknowledge the hard work and diverse interests of these sociology students that led to the current study.

References

Plug-In Electric Vehicle Integration into Smart Grids: An Overview of a Mixed-Integer Linear Programming Optimization Model

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Abstract — Plug-in electric vehicles have seen a rise in popularity for reasons such as efficiency and reduction in greenhouse gas emissions compared to internal combustion engine vehicles. Battery and fast charging technology are improving and getting less expensive, which means that plug-in electric vehicles will become increasingly cost competitive with internal combustion engine vehicles. Due to the potential for high penetration of plug-in electric vehicles, there is a need to design effective mechanisms for the integration of these vehicles into the power grid to avoid adverse effects. This paper describes vehicle-to-grid optimization and explores approaches for solving vehicle-to-grid optimization problems. Furthermore, this paper describes a multi-objective mixed-integer linear programming model for vehicle-to-grid optimization.

Keywords — Plug-in electric vehicles, Vehicle-to-grid, Smart Grid, Optimization

Introduction

Due to the advantages of plug-in electric vehicle (PEV), there is a potential for large-scale PEV integration into the power grid. This integration can have drastic consequences such as high energy costs, power peaks or shutdowns. However, if coordinated intelligently, these issues can be overcome (Egbue & Uko, 2019). This is where the concept of vehicle-to-grid (V2G) comes into play for the optimal coordination of PEV charging and discharging. V2G is generally classified into unidirectional V2G and bidirectional V2G. Where unidirectional means there is only controlled charging, and no discharging occurs from the vehicle to the power grid. An example of unidirectional V2G was implemented in a study by Wang et al. (2018), where they used a mixed-integer programming methodology to solve for an optimal schedule that maximized the revenues in a real-world demand response market in California. In the case of bidirectional charging, the flow of energy from between the grid and PEVs occurs in both directions. Therefore, in a bidirectional case, PEVs can be charged but they can also discharge energy to the power grid. Examples of studies on bidirectional V2G were conducted by Huang et al. (2020) and Li et al. (2020). The authors implemented a multi-objective strategy to coordinate the charging of PEVs. Their model carried out both charging and discharging to reduce the gap between the load peak and the valley. The results of their study show that the use of V2G can reduce the active power loss and power supply pressure.

Vehicle-to-grid optimization can be carried out for a single objective or multiple objectives depending on the goals of the designer and system planner. For single objective methods, the purpose of the problem is to either maximize or minimize a chosen objective while for multi-objective methods, more than one objective is considered in solving for the optimum charging schedule of the participating PEVs. Studies conducted by Hosseinpour and Egbue (2015) and Egbue and Hosseinpour (2014), address bidirectional V2G optimization with single objective functions. However, to satisfy all the participating stakeholders in a V2G system, the multi-objective optimization may be used instead of a single objective. Several studies have implemented multi-objective optimization of V2G. An example of such implementation is a model by Tong et al. (2014). The authors used NSGA-II to solve a multi-objective problem that minimized the charging cost and minimized the load variance in the system. These objectives were solved while considering constraints such as the power limit and the charging efficiency. The results of their study showed that their proposed strategy was effective in reducing the charging cost of participating vehicles compared to an uncontrolled scenario. In the next section, an overview of a multi-objective optimization by Egbue and Uko (2019) is presented.

Multi-Objective Mixed-Integer Linear Programming Model for V2G System Optimization

Egbue and Uko (2019) developed a mixed-integer linear programming optimization model for a V2G system. The methodology for modeling the V2G system is shown figure 1 below. The authors argue that to carry out the optimization of the V2G system, certain factors including the requirements of participants in the system should be taken into account.
consideration. This consideration is essential to develop objectives that meet the needs of all participants where possible. Three key participants are considered in the study by Egbue & Uko (2019), namely the electric utility, PEV owners, and the charging station agent also known as the PEV aggregator. As illustrated in figure 1, the study considered two objective functions that focused on minimizing the PEV drivers’ cost of participating in V2G and maximizing the aggregator’s profit. The study was subject to several constraints such as a constraint that the state of charge (SOC) of the participating vehicles must remain within the range of their given battery capacity. Another constraint considered was setting the charging power not to exceed 6.6 kW. There were also constraints related to PEV arrival times and departure times to ensure that vehicles only charge during periods when they are in the charging station. The information that was used to generate realistic travel behavior and characteristics for the vehicles in the simulation were obtained from National Household Travel Survey (2018) and U.S. Department of Energy (2020). The results of the optimization include a Pareto front that presents the conflicting relationship between the different objectives and the best trade-off points where neither objective outperforms the others.

**Figure 1. Vehicle to grid Optimization overview**

The study can be expanded to account for more objectives of the various stakeholders in order to increase satisfaction of V2G participants. For instance, for the PEV owners, the objectives could include minimizing the charging cost, maximizing earnings from selling energy back to the grid, minimizing the degradation effect on the battery due to repetitive charging and discharging and receiving adequate charging to get to the next available charging opportunity. The aggregator’s objective includes maximizing profit from operating the charging station, ensuring vehicles are charged to meet the customer’s expectation on departure, and providing ancillary services such as frequency regulation. For the electric utility, objectives include the reduction of energy production cost, peak demand shaving and valley filling, frequency regulation, and reduction of emission cost.

**Conclusions**

The topic of using V2G optimization to augment the performance of the power grid is very important given the potential for mass deployment of V2G and related impacts on the power grid. This paper provides an overview of V2G optimization and discusses some methods and approaches for solving V2G optimization problems. Furthermore, a multi-objective mixed-integer linear programming model developed by the authors is
described. Finally, this study emphasizes the importance of considering objectives of V2G stakeholders when solving V2G optimization problems in order to meet stakeholder needs where possible.

Acknowledgements

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References


Progress on Establishing the Heavy Metal Profiles of Lake Murray and Lake Thurmond

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Abstract — It is necessary to establish a profile for the heavy metal concentration of a watershed in order to ensure that pollution is not adversely impacting the environment. In this report we establish the heavy metal concentration in water and sediment for Lake Murray, SC and Lake Thurmond on the Georgia-South Carolina border. Heavy metals were extracted from the sediment by means of an acid digestion. Water samples were preserved by the addition of nitric acid and stored at 4 °C. All samples were analyzed utilizing graphite furnace atomic absorption spectroscopy. The measured concentrations were compared to the naturally occurring background levels of the heavy metals, as well as the guidelines established by the United States Environmental Protection Agency.

Keywords — Heavy Metals, Surface Water, Sediment, Lake Murray, Lake Thurmond

Introduction

One of the most significant threats to our supply of fresh water is pollution, it has been estimated that up to one third of the stream miles in the United States are at risk of being significantly polluted (Stoker & Seager, 1976). Heavy metals represent a class of pollutant that cannot be decomposed into safer compounds, as can occur with some organic pollutants. Common heavy metal pollutants include lead, cadmium, zinc, chromium, cobalt, and nickel. The most likely sources for these heavy metals are sewage treatment facilities, mining, metal processing, and textile manufacturing (Audry et al., 2004; Birch et al., 2001; Bubb & Lester, 1996; Dey & Islam, 2015). The health impact of heavy metal poisoning has been well documented (Tchounwou et al., 2012).

Samples Collection and Preparation

Sediment and water samples were each collected from the same location, which are detailed in Figure 1. Water samples were collected in glass jars which were pre-cleaned with nitric acid, and filtered with Whatman no. 41 filter paper. To each water sample, 1 mL of concentrated nitric acid was added then stored at 4 °C prior to analysis. Sediment samples were collected from the surface sediment (top 8cm). Heavy metals were extracted from the sediment via acid digestions according the EPA Method 3050B (EPA, 1996). Samples were analyzed using graphite furnace atomic absorption spectroscopy (Perkin Elmer PinAAcle 900T), with the default furnace program for each element. Each sample was analyzed in triplicate to determine the average and standard deviation of each metal in each sample.

Results and Discussion

The concentration of various heavy metals in the sediment are shown in Table 1. The measured concentrations of Cu, Cd, Mn, and Pb are on the order of the naturally occurring background concentration (Canova, 1999). The concentration of Cr is on the order of the naturally occurring background concentration, with isolated samples having slightly higher concentrations than the naturally occurring background level (Canova, 1999). The concentration of each heavy metal (Cu, Cd, Mn, Pb, and Cr) are below the United States Environmental Protection Agency screening level for groundwater (US EPA, 2019).

Conclusions

The measured concentration of the heavy metals in the sediment were on the order of the naturally occurring background concentrations. As the concentrations are similar to the natural levels, pollution is likely not the cause of the measured concentrations. In all water samples, every metal was below the screening level established by the United States Environmental Protection Agency, and thus the concentrations measured in this study is not a cause for concern.

Acknowledgements

The authors would like to thank Dr. Daniel Pardieck for many helpful discussions on the geological sources of the heavy metals in this study.

References

Audry, S., Schäfer, J., Blanc, G., Bossy, C., &


### Figures & Tables

**Table 1.** Concentration of heavy metals in collected sediment samples. BD means the metal was below the detection limit of the instrument (5ppb).

<table>
<thead>
<tr>
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<td>3.77 ± 0.0767</td>
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<td>2.47 ± 1.09</td>
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<td>29.8 ± 0.263</td>
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<td>0.095 ± 0.00242</td>
<td>3.10 ± 0.156</td>
<td>9.46 ± 0.387</td>
<td>18.2 ± 0.839</td>
</tr>
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Table 2. Concentration of heavy metals in collected water samples. BD means the metal was below the detection limit of the instrument (5 ppb)

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Figure 1. The maps show the sample locations for Lake Murray (A) and Lake Thurmond (B&C)
The Effect of Decreasing pH on Dominance Relationships of Tiger Pistol Shrimp, *Alpheus bellulus*

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**Abstract** — Increasing carbon dioxide levels in the ocean pose a threat to the biology of marine invertebrates, but how is not widely understood. We observed social interactions of tiger pistol shrimp, *Alpheus bellulus*, at three different pH levels to assess the effects of decreasing pH on dominance relationships. Dominance relationships changed across the different pH levels, while the duration of encounters did not.

**Keywords** — ocean acidification, environmental change, marine invertebrates

**Introduction**

The tiger pistol shrimp, *Alpheus bellulus*, is native to the Indo-West Pacific, where it burrows in the sandy substrates of shallow seas. These and other snapping shrimps are territorial and establish dominance using hydrodynamic signaling via low-energy gill currents and high-energy, snapper-claw generated water jets (Obermeier & Schmitz, 2003). Anthropogenic increases in atmospheric CO₂ are driving ocean acidification (Feely et al., 2009), and the elevated CO₂ levels and associated decreases in pH have been observed to alter behavior in several aquatic invertebrates and vertebrates (Watson et al., 2017). While there has been considerable research on snapping shrimp burrowing (Karplus et al., 1972; Palomar et al., 2005), sound production (Lillis & Mooney, 2018), and dominance establishment (Obermeier & Schmitz, 2003), we are just beginning to learn of the effects of ocean acidification on these types of behavior. Rossi et al. (2016) found that the intensity and frequency of pistol shrimp snapping sounds were reduced at increased CO₂ levels. In this project, we investigated potential effects of reduced pH on established dominance relationships between pairs of *A. bellulus* and on the amount of time (and thus energy) they spent establishing and maintaining dominance.

**Materials and Methods**

A group of six tiger pistol shrimp, *Alpheus bellulus*, were purchased from a commercial supplier and maintained individually in separate 38 liter saltwater tanks. The tanks contained a 3 cm deep substrate of live reef sand, and each also housed one red reef hermit crab, *Paguristes cadenati*, to initiate and maintain tank nitrogen cycling. A small Duetto submersible filter provided biological filtration in each tank. The aquaria were kept at a specific gravity of 1.02-1.03 g/cm³, a temperature of 19-20°C, and a starting pH of 7.95. Measurements were made three to four times per week using a standard aquarium hydrometer and an Extech EC500 ExStik II pH/conductivity meter. In each tank, a 15 cm length of longitudinally sectioned PVC served as shelter for the shrimp. The subjects were maintained on a 12 hour light / 12 hour dark time schedule and fed a diet of frozen brine shrimp three times a week. Aquaria were separated by opaque plastic dividers to ensure visual isolation of the shrimp.

Shrimp were assigned to same-sex (Miya and Miyake, 1969), similar-size pairs and observed in staged interactions to assess dominance relationships at each of three pH levels: 7.95, 7.75, and 7.45. We decreased the pH sequentially to somewhat mimic the natural progression of ocean acidification. The different pH levels were achieved by adding seltzer water to the subjects’ home aquaria. Interaction trials were conducted in a 19 liter aquarium holding 6 liters of water comprising one liter from each of the subjects’ home tanks. This allowed us to efficiently create a uniform environment controlling for salinity, temperature, pH, and potential conspecific chemical cues. To ameliorate effects of potential fight-related chemical cues, the test aquarium was rinsed and restocked with new home-tank water after each trial.

For each trial, an introduction chamber constructed of two vertical PVC tubes was placed into the test arena. Subjects were then placed into each tube separately and allowed to acclimate for 5 minutes before the introduction chamber apparatus was lifted, leaving the shrimp to interact freely in the test arena. Trials continued until the shrimp had engaged each other and one of the shrimp retreated. With the exception of a seven-day interruption between the first two testing dates, pairs were tested once every two to four days until each pair had been observed 5 times at each of the
three pH levels. Data collected from each trial included latency to the first encounter (the first moment the subjects were clearly aware of each other’s presence), the times of all snaps generated, the time at which one of the subjects retreated (decision latency, from the start of the first encounter to the decision), and which shrimp won and lost the fight. We examined decision latencies for differences among treatments using the Quade test (Conover, 1999).

**Results**

Although not every pair engaged in fights in all five of their matches at each pH level, they all did so in at least three matches at each pH level, allowing us to determine winners for each pairing at each pH level. Dominance relationships in two of the three pairs reversed after the first reduction in pH and then reversed again after the second pH reduction (Figure 1). There was no statistically significant difference in amount of time between initial encounters and the ends of fights (decision latency) among the different pH levels (Quade test, $T = 0.897, df = 2, 4, p = 0.48$; Figure 2).

**Conclusions**

Decreasing pH did not appear to systematically alter the amount of time subjects spent fighting and establishing dominance. Interestingly, the environmental change might have had a temporary effect on the dominance relationships in two of the shrimp pairs. One pair, individuals C and E, only fought in three trials at the middle pH level, thus the dominance reversal was somewhat equivocal. Individuals A and F, however, demonstrated a complete and decisive reversal. These two individuals were the largest of the six shrimp and also the only males, raising the question as to whether an interaction between environmental change, sex, and/or size might temper loser and winner effects (Obermeier & Schmitz, 2003). The possibility that ocean acidification could alter the stability of dominance relationships warrants further investigation, as it is relevant to the evolution of populations in the face of environmental change.

**Acknowledgements**

We thank the Lander University Department of Biology for funding, Lisa McDonald for helpful discussion and assistance with figures, and Emily Prince and Jason Lee for equipment loans.

**References**


Figures

**Figure 1.** Proportions of fights won by individuals in three pairs of tiger pistol shrimp, *Alpheus bellulus*, at three different pH levels: 7.95 (High), 7.75 (Med), and 7.45 (Low). Proportions are based on the number of matches (n) in which encounters occurred (not all pairs interacted during each of their five trials at each pH level).

**Figure 2.** Median decision latencies (the amount of time between initial encounters and the ends of fights) of three pairs of tiger pistol shrimp, *Alpheus bellulus*, at three different pH levels: 7.95 (High), 7.75 (Med), and 7.45 (Low). The median latencies did not differ significantly among the different pH levels.
Bisphenol A Degradation by Peroxymonosulfate Activated Via Magnetically Separable Nanocomposite

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Abstract - Sulfate radical (SO₄⁻•), generated via activation of peroxymonosulfate (PMS) can degrade organic pollutants in aqueous systems. The main goal of this work is to develop an environmentally friendly and recyclable nanocomposite that can efficiently activate PMS for bisphenol-A (BPA) degradation. Magnetic iron oxide nanoparticles (Fe₃O₄) were coated with manganese oxide (MnOₓ) via two methods of reagent addition. The first (mode 1; M₁-MnOₓ), was accomplished by adding manganese (II) sulfate (MnSO₄) dropwise to a solution of potassium permanganate (KMnO₄) and iron oxide nanoparticles. In the second (Mode 2; M₂-MnOₓ), KMnO₄ was added dropwise to a solution containing MnSO₄ and iron oxide nanoparticles. Both Fourier-transform infrared (FTIR) spectroscopy and thermogravimetric analysis (TGA) confirmed the successful coating of the nanoparticles. PMS (0.01 - 0.05 mM) was activated by the particles for BPA (2.00 ppm) degradation at pH 4.0 and fixed ionic strength (1 mM NaCl). BPA concentrations were determined using high-performance liquid chromatography (HPLC) fitted with a fluorescence detection system. Our results indicate PMS, activated via manganese coated iron nanoparticles, was highly effective in BPA degradation.

Keywords - Pollutant degradation, HPLC analysis

Introduction

BPA is a monomer used in the production of polycarbonate and epoxy polymers, which have applications in the production of many household and commercial products, including paints, food container liners, etc. (Koh et al., 2006; Rochester, 2013). As a result of its widespread applications in numerous products, BPA has been detected in many food products, human body fluids, natural waters, and drinking water (Vinas et al., 2012). Sulfate (SO₄⁻•) based advanced oxidation processes initiated by the catalytic activation of peroxymonosulfate (PMS) or persulfate (PS) are gaining interest in the treatment of water (Huang et al., 2017; Sun & Wang, 2015). Sulfate radical (SO₄⁻•), generated via activation of PMS can degrade organic pollutants in aqueous systems. It has been demonstrated that the application of Fe₂O₃ as a support for MnO₂ enhanced PMS degradation of 4-dichlorophenol (Saputra et al., 2013).

Two different magnetic iron oxide nanoparticles modified with manganese oxides by varying the mode of reagent addition were synthesized in our lab and shown to exhibit strikingly different BPA degradation potential in water. Magnetic nanoparticles (MNs) coated by the first mode (addition of KMnO₄ before Mn²⁺ to MNPs degraded nearly all BPA in solution within 2 days, but nanoparticles coated by the second mode (addition of Mn²⁺ before KMnO₄ to MNPs) did not degrade a significant amount of BPA (Omoike & Hall, 2016). In this work, magnetic iron nanoparticles were coated with manganese oxides and used to activate PMS for accelerated BPA degradation.

Experimental Methods

Magnetic iron oxide nanoparticles (Fe₃O₄) were coated with manganese oxide (MnOₓ) using two reagent addition methods. The first method (Mode 1; M₁-MnOₓ), was conducted by adding manganese (II) sulfate (MnSO₄) dropwise to a solution of potassium permanganate (KMnO₄) and iron oxide nanoparticles. The second method (Mode 2; M₂-MnOₓ), KMnO₄ was added dropwise to a solution containing MnSO₄ and iron oxide nanoparticles. Both coating methods were conducted at room temperature under constant sonication. PMS (0.01 or 0.05 mM) was activated by the particles for BPA (2.00 ppm) degradation at pH 4.0 and a fixed ionic strength (1 mM NaCl). BPA concentrations were determined using high-performance liquid chromatography (HPLC) fitted with a fluorescence detection system. Our results indicate PMS, activated via manganese coated iron nanoparticles, was highly effective in BPA degradation.

Results

Both Fourier-transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA) confirmed the successful coating of the nanoparticle using both coating methods (Figure 1 and 2). Activation of PMS (0.01 mM) activation with M₁-MnOₓ and M₂-MnOₓ degraded >97 % and >90 % of BPA respectively within 24 h (Figure 3). Complete degradation of BPA was achieved within 2 h when PMS concentration was increased from 0.01 mM (Figure 3) to 0.05 mM (Figure 4).
Figure 1. FTIR spectra of uncoated magnetic iron oxide nanoparticles compared with manganese oxide coated nanoparticles (modes 1 and 2).

Figure 2. Derivative TGA profiles obtained under nitrogen atmosphere of uncoated magnetic iron oxide nanoparticles compared with manganese oxide coated nanoparticles (modes 1 and 2).

Figure 3. Percent degradation of BPA by mode 1 (M1-MnOx) and mode 2 (M2-MnOx) over time with low concentration of PMS. Reaction conditions: \([BPA]_0 = 2.00\) ppm; \([PMS]_0 = 0.01\) mM; mass of MnOx MNPs = 0.1000 g. The error bars are set to mean ± SD (n = 2).

Figure 4: Percent degradation of BPA by mode 1 (M1-MnOx) and mode 2 (M2-MnOx) over time with high concentration of PMS. Reaction conditions: \([BPA]_0 = 2.00\) ppm; \([PMS]_0 = 0.05\) mM; mass of MnOx MNPs = 0.1000 g. The error bars are set to mean ± SD (n = 3).

Conclusion

Our results demonstrate that the coated nanoparticles are highly efficient in activating PMS for BPA degradation in aqueous systems. The particles synthesized utilizing mode 1 coating process were much more effective in PMS activation when compared to the particles utilizing the mode 2 coating process. In addition, due to iron core of the MNPs, manganese oxide coated particles can be easily retrieved for reuse via an external magnet.

Acknowledgements

We would like to thank Dr. Haijun Qian of Clemson University’s Electron Microscope Facility for his assistance with TEM analysis. In addition, we would like to thank USC Columbia’s Magellan Voyager Program and USC Upstate’s Office of Sponsored Awards and Research Support for partial funding of our work.

References


Synthesis, Characterization and Effects of an Alkoxysilane Bisphenol A on Epoxy Composites

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Abstract – Epoxy resins are used to make thermosetting materials with desirable mechanical properties and high thermal and chemical resistance. However, to be used for epoxy telescope mirrors these thermosetting materials have a relatively high Coefficient of Thermal Expansion (CTE). Alkoxysilanes have been shown to lower the CTE while enhancing the thermal, optical and mechanical properties of epoxy resin. Diglycidyl ether of 2,2'-di(triethoxysilyl) bisphenol A was synthesized, characterized, and mixed with other epoxies then cured using a tetrafunctional diamine. The CTE, storage modulus, and glass transition temperature were determined.

Keywords – Low CTE composites, Epoxy Telescope Mirrors, Alkoxysilanes

Introduction

Varying the temperature of a material causes its dimensions to change; the basic idea of expansion when a substance is heated or contraction when cooled. The Coefficient of Thermal Expansion (CTE) of a material quantitatively outlines this thermal property (Sulaiman et al., 2006). For telescope mirrors, the CTE value needs to be as low as possible because dimension variations affect the imaging properties of the mirror. Some CTE progress has been made on spin-cast epoxy telescope mirrors with the incorporation of carbon nanotubes and polyhedral oligomeric silsesquioxanes (Smith & Brodhacker, 2017); both of which are well known for lowering CTE values in composites.

The addition of an alkoxysilane to an epoxy allows for the formation of an organic-inorganic hybrid composite which has significantly better thermal properties (Lee et al., 2006). This method has also been successful in lowering the CTE of epoxy composites which include bisphenol A starting materials. Alkoxysilanes generally lower the CTE because of the presence of silicon and oxygen atoms. Due to the inward torqueing around the Si-O bond, these compounds will contract when heated (the opposite of epoxy) which lowers the CTE of the overall polymer (Abad et al., 2003).

The original components to make epoxy mirrors were carefully chosen to include a 50:50 mixture of two epoxies: diglycidyl ether of bisphenol A (DGEBA) and cyclohexane dimethanol diglycidyl ether (ED757), with 4,4-methylene-bis-3-chloro-2,6-diethylaniline (MCDEA) as the curing agent. Such compounds provide the best conditions for curing, such as high modulus, slow reaction rate, and low viscosity.

This research focuses on the synthesis and characterization of a bisphenol A type epoxy with an alkoxysilyl functionality and investigates its effects on the CTE, storage modulus, and glass transition temperature of composites containing the original components listed above.

Experimental

Materials

Diglycidyl ether of bisphenol A (DGEBA) epoxy resin type was supplied by Mozel. Cyclohexane dimethanol diglycidyl ether (ED757), ordered from Chemarco, was used as a diluent for the epoxy. The curing agent, 4,4-methylene-bis-3-chloro-2,6-diethylaniline (MCDEA), was supplied by Air Products. Platinum oxide and 2,2’-diallyl bisphenol A were purchased from Sigma Aldrich. All other materials were purchased from Fisher Scientific and used with no further purification.

Synthesis

In the first step of the synthesis (see figure 1.), 37.26 g of 2,2’-diallyl bisphenol A and 111.3 mL of epichlorohydridin were refluxed at 82°C for 24 hrs in 350 mL of acetonitrile with 99.71g of anhydrous potassium carbonate (K₂CO₃) catalyst. Thin Layer Chromatography (TLC) was used to track the reaction progress at hourly intervals. The solid catalyst was removed from the mixture using vacuum filtration. Epichlorohydridin and acetonitrile were removed from the solution using rotary evaporation. Using equal amounts of diethyl ether and hexanes as a solvent, flash column chromatography was used to separate the diglycidyl ether of 2,2’-diallyl bisphenol A product from the solution. Fractions containing the product were subjected to rotary evaporation and the remaining liquid (2.16 g) was reacted with 2.20 mL of triethoxysiliane in 12.5 mL of toluene solvent with 0.03 g of platinum oxide (PtO₂) at 85°C in an oil bath for 24 hrs. The product was centrifuged to
remove PtO$_2(s)$ colloidal particles and the supernatant liquid was rotary evaporated to acquire the final product, diglycidyl ether of 2,2’-di(triethoxysilyl) bisphenol A.

**Figure 1.** 2,2’-diallyl bisphenol A (a) and epichlorohidrin were refluxed to make diglycidyl ether of 2,2’-diallyl bisphenol A (b) which was then reacted with triethoxysilane in benzene to make diglycidyl ether of 2,2’-di(triethoxysilyl) bisphenol A (c).

**Polymerization and Analysis**

Diglycidyl ether of 2,2’-di(triethoxysilyl) bisphenol A was mixed with a 50/50 mixture of DGEBA and ED757 at varying weight ratios. The sample mixtures were cured using MCDEA. After curing, samples are sanded for modulus and Tg testing using a Q 800 DMA from TA Instruments according to ASTM D 4065-01 and samples were sanded and cut for CTE testing using a Q 400 TMA from TA Instruments according to ASTM E 831 – 06.

**Results**

![IR spectrum](image)

**Figure 2.** IR spectrum of triethoxysilane (red), diglycidyl ether of 2,2’-diallyl BPA (black), and the final product (blue) A strong Si-C doublet at 1075cm$^{-1}$ for the final product (also present in the triethoxysilane) confirmed that the final product was diglycidyl ether of 2,2’-di(triethoxysilyl) bisphenol A.

**Characterization**

After a positive identification of the product was made on the IR (see figure 2.) further characterization tests were done using NMR. 1H-NMR of diglycidyl ether of 2,2’-diallyl Bisphenol A (60MHz, D-chloroform): $\delta$ = 1.7 (s, 6H, C-(CH$_3$)$_2$), 2.6-2.9 (m, 4H, epoxy, ph-CH$_2$-C), 3.2-3.4 (d, 4H, epoxy, ph-O-CH$_2$-C), 3.7-4.2 (m, 2H, epoxy, C-CH-), 4.0-4.2 (d, 4H, epoxy, C-CH$_2$-O), 4.9-5.1 (d, 4H, C=CH$_2$), 5.6-6.3 (m, 2H, -CH=C), 6.7-7.2 (m, 6H, ph-H).
CTE, Storage Moduli, and Tg.

Table 1. Increasing the alkoxy silyl content slightly increases the CTE. A sample without the alkoxy silyl component had nearly twice as much of the storage modulus as the functionalized epoxies. The alkoxy silyl function lowered the glass transition temperature of the samples.

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Conclusions

The function of the alkoxy silyl as an agent to lower the CTE of the epoxy composites is outweighed by its effect on the arrangement of the long chain molecules in the network (see Table 1). The bulky propyl triethoxysilyl function disturbs the alignment of the bisphenol molecules and impedes the pi-pi stacking of the benzene rings hence weakening the composite as evidenced by the decreasing glass transition temperatures with increasing alkoxy silyl content. The weak crosslinks in the epoxy macromolecules in turn causes the composite to be unable to withstand a large strain thus a significantly low storage modulus. In the future, to curb this effect, a less bulky alkoxy silyl function can be used, or a catalyst/additive that can correctly orient the chains for better intermolecular interactions can also be used.

Acknowledgements

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References


Analysis of Knockoff Cosmetics Utilizing Polarized Light Microscopy and Infrared Spectroscopy
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Abstract - The recent expansion of the cosmetic industry has led to a high demand of counterfeit makeup products, which while not highly regulated, are increasingly affordable. A genuine James Charles Eyeshadow Palette was purchased from a reputable source and was compared to an eyeshadow palette from Wish.com that was noticeably trying to replicate the original product. To analyze the eyeshadow samples, Polarized Light Microscopy (PLM) and Infrared Spectroscopy (IR) were utilized. It was determined that the eyeshadows had distinctive differences in ingredients, optical properties, and in peaks appearing on their IR spectra.

Keywords- Cosmetics, Infrared Spectroscopy, Polarized Light Microscopy, Eyeshadow

Introduction

Cosmetics are a broad category of self-care items including powders, lipsticks, lotions, perfumes, hair sprays, skin-care creams, hair colors, deodorants, etc (FDA, 2020). The cosmetic industry has grown exponentially in the past years and the global market is expected to reach approximately $805 billion within the next 5 years (Lei, 2019). One of the main influencing factors of this growth can be attributed to the video-sharing website, YouTube. Many cosmetic brands have started partnering up with popular “beauty vloggers” who have millions of followers on this platform. They share make-up tutorials and reviews of the newest cosmetics products to hit the market. The collaborations with these YouTube stars help companies reach a larger target audience, especially younger consumers (Jones & Gelbart, 2018).

The rise of the beauty industry comes with a surprisingly large black market for knockoff makeup. Customs and Border Protection even stated that these counterfeit products cause the cosmetic industry to lose approximately $75 million a year (CBS News, 2017). Although most of the counterfeit cosmetics are sold by vendors at street markets, a large amount is starting to be sold online on websites like Wish.com and Aliexpress.com, where consumers find “too good to be true” prices. Some products are even advertised to be the authentic product, containing the same packaging and branding. The producers of the knockoff makeup products will replace ingredients from the original formula so they can sell at such a low price. The ingredients will either be replaced by something similar and cheaper, or they will add ingredients that might contain contaminants like mercury, lead, arsenic and cyanide (Lei, 2019). Consumers are not only getting lower quality products; they are also risking their health by purchasing products that can contain harmful ingredients.

Polarized Light Microscopy and Infrared Spectroscopy will be used in this study to compare product formulations and to test for contaminants. PLM is one of the main accepted methods for identifying asbestos, which can be found in a common cosmetic ingredient, talc (“Asbestos Analytical Methods”, n.d.). IR spectroscopy is also a widely used technique when analyzing cosmetics, especially in the forensic field. This is due to the fact that it is fast, requires minimal sample and preparation, and will not destroy the sample (Chophi et al., 2019).

Experiment

PLM Analysis

A variety of both pressed pigments and eyeshadows from the authentic James Charles Palette were placed into labeled glass vials with their corresponding shade names. A small bent spatula was used to transfer the scraped eyeshadow into the vials. This process was repeated with a variety of shades from the knockoff eyeshadow palette. Acetone was used to clean the spatula between different eyeshadows.

Each sample was used to prepare microscope slides using either canola oil or cassia oil as the medium, which have refractive indices of 1.465 and 1.620, respectively. A small drop of this medium was placed onto a labeled microscope slide that had been cleaned with a kimwipe to remove any dust. A dissecting needle was used to pick up a very small amount of the sample and was tapped to place the particles onto the slide. A clean cover glass was placed on top of the sample and a pencil eraser was used to gently press on the cover glass to separate the particles. This was repeated with each sample.

The polarized light microscope (PLM) was set up with 10x ocular lenses and each slide was observed
to determine if different particles were isotropic, their refractive index, transparency, color, morphology, retardation colors, and color index of pigments. Pictures were captured using a phototube attached to the top of the polarized light microscope using each the 4x, 10x, 40x, and 60x objective lenses.

**IR Analysis**

Each sample was testing using an IR spectrophotometer with a solid sample attachment. The spectra produced were analyzed to check for any contaminants in the product, specifically heavy metals. The spectra were also used to compare the formulas of the authentic eyeshadow samples to the knockoff eyeshadows by analyzing the occurrence and magnitude of the peaks.

**Results**

![Figure 3: Infrared Spectrum of both authentic and knockoff versions of the shade “Artistry” from each palette](image)

**Discussion**

The ingredient list on each product’s packaging were compared to find similarities and differences. The authentic eyeshadow palette had thirty-one different ingredients, whereas the knockoff product had only eighteen. The ingredients that both formulations had in common were mica, talc, magnesium stearate, nylon-12, and eight different types of pigments. The majority of the ingredients that were missing from the knockoff formulation are additives that improve the consistency and texture, and additives that condition the skin (phenyl trimethicone, isononyl isononanoate, tridecyl trimellitate). This indicates that the knockoff eyeshadows are lower quality and will not perform as well as the authentic eyeshadows.

When comparing the real eyeshadow to a knockoff of the same shade, it was determined that each sample was optically different. This immediately confirms that the knockoff cosmetics are not the same formula as the real product. Figures 1 and 2 show photomicrographs of the shade “Wig” from each palette. Both photos were taken at the same magnification and thus show the difference in particle size between the two samples. The particles in Figure 1 are mostly a rusty brown color, whereas the particles in Figure 2 are a variety of blues, greens, purples, and browns. Similarly, some of the particles in each sample have a similar morphology that resemble thin, flat, plates. This could indicate that these are particles of mica, an ingredient listed in each of the eyeshadow formulations.

When comparing the shade “Brother” from each palette, it was determined that each eyeshadow had blue pigment, red/pink pigment, and crystals of
equant and shard morphology present. The authentic eyeshadow also had the presence of perfectly spherical particles that were not present in the knockoff version. The crystals in each sample were further analyzed and it was determined that both the authentic and knockoff eyeshadows had anisotropic crystals with a refractive index between 1.465 and 1.620 based on the mediums they were mounted in. It was also determined that the crystals had a low birefringence based on the blue and yellow colors that were exhibited when a full wave retardation compensator was used. Crystals from each sample also exhibited parallel extinction angles. The sample from the James Charles palette had a noticeably smaller amount of red pigment and crystals distributed throughout the slide.

The IR spectra produced for each authentic and knockoff eyeshadow sample were used to compare the occurrence and magnitude of the peaks. An example of a comparison spectra produced is shown in Figure 3, which depicts the shade “Artistry” from both palettes. Although the spectra appear very similar, there is an absence of a peak at approximately 1750 cm⁻¹ in the knockoff eyeshadow. Also, the peaks occurring at approximately 1000 cm⁻¹ and 1250 cm⁻¹ in the knockoff eyeshadow are noticeably larger than those in the authentic James Charles eyeshadow.

**Conclusion**

The results of this study comparing authentic cosmetics to knockoff products utilizing Polarized Light Microscopy and IR spectroscopy demonstrates that the products are different. This was determined based on the optical properties of particles in each sample, the ingredients, and the presence or absence of peaks in the corresponding IR spectra. No known contaminations were found in the two cosmetic products.

**Acknowledgements**

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**Reference**


Substrate Temperature Preferences of Basking Eastern Painted Turtles (Chrysemys picta picta)

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Abstract -- Eastern painted turtles were surveyed in an environmental chamber to evaluate substrate temperature preferences before and after acclimation. We believed that both groups would have similar temperature preferences. Turtles underwent two sequential 10-day trials using air temperatures of 25°C and 30°C. Turtle movement on the basking platform were evaluated using the computer program Ethovision 14 to determine substrate temperature preference. We found that the most turtles preferred a substrate temperature slightly below 30°C for basking. Surprisingly, turtles novel to the chamber and exposed to 30°C air temperatures preferred a 41.5°C substrate temperature.

Keywords - Chrysemys picta, Basking, Temperature Preference

Introduction

Like all reptiles, the Eastern Painted Turtle (Chrysemys picta) is an ectotherm and dependent on the environment for body temperature regulation. Turtles achieve this body temperature regulation via a behavior called basking. The temperature that turtles acquire during basking events is referred to as the operative environmental temperature ($T_e$). However, Schwarzkopf and Brooks (1985) and Crawford et al. (1983) conducted field studies on turtle $T_e$ preferences and reported widely different results. Unfortunately, field studies include uncontrollable factors such as variations in air temperature and water temperature that may influence results and replicability. Crawford et al. found that turtles basked when the $T_e$ exceeded 28°C and that substrate temperature was closely related to $T_e$. Schwarzkopf and Brooks found that turtles preferred a basking $T_e$ between 19.5°C and 21.5°C and noted that C. picta body temperature and $T_e$ were within 1.5°C of each other.

Although studies have been conducted on the $T_e$ and temperature preferences, there has been no consensus regarding the optimal basking temperature for C. picta. Huey and Bennett (1987) hypothesized a coadaptation of thermal preference and performance, what might be considered an animal’s optimal $T_e$. At this temperature, physiological processes should function at or near an optimal level. By utilizing a controlled environment, a more precise estimate of turtle basking temperature preferences may be determined. The purpose of our study was to assess the preferred basking temperature of the Eastern Painted Turtle under tightly-controlled laboratory conditions.

Materials and Methods

Turtles were captured through a partnership with Scotsgrove Stables located in Inman, SC. Turtles were captured periodically from Spring through early Fall (2018-2020). Turtles were captured using hoop traps and transported back to the University of South Carolina Upstate located in Spartanburg, SC. Turtles were housed at the University in a holding tank until their designated trials were completed (up to 4 months). The holding tank was a 189-liter, modified horse trough. All turtles were housed together while waiting experimental trials. Water was maintained at a constant 25°C. The holding tank was fitted with an artificial basking area illuminated by a UV lamp to simulate sunlight, and a ceramic thermal lamp for heat. The UV lamp was set to a 12h diurnal cycle, with the light on at 10AM.

The experiment was conducted inside a modified Percival Scientific AR-41L2 environmental chamber. Inside the chamber, a 150 L aquarium (90cm x 38cm x 40 cm) was placed onto a specially designed support platform. The aquarium was filled with approximately 100 L of water. Water depth was maintained at 30cm. The environmental chamber itself allows full control of humidity +/- 10%, temperature and lighting cycle. The chamber maintained a 12h light cycle (10am on 10pm off) and 50% humidity. Air temperature in the chamber was either 25°C or 30°C, depending on the specific trial. Aquarium water was filtered using an external wet/dry system with mechanical separation and bacterial degradation. Water cooling was accomplished using an aquarium chiller. A closed-loop circuit pumped water through the chiller into the chamber, then through cooper heat-exchanging pipes located on the bottom of the 150 L aquarium. Water was kept at 20°C at all
times. To ensure that turtles did not get caught under the copper heat-exchanging pipes, a plastic eggcrate was fitted to the bottom of the chamber above the pipes. Turtles were fed using an electric feeder to dispense food daily. Videos of turtle activity were recorded during the 12 hours of light; no nocturnal behavior was assessed.

The acrylic basking platform was 40cm x 20cm, not including the ramps on each short side. The top of the platform was filled with play sand to a depth of 1.5 cm. The platform was mounted in the center of the aquarium within the environmental chamber. A 200 watt ceramic heat emitt er was suspended 27cm above one end of the platform. Substrate temperatures were determined using ibuttons placed on the sand surface recording the temperatures at each of the 10 zone centers.

Turtle trials were a maximum of 10 days each. Trials were either control-only (Air temperature 25°C, Water Temperature 20°C), or a combined run that included both a control and experimental (Air temperature 30°C, Water temperature 20°C) trial. The type of trial used first for each combined run, the control or experimental trial, was randomized. During the combined run, a turtle underwent 10 days of one trial followed by 10 days using the other parameters (control or treatment). The chamber was cleaned and reset on day 10, between trials, to ensure the health of the turtle.

Data was analyzed using Noldus Ethovision 14 software to track and score frequency, and duration of each basking event as well as the turtle’s location on the platform. To assess the preferred substrate temperature for basking, the platform was divided into 10 temperature zones. Each turtle was analyzed based on Control vs Treatment and whether they were “novel” to the chamber. Novel was defined as having no prior exposure to the experimental chamber. EthoVision was set to track each turtle using a detection setting calibrated to track the movement of the turtle by size. If a discrepancy was observed the detection setting was recalibrated to ensure accurate tracking by Ethovision. Turtles were analyzed in two groups within the control/treatment and novel vs. not novel, turtles were split into pre-acclimation and post acclimation. Acclimation being the time it takes the turtles to display consistent behavior which is displayed around Day 8 in the chamber (Pitts & Ferris, 2018).

Results

Turtles (n=7) were observed for a total of 50 days (including both treatment and control). Noldus Ethovision 14 software was used to track basking activity and generate the cumulative time turtles spent in each of the 10 substrate temperature zones (Figure 1). Days 1 and 2 and Days 8 & 9 were consolidated into before acclimation and after acclimation, groups, and treatment or control groups. Due to the descriptive nature of this study, no statistical analyses were performed.

Days 1 and 2 control “novel” turtles spent 73% of their time on the basking platform in temperature zones that were less than 30°C. After acclimation, Days 8 and 9 control “novel” turtles spent 64% of their time in temperature zones less than 30°C. In comparison, on Days 1 and 2 control “not novel” turtles also spent 75% of their time on the platform at temperatures less than 30°C. Days 8 and 9 control “not novel” spent 51% of their time in the temperature zones that were less than 30°C.

Days 1 & 2 treatment “novel” turtles spent only 2% of their time in temperatures less than 30°C. However, they spent 97% of their time in temperature zones more than 30°C. After acclimation, Days 8 & 9 treatment “novel” spent 41% of their time on the platform in temperatures less than 30°C. Days 1 & 2 treatment turtles “not novel” spent 51% of their time in the areas that had temperatures less than 30°C. This is widely different than the other turtles. On Days 8 & 9 treatment “not novel” spent only 20% of their time in temperatures less than 30°C.

Discussion

Overall, the turtles preferred a substrate temperature that was slightly below 30°C. By percent, they typically spent the majority of their time within this area. This was observed in turtles from treatment and control groups, regardless if they were new to the environment or not. This matched well with reported Te operative environmental temperatures of C. picta (Crawford et al. 1983). However, there was one notable exception. Turtles that were novel to the chamber and under treatment conditions occupied the very warmest substrate zone (41.5°C) with 97% of their basking time spent in this area. This was unexpected as previous literature reports that turtles typically will not bask or occupy an area with a temperature that is warmer than what they prefer (30°C). It is difficult to hypothesize why these particular turtles preferred this very warm substrate but it could have been due to the stress of an unfamiliar environment.

Due to the small sample size, and the preliminary nature of this research it is hard to say if these results are consistent throughout the population of the Eastern Painted Turtle. Further trials will need to be conducted to refine the data.
and allow appropriate statistical analyses. Our data supports published literature that the Eastern Painted turtle strives to maintain a body temperature close to 30°C.

**Acknowledgements**

We would like to thank Mrs. Bob Scott of Scotsgrove Stables in Inman, SC for the generous loan of her painted turtles.

**References**


**Figures**

*Figure 1.* Example of activity maps generated by Noldus Ethovision 14. Red indicates the area with highest turtle occupancy.
The Effects of *In Ovo* Ethanol Injections on Craniofacial Development in Chick Embryos

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Abstract — Craniofacial abnormalities of the embryo is one of many complications that can occur after excessive alcohol consumption in pregnant women. This experiment investigated the effects of ethanol on craniofacial development in chick embryos. Fertilized chicken eggs were injected in ovo with either a 25% or 50% ethanol solution on embryonic day 2 (E2). Dlx-5 mRNA expression was observed on E15 of the craniofacial region of the chick, and embryos were harvested to observe cartilage and bone development. The embryos were examined for anatomical differences relating to the craniofacial region. Results showed that more microcephaly occurred in embryos treated with a 50% ethanol solution compared to the 25% ethanol solution and control. Dlx-5 expression decreased as ethanol concentration increased indicating an overall decline in neural crest cell migration and substantial bone ossification.

Keywords — Craniofacial, Microcephaly, Neural Crest Cells, Ethanol, Dlx-5

Introduction

Prenatal alcohol exposure (PAE) is the largest known cause of developmental disabilities. It affects between 9 and 50 births out of 1000 in the U.S. and that number increases to 68 to 89 out of 1000 in populations with high levels of alcohol abuse (May et. al., 2007). If a mother consumes too much alcohol during pregnancy, complications can arise in numerous areas of the embryo. Fetal alcohol syndrome (FAS) is characterized by growth retardation, mental deficiencies, and numerous craniofacial and neuronal abnormalities (Cartwright & Smith, 1995). The type and severity of these defects can be widespread and may be affected by timing and dosage of maternal alcohol exposure (Cartwright & Smith, 1995). Alcohol can be a huge factor in affecting the embryonic development of the cranial region. The neural crest, an intricate cell population, forms much of this region including the skull and facial skeleton, teeth, cartilage, and tendons (Graham et. al., 2004). Chick embryos treated with 2% ethanol displayed craniofacial defects due to substantial cell death and reduced neural crest cell migration (Zhang et. al., 2017). This can also lead to microcephaly which is a condition where the circumference of the head is smaller than normal. Dlx-5 is a homeobox gene that controls the pattern of cranial neural crest cells and is expressed during development of the craniofacial region, brain and limb (Robledo et. al., 2002). This study aimed to analyze the effects of ethanol on craniofacial development, microcephaly, and Dlx-5 expression in a developing chick embryo. It is expected that embryos treated with increasing concentrations of ethanol will display microcephaly and decreased Dlx-5 expression.

Methods

This experiment was approved by the Lander University Institutional Animal Care and Use Committee (IACUC). Nine dozen fertilized chicken eggs were purchased from Clemson University and were split into three groups, control, 25% ethanol solution, and 50% ethanol solution. Each embryo was injected with 50µl of the respective treatment 48 hours following incubation (E2). The chick embryos and craniofacial tissue was collected on E15. Whole embryos were stained with Alcian Blue and Alizarin red according to the protocol used by Yamazaki et. al. (2011). Embryos were then observed for anatomical differences in the cranial region. Tissue was also extracted from the craniofacial region for analysis of Dlx-5 mRNA expression. Tissue homogenization and RNA isolation was conducted using the Qiagen RNeasy Plus Mini Kit. Reverse Transcription of the extracted RNA was performed using GoScript Reverse Transcription System protocol (ProMega Corporation). qRTPCR was performed. The data was analyzed using a one way ANOVA and Tukey’s HSD Post-hoc test was used to determine the difference among the groups.

Results

Examination of the chicken embryos after staining and rinsing resulted in noticeable differences between control and treatment groups. The 25% ethanol treated group exhibited some microcephaly and underdevelopment of the head region, which may be due to a slight reduction in neural crest migration in the hindbrain and forebrain, when compared to the control. The 50% ethanol treated group exhibited extreme microcephaly and considerable underdevelopment.
of the head region compared to the control and 25% ethanol group (Figure 1). There is a significant decrease in Dlx-5 expression between the control and 25% groups (p<.01), the control and 50% groups (p<.01), and the 25% and 50% groups (p<.01; Figure 2).

**Figure 1:** Craniofacial morphology of embryos stained with Alcian Blue and Alizarin Red. Alcian Blue stains cartilage as Alizarin Red stains bone. The control embryo on the left exhibits a darker stain (as shown by the arrow) whereas the 50% ethanol treated embryo on the right shows reduced staining.

**Figure 2.** Densities of Dlx-5 expression in E15 chick embryos treated with 25% EtOH, and 50% EtOH. The results are represented as mean ± SEM. There was a significant decrease in expression between the control and 25% groups (p<.01), the control and 50% groups (p<.01), and the 25% and 50% groups (p<.01).

Conclusions

The injection of ethanol at E2 caused substantial differences in craniofacial characteristics and overall body development as the concentration of ethanol increased. A study, by Kiecker (2016), examined the effects of ethanol on cranial development on chick embryos and concluded there was overall underdevelopment in the head region with smaller and shorter facial features. This is consistent with our findings as there was microcephaly and an apparent emptiness and lighter staining of the Alcian Blue in the cranial region observed in embryos treated with ethanol due to less cartilage and bone formation. This is likely due to the high rate of ethanol-induced cell death from the cranial neural crest (Cartwright and Smith, 1995) which made the embryos notably softer and more fragile when handling. qRTPCR showed evidence of decreased Dlx-5 expression between the control and both treatment groups. This is also consistent to a previous study. Zhang et. al. (2017) noted a downregulation of HNK1 expression in ethanol treated chick embryos. HNK1 is another gene responsible for cranial neural crest cell migration and brain development. Future studies will involve using a scanning electron microscope to show more detail of cranial neural crest cell migration.

Acknowledgments

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References


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The Effect of Caffeine on Left Ventricular Wall Thickness in Developing Chicken Embryos

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Abstract - Caffeine addiction is a current issue posing many health risks in individuals, including its negative effects on the developing embryo. The purpose of this study was to investigate the effect of increasing concentrations of caffeine on left ventricular wall thickness in developing chicken embryos. Embryos were injected in ovo with either 3.75, 7.5, or 11.25 μg/ml of caffeine on embryonic days (E) 1, 2, 3, 9, and 15. On E18, the hearts were harvested, processed, sliced, and the thickness of the left ventricle was measured. There was a tendency for the left ventricular wall thickness to decrease as caffeine concentration increased, however, a one-way ANOVA provided no significant difference among the treatment groups compared to the control. Although there was no significant difference, the decreased trend in myocardial thickness is consistent with previous studies performed in embryonic mice.

Keywords - Caffeine, Left Ventricle, Hypertrophy

Introduction

Caffeine is a widely consumed stimulant drug and is consumed in various forms ranging from over-the-counter supplements to cups of tea. Caffeine is known for its transient ability to increase alertness and energy. Despite caffeine’s popularity, various studies have demonstrated its negative effects on embryonic development. Ma et al. (2012) demonstrated that caffeine inhibited neural tube development. One study performed by Rana et al. (2010) demonstrated increasing caffeine concentration decreased heart rate in zebrafish embryos. However, few studies have been conducted on heart development, specifically left ventricular hypertrophy (LVH). LVH is an increase in the thickness of the ventricular wall. It is usually caused by hypertension, cardiac diseases, and can also be due to intense exercise training (Lorell and Carabello, 2000). Pregnant mice treated with 20 mg/kg of caffeine from E 8.5 -10.5 displayed a decrease in the myocardium during left ventricular development (Wendler et al., 2009). In addition, caffeine treatment in adult rats was found to be linked to LVH. The caffeine treated rats displayed an increase in myocardium thickness and the left ventricle had a smaller diameter than the control (Ahmad et al., 2015). This study aimed to demonstrate the effects of increased concentrations of caffeine over several days on left ventricular wall thickness in developing chick embryos. It is predicted that increasing concentrations of caffeine would cause increased left ventricular wall thickness.

Methods and Results

Methods

This experiment was approved by the Landers University Institutional Animal Care and Use Committee. Five dozen fertilized broiler chicken eggs were purchased from Clemson University and divided evenly into four groups: untreated, 3.75 μg/mL, 7.5 μg/mL, and 11.25 μg/mL of caffeine, respectively. The treated groups were injected in ovo with 100 microliters (μL) of their respective concentrations of caffeine on embryonic days (E) 1, 2, 3, 9, and 15. On E18, the hearts were harvested. Tissue slicing was performed by first processing the harvested heart tissue with an Excelsior AS (ThermoScientific). The hearts were then embedded in paraffin wax using a Histostar (ThermoScientific) and sliced (8μM cross sections) using a Microtome HM 355S (ThermoScientific). Tissue slices were placed onto slides, melted, and stained using Harris Hematoxylin and Eosin staining protocol (IHC World). Measurements were taken along five points of the left ventricular wall using the Motic images + 2.0 software (Figure 2). A
one-way ANOVA test was performed to analyze the thickness of the ventricle wall from each sample.

Results

Treatment of caffeine showed that it had no significant effect on left ventricular wall thickness with increasing concentrations (p>0.05). However, the data displays a decreased trend in thickness with increasing concentrations. The control group had an average ventricular wall thickness of 345.25 μm, the averages for the treatment groups were 357.06 μm, 327.2 μm, and 291.11 μm respectively (Figure 1).

Conclusions

The caffeine treatments had no significant effect on the thickness of the left ventricles of the treated chicks, as shown by the one-way ANOVA. However, results showed there was a trend towards a negative correlation between increasing caffeine treatment and decreasing left ventricular wall thickness, as Figure 1 shows the control hearts had on average, thicker left ventricular walls than the highest concentration of caffeine (11.25 μg/mL). It was hypothesized that developing chicks treated with increasing concentrations of caffeine would experience increasing left ventricular wall thickness. Although our data does not support this hypothesis, it is consistent with previous studies where pregnant mice were given in utero injections of one concentration of caffeine and the embryos displayed decreased myocardial thickness. The embryonic mice later showed LVH in adulthood (Wendler et al., 2009).

Based on the findings of this study, left ventricular thickness may still decrease with increasing concentrations of caffeine and like the mice, develop LVH as adults. The results of our study should not be dismissed until additional studies are completed. Future studies will include higher concentrations of caffeine, as well as observing the expression of genes involved in heart development.

Acknowledgements

We would like to thank Lander University for supplying the funds, facilities, and equipment for this experiment. We would also like to extend a sincere thank you to Dr. J. Maze for her assistance and mentorship during this experiment.

References


**Figures**

**Figure 1:** Left ventricular wall thickness in E18 chick embryos treated with 3.25, 7.5, and 11.25 µg/ml caffeine. There is no significant difference between the groups (p>0.05). The results are represented as mean ± SEM.

**Figure 2:** The left ventricular wall of a heart treated with 11.25 µg/mL of caffeine using Motic images + 2.0 software.
Does an Intermittent Sucrose Treatment Followed by its Removal, Cause Symptoms Associated with Withdrawal Induced Anxiety in CD-1 Mice?

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Abstract — Sugar intake in today’s society is prevalent across all ages. Of growing concern is how sugar is an addictive substance and can alter stimulation in the brain. The present experiment seeks behavior data on mice on an intermittent 10% sucrose intake compared with control water intake in an elevated plus maze. Using 5 CD-1 mice per group for 14 treatment days indicated a significant difference in sucrose intake over water intake in the experimental. Further results suggest there is no significant difference between time spent within any area of an elevated plus maze. This data supports the conclusion that a 5 day withdrawal period did not induce a period of addiction within CD-1 mice.

Keywords — Sucrose, anxiety, addiction, mice

Introduction

In today’s society, foods with high sugar content are marketed especially to children via many forms of advertising. With mounting evidence supporting that sugars are an addictive substance, their frequent use in the Western culture is concerning (Rada et al., 2005; Megalie et al., 2007). Consuming sugar regularly is theorized to cause the brain to adjust its hedonic setpoint to assuage the stress of surplus stimulation (Koob & Moal, 1997). A greater consumption of sugar would then be required to receive the same pleasure response. A study done by Grimm et al. (2005) on rats’ incubation of craving suggests that craving for sugar increases as time abstinent is prolonged.

With evidence supporting sucrose as an addictive substance, this study is focused on the behavioral aspects of sucrose as an addictive substance. This research was used to determine whether the withdrawal symptom of anxiety occurs when mice that show binging behavior are given an abstinence period and tested for anxiety within an elevated plus maze.

Materials and Methods

Ten CD-1 mice were group housed (5 mice per shoe box cage) in a controlled facility. The light/dark cycle was from 7am to 7pm over the course of the 14 days of treatment. A 10% sucrose solution was provided in addition to water on an intermittent 12hr chow and treatment schedule. Sucrose intake was recorded 1hr after provided. Water intake by both groups was recorded 1hr after provided beginning on the sixth day of treatment. On Day 14, sucrose treatment was terminated for a 5-day abstinence period. After abstinence, each mouse was tested for 5 minutes in an elevated plus-maze. Time spent in open/center/closed area of the maze was recorded with methods as previously described by Csilla et al (2019), excluding differences such as manually using a stopwatch and a camera system to record for data validity. Maze dimensions were: length of one arm (20in), width of space in arm (4in), and height of maze (20in). Independent sample ANOVA was used for maze area time percent differences. All experiments were approved by the Lander University Animal Care and Use Committee (IACUC).

Results

The behavior of the mice within the elevated plus-maze did not reflect that expected of mice undergoing withdrawal. The 12hr intakes from 7pm-7am was recorded. Independent sample ANOVA showed significant difference between the sucrose treated mice and the control mice (n=5) intake of water over the course of treatment (p<0.05) (See Figure 1). Independent sample ANOVA was run between the Control (without sucrose) and Sucrose group of mice (n=5). No significant difference was found between the average times of each treatment group within each arm of the maze (See Figure 2).

Conclusions

The mice showed a preference for the 10% sucrose solution based on the difference of intake between the (sucrose treated group) sucrose intake and the (control group) water intake. However no significant difference was found between the control and treatment groups during the elevated plus-maze test. This indicates that elevated intake of 10% sucrose solution, although preferred, did not cause withdrawal symptoms within the mice. Previous studies with rats (Grimm et al., 2005; Rada et al.,
and humans (Goldstein, 2007) involving addiction include a training, or reward aspect in their studies which may have brought to light behavioral factors this study did not access without.

References


Figures

Figure 1. Liquid intake by each group of mice over a 12hr period separated by content. Mice were treated with 10% sucrose solution for 14 days on a 12hr intermittent schedule. Initial and final volume of solution and water was recorded as necessary for each group of mice at onset and end of the 12hr period. Using ANOVA, a significant difference between the intake of 10% sucrose and the control intake of water was determined (p<0.05).

Figure 2. Average time spent by each group of mice in areas of elevated plus-maze. Mice were placed in center of maze at which time was taken upon four paws making contact with maze. For an area to be considered occupied, all paws were required to be within area. No significant difference was found between the average times of each treatment group within each arm of the maze.
Does Vitamin B12 Affect Gene Expression in a Human Neuronal Cell Line?

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Abstract — Vitamin B12 consumption has increased via energy drinks, vitamin waters, and supplements. Little research is dedicated to high levels of Vitamin B12; research has centered on low Vitamin B12 and associated neurotoxic homocysteine levels. Interestingly, as Vitamin B12 consumption increased, neurological diseases such as Autism Spectrum Disorders (ASD) increased exponentially. Currently, 1 in 59 children is diagnosed with ASD. ASD is a disorder that involves epigenetics, and neurobiology changes that lead to behavioral patterns like decreased sociability and increased repetitive behaviors. These behavioral changes are rooted in neuronal communications involving vesicle trafficking along microtubules that are stabilized by Tau using dynein and kinesin as molecular motors. Vitamin B12 has the potential to affect gene expression since it assists with the one carbon metabolic pathway where a methyl group is added to DNA and histones. Therefore, we investigated whether excess Vitamin B12 affects gene expression and vesicle trafficking in a neurobiological model, the SHSY5Y cell. High Vitamin B12 does slightly affect gene expression in SHSY5Y cells so far, and more research is needed to understand the physiological changes that may occur with high Vitamin B12 exposure in a full organism.

Keywords — Vitamin B12, Autism, Vesicle Trafficking, Gene Expression, Epigenetics

Introduction

One of the most common neurobiological disorders that is linked to a deficiency of B Vitamins like Vitamin B12 is Autism Spectrum Disorders (ASD). According to the Center for Disease Control, 1 in 59 children have been diagnosed with ASD (CDC, 2019). ASD presents with decreased social interactions and increases in aggressive and repetitive behaviors (Lewis et al. 2007). Studies have associated nutritional deficiencies with ASD, and hence, low Vitamin B12 levels have been studied extensively. One of the main ways a person counteracts Vitamin B12 deficiency is to consume high doses of Vitamin B12 at levels well above the FDA’s recommended daily amount through either supplementation or via injections. Some commonly found supplements can contain up to or more than 2,500 mcg of Vitamin B12, which is 41,667% of the FDA’s recommended daily amount for an individual. Excess Vitamin B12, however, has received little attention when it comes to neurological effects.

Behavioral changes in ASD can be attributed to both the neurobiological changes, specifically dendritic spine count changes and decreases in neuronal intracellular trafficking, and epigenetic changes. Metabolically, Vitamin B12 is used to produce methyl-cobalamin, which is a cofactor for methionine synthase enzyme that assists in formation of a methyl group by forming S-adenosylmethionine (SAM). SAM is then utilized to donate a methyl group to DNA and/or histones. This affects gene expression. Little is known, however, in regards to how Vitamin B12 may affect vesicle trafficking in neurons, which is the basis for neuron to neuron communication. Proper neuronal communication relies on microtubules that are stabilized by Tau protein. If Tau is hyperphosphorylated, aggregates form and it will not stabilize microtubules, causing dynein and kinesin motor proteins to be trapped in tangles. Low Vitamin B12 levels have been studied extensively and are associated with high homocysteine (Hcy) levels, which are neurotoxic. Increased Hcy leads to higher activity of a cyclin-dependent kinase (CDK5) that phosphorylates proteins like Tau (Shirafuji et al., 2018; Zhang et al., 2008). Increased Hcy also inactivates a protein phosphatase (PP2A) that removes phosphates from proteins like Tau (Shirafuji et al., 2018). Therefore, high Hcy is likely a cause of neurofibrillary tangles through hyperphosphorylation of Tau. However, in many circumstances, a deficiency in a vitamin does cause similar effects as an overconsumption, as has been seen in the many folic acid studies done in many different labs (Al Sayed et al., 2019; and Degroote et al., 2018). Vitamin B12 is thought to inhibit Tau aggregation, but these studies were done using isolated bacterial Tau protein mixed with Vitamin B12 in a test tube (Raffiee et al., 2017).

Physiological studies indicate synthetic Vitamin B12 (in fortified foods and dietary supplements) combines with a protein called intrinsic factor in the stomach so that the intrinsic factor-Vitamin B12 complex can be absorbed by the small intestines (Carmel, 2008; Klee, 2000). Absorption drastically decreases when the stomach intrinsic factor is
saturated with Vitamin B12, notably at only a 1-2 mcg dose (Carmel, 2008; Klee, 2000). However, it has been proven that Vitamin B12 can be absorbed by diffusion without intrinsic factor. This is concerning considering there are many energy drinks and Vitamin waters that contain 100% of the FDA’s recommended daily amount, grains are fortified with Vitamin B12, and supplements such as the prior mentioned supplement contain exorbitant levels of Vitamin B12. The Mayo Clinic states that high Vitamin B12 is associated with neurological symptoms such as anxiety, but there is no research into how this may occur (Mayo Clinic, 2017). Recent study shows the association of extremely high levels of B12 levels with ASD risk in humans, and this should lead to concerns regarding the B12 exposure on early brain development (Ji et al., 2017). It is evident there needs to be more research both in vitro and in vivo for the effects of excess Vitamin B12. Therefore, my study investigated the effects of high Vitamin B12 on gene expression and vesicle trafficking in a neuronal cell line.

**Materials and Methods**

SHSY5Y cells were grown in tissue culture-treated T75 flasks with DMEM:F12 medium supplemented with 10% fetal bovine serum (FBS) and 1% penicillin/streptomycin at 37°C with 5% CO2 and high humidity. Cells were passaged at 80% confluence and were plated at 50,000 cells/well in 24-well tissue culture treated plates for gene expression experiments. Three replicates were obtained per treatment group per experiment. Cells were plated at 15,000 cells/well on poly-d-lysine coated glass coverslips for vesicle trafficking analyses. Cells were then differentiated with 10uM all-trans-retinoic acid for 72 hours using reduced-serum medium (3% FBS). After differentiation, cells were treated with a control (water), 2x Vitamin B12, or 10x Vitamin B12 treatment based on the amount of Vitamin B12 already in DMEM:F12. The 2x dose is equivalent to persons that are diagnosed with “elevated” B12 levels, and the 10x dose is equivalent to B12 levels in persons with liver disease.

Protein was isolated from cells using the RIPA buffer system from Santa Cruz. Each protein sample consisted of the contents of 12 wells- four wells from three separate 24-well plates. Three replicates per treatment group were obtained for a total of 9 samples. Protein amounts were determined by Bradford Assay and Western Blotting was done PP2A, a phosphatase that dephosphorylates Tau. B-tubulin was also assayed as an endogenous control in Western Blotting. Images were analyzed using ImageJ. Statistical analyses were conducted via t-tests. Dynein, Kinesin, Tau, P-Tau, and CDK5 Western Blotting and vesicle trafficking studies are still currently in progress.

**Results**

Expression of PP2A was not changed significantly between treatment groups though it did increase some in the 2x B12 treated cells (Figure 1).

**Conclusions**

PP2A expression did not change significantly, but it did increase some in the 2x B12 treatment group. The lack of significance might be due to the large variation in PP2A expression among the 3 replicates. Since PP2A expression did not significantly change, we might expect that Tau phosphorylation could remain the same (Raffiee et al., 2017; and Shirafuji et al., 2018). This is not a definitive statement though, as CDK5 expression is just as important since CDK5 phosphorylates Tau. We also still don’t know whether dynein or kinesin expression levels are altered, which could affect retrograde and anterograde transport, respectively.

**Acknowledgements**

We would like to thank the Magellan Scholar program (University of South Carolina) for funding of the work presented. We would also like to thank Whitnei Smith for assistance with Western Blotting. Finally, we would like to thank Dr. Ben Montgomery, chair of the Division of Natural Sciences and Engineering at the University of South Carolina Upstate, for his support of the work presented.

**References**

Al Sayed, R., Smith, W., Rogers, N., Smith, N., Clark,


Mathematical Model of Zombie Epidemic

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Abstract — In this work, we develop a simple mathematical model to analyze the outbreak of a zombie infection in a given population. We develop a SIR (Susceptible-Infected-Removed) type epidemiological model to predict the evolution of infection and conversion of healthy humans to zombies in a closed population over time. Our model results in three coupled nonlinear ordinary differential equations. For a fixed infection rate $\beta$, we find analytical steady state solutions of the system and present numerical solutions to illustrate model outcomes. We also refine the model to consider more realistic case of variable infection rate $\beta = e^{rt}$, where infection rate depends upon the zombie population. Graphical results are presented and discussed in detail.

Keywords — Zombies, infectious diseases, infection rate, ordinary differential equations

Introduction

People who operate in a conformist and by the book fashion with respect to science may argue that real life data has to be utilized to reveal the hard to reach truths of the world; however, we believe that we can establish key associations and highlight important trends, merely by using thought experiments.

We have all probably seen at least some sort of media detailing zombies, whether it be a comic or a movie or a video game--these living yet dead humans are pervasive in popular culture. Therefore, we thought it would be an interesting mathematical study to explore what a potential zombie pandemic would look like, especially in light of the deadly Corona virus spreading worldwide.

On a more serious note, let us explore the mathematics and epidemiological aspect of this issue. According to Kermack and McKendrick (1927), one of the basic procedures in modeling of any disease outbreak is to use a compartmental model, in which the population is divided into different groups. This kind of model predicts the number and distribution of cases of an infectious disease as transmitted through a population over time (Rhodes & Allman, 2003).

There are three distinct classes: the susceptible, “S”-- healthy individuals who are vulnerable to infection-- the infected, “I”-- those who got the disease and can transmit it further-- and the removed, “R”-- individuals who got the disease and are now recovered from infection or died.

Schematically, the individual goes through consecutive states: “S” to “I” to “R”. Intuitively, such models are often called the SIR models in today’s scientific literature (Munz et al., 2009; Rhodes & Allman, 2003).

Mathematical Model

Model Assumptions

The SIR model is used in our work to compute the amount of susceptible, infected, and recovered people in a population. This model remains valid to use under the following assumptions:

1) Our model includes constant births at fixed rate $\Pi$ and deaths at constant rate $\delta$

2) The only way a person can leave the susceptible group is to become infected or due to natural death.

3) Zombies only die when you destroy its brain or cut its head off. Some of the dead can ‘resurrect’ and become zombies, increasing the zombie population.

4) Age, sex, social status, and race do not affect the probability of being infected.

5) There is no inherited immunity.

Our model is best represented by this flow diagram:

We define $S(t)$ to be the population of susceptible individuals-- that is, individuals who have not yet contracted infection. $Z(t)$ refers to the population of individuals that are currently infected and exhibit symptoms of being a zombie. For simplicity, we assume that as long as a person is infected with the disease, the infected person is capable of transmitting the disease to a susceptible person. $R(t)$, the removed population, represents the population of individuals who have been infected and have either recovered from the illness or have died (Munz et al., 2009; Woolley et al., 2014).
What follows is a derivation for the mathematical equations for all three variables.

Equation for Susceptible Population
This is a group of healthy normal people with natural births and deaths and vulnerable to zombie attack. The group $S(t)$ is changing with respect to time. Here are a few important characteristics of this group:

(i) $S(t)$ increases due to constant births, represented by $\Pi$
(ii) $S(t)$ decreases due to natural deaths (non-zombie related) at a constant rate $\delta$
(iii) Most importantly, this group decreases due to zombie encounter resulting in a bite.

Including all three factors, our first equation for the susceptible population takes the form:

$$\frac{dS}{dt} = \Pi - \beta SZ - \delta S. \quad (1)$$

where $\beta$ represents the encounter rate at which the zombie-human interaction is likely to happen, and $\delta S$ represents the number of people dying with natural causes.

Equation for Zombie Population
This population group consists of zombies, a group people which can turn more humans into zombies. This group $Z(t)$ is also changing with respect to time. Some key aspects are:

(i) $Z(t)$ increases due to a successful zombie attack on humans, which results from a bite
(ii) $Z(t)$ decreases when during an encounter the human wins and the zombie is killed.
(iii) $Z(t)$ increases, when dead people wake up again as ‘resurrected zombies’ and contribute to the zombie population.

Including all three factors, our second equation for the zombie population takes the form:

$$\frac{dZ}{dt} = \beta SZ + \xi R - \alpha SZ. \quad (2)$$

where $\alpha$ represents the encounter rate which results in the death of a zombie and $\xi R$ represents the number of dead people coming back as zombies.

Equation for Removed/Dead Population
The Removed/Dead population group, intuitively, consists of people that are removed or dead. The removed group $R(t)$ is also changing with time:

(i) $R(t)$ increases due to natural deaths of susceptible individuals
(ii) $R(t)$ increases when zombies are beheaded during each encounter
(iii) $R(t)$ increases when zombies resurrect and therefore contribute to the zombie population.

Including all three factors, our last equation for the removed population takes the form:

$$\frac{dR}{dt} = aSZ - \xi R + \delta S. \quad (3)$$

The differential equations given in (1), (2) and (3) are the governing equation for our model. The system they represent is a coupled nonlinear system of ordinary differential equation given below:

$$\frac{dS}{dt} = \pi - \beta SZ - \delta S$$
$$\frac{dZ}{dt} = \beta SZ + \xi R - \alpha SZ$$
$$\frac{dR}{dt} = aSZ - \xi R + \delta S$$

Conclusions

We developed a simple mathematical model for zombie infection and illustrated possible outcomes with the help of numerical solutions. In the first set of results, we kept the infection rate, $\beta$, as a constant. Then, we refined the model to introduce a variable zombie dependent infection rate: $\beta = e^{\varepsilon Z}$. With the help of steady state analysis, we determined the equilibria and their stability, under further simplified assumptions. We conclude that in the case of zombie outbreak, there will be no co-existence, unless some kind of cure or treatment or vaccine is introduced into the population.

References

Synthesis of VHL Ligand for the Development of PROTAC Degrades

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Abstract — Proteolysis Targeting Chimeras (PROTACs), which mediate the degradation of select proteins of interest by hijacking the activity of E3 ligases for protein ubiquitination and subsequent degradation by 26S protease, are molecules that are currently being studied and used to develop new potential drugs that can provide the capability to target and degrade specific proteins of interest. In this study, PROTACs were used to establish potential anti-cancer drugs via manipulation of E3 ligases, allowing for the ubiquitination and degradation of specific kinases. Specifically, the von Hippel Lindau (VHL) E3 ligase was used, particularly for its ability to recognize hydroxylation of the Hypoxia-Inducible Factor 1a (HIFα) degron. VHL is one of the substrate recognition subunits of two ubiquitously expressed and biologically important Cullin RING E3 ubiquitin ligase complexes. Incorporation of the VHL ligand provides the PROTACs the opportunity to recruit E3 ligase, allowing for selective degradation and depletion of specific kinases. Here we report an efficient synthetic route to the VHL ligand in large quantities. Moving forward, the synthesized VHL will be incorporated into small molecule PROTACs that targets specific kinases such as PI3K and TLK2 to initiate the protease degradation of those kinases in cancer cells.

Keywords — VHL, PROTAC, synthesis, degradation, kinase

Introduction

Targeted protein degradation using Proteolysis Targeting Chimeras (PROTACs) has emerged as a novel therapeutic modality in drug discovery. By binding to the protein of interest on one end of the structure and recruit E3 ligase on the other end of the structure, PROTAC is able to bring the E3 ligase close to the protein of interest and initiate its degradation by the 26S proteasome (Lu et al., 2019). This mechanism has been developed to degrade various types of disease-relevant proteins, especially the kinases usually upregulated or mutated in cancer cells. Structurally, PROTACs are heterobifunctional molecules with three essential parts: a ligand that binds to a protein of interest, a ligand that recruit an E3 ubiquitin ligase or E3 recruiting element E3RE, and a linker that connect these two ligands (Fisher & Phillips, 2018).

E3 ubiquitin ligases (of which over 600 are known in human) through binding to the protein targets, lead to their ubiquitination and subsequent degradation. One E3 ubiquitin ligase with exciting therapeutic potential is the von Hippel-Lindau (VHL) complex consisting of VHL, elongins B and C, cullin 2 and ring box protein 1 (Rbx1) (Kamura et al., 1999). The small molecule VHL ligand, with its ability to bind to VHL by competing with the transcription factor HIF-1α, a substrate of VHL, will be able to recruit E3 ligase and bring it close to the protein of interest to initiate its degradation. The initial synthesis of VHL ligand was performed in solid phase that involved the attachment of Fmoc-Hyp-OAllyl to Wang resin (Buckley et al., 2012). Here we are trying to develop a synthetic route to the VHL ligand in liquid phase with large quantities. The objective of this study is to develop an efficient synthetic route specifically to the VHL ligand that can be applied to large scale synthesis to facilitate the development of potential anti-cancer PROTACs.

Methods

Chemistry Synthesis

Starting from the commercial available 4-methylthiazole and 4-bromobenzonitrile, the targeted VHL ligand is designed to be synthesized through a 6-step synthetic route as shown in Scheme 1.
Figure 1. Synthesis of VHL ligand

Nucleophilic attack of 4-methylthiazole to 4-bromobenzonitrile in DMA in the presence of Pd(OAc)$_2$ at 150$^\circ$C for 5 hours resulted in the formation of compound 3 in good yield (86%), which was further reduced under reflux for 5 hours to compound 4 by LiAlH$_4$ in the solution of THF. Peptide coupling reaction of compound 4 with Boc protected 4-hydroxyproline with the help of HATU and DIPEA in the solution of DMF at room temperature for 2 hours gave compound 6. The Boc protecting group was easily deprotected in acidic methanol at room temperature for 2 hours to yield compound 7. Another round of peptide coupling reaction of compound 7 with N-Boc-L-tert-leucine in the solution of DMF with the HATU and DIPEA at room temperature overnight gave the N-Boc-protected VHL ligand. The N-Boc protecting group was readily removed by acidic methanol at room temperature for 2 hours to furnish the desired VHL ligand compound 8.

Results

We have designed and developed a synthetic route for the preparation of VHL ligand in liquid solution with high yield. The synthetic route consists of 6 steps with two runs of peptide coupling reactions and two runs of removing the N-Boc protecting group, which can be carried out at room temperature under very mild reaction conditions. Moreover, the synthetic route can be employed to synthesize gram scale of the VHL ligand, which is very helpful in developing PROTACs for degradation the proteins of interest as a novel approach in anti-cancer drug discovery.

Conclusions

We have designed and developed an efficient and mild synthetic route to the VHL ligand in liquid solution with high yield. Through our synthetic route, the desired VHL ligand can be synthesized in large quantity. We will further incorporate the synthesized VHL ligand to develop PROTACs for the degradation of PI3K and TLK2 which are overexpressed or mutated in certain breast cancer cells.

Currently we are still working to have the desired VHL ligand synthesized in gram scale. Once we have enough VHL ligand, we still start to work on the coupling of this ligand to the linkers and some kinase inhibitors such as PI3K inhibitor and Sunitinib which has been discovered in our collaborator’s lab to have inhibitory activity against TLK2. Since both PI3K and TLK2 are found to be
either mutated or upregulated in certain breast cancer cells. We will test our PROTACs with VHL ligand on their activities in degrading PI3K and TLK2 in some breast cancer cell lines.

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References


Ejaculatory Duct Obstruction in the Setting of Ectopic Ureter

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Abstract — A 17-year-old male was referred to a tertiary care urologist for hematuria, hematospermia, and testalgia. The patient had a history of right-sided renal dysgenesis at birth. Methods: Fluoroscopic investigation with retrograde seminal vesiculography demonstrated the right ureter was implanting ectopically into the right ejaculatory duct. MRI of the pelvis showed the ureter present proximally from the level of the external iliac vessels and implanting into a cystic dilatation on the posterolateral aspect of the prostate. Robot-assisted laparoscopic nephroureterectomy was performed finding an ectopic implantation of the right ureter into a confluence of the right ejaculatory duct comprised of the seminal vesical (SV) duct, ureter, and ductus deferens. Mucin balls were found to be obstructing the ejaculatory duct. Results: The nephroureterectomy and removal of the mucin balls resolved the patient’s pain at 1-month follow-up. Conclusion: Painful ejaculation or hematospermia may be indications for pelvic MRI or retrograde seminal vesiculography. The classic presentation of pain with contraction of hollow organs and associated proximal dilation on imaging can be applied to the ejaculatory duct. Robot-assisted laparoscopic nephroureterectomy was a suitable surgical approach for both diagnostic and therapeutic purposes in this case of hematospermia with painful ejaculations.

Keywords—hematospermia, nephroureterectomy, seminal vesicles, ureter

Introduction

Hematospermia is an unusual complaint comprising only 1-1.5% of all urologic referrals that deserves appropriate investigation especially outside of clear traumatic incidents (Carbone, et al., 2007). In patients less than 40 years old it is usually related to self-limited inflammation. However, the causes of hematospermia are numerous with obstructive causes including calculi, post-inflammatory SV cysts, SV diverticula, urethral strictures, utricular cysts, SV tumors, and BPH (Kiremit, et al., 2018). Painful ejaculation is a much more common complaint than hematospermia with an even broader differential. The investigation into dysejaculation alone rarely reaps a successful diagnosis (Kowalczyk et al., 2009). The forming ureter can implant ectopically anywhere along the Wolffian duct system where it originates. Ureteric bud insertion into an inappropriate location will likely not find a supportive mesenchyme resulting in renal dysgenesis as well as 10-15% having associated genital tract malformations (Kumar et al., 2006). The lack of apoptosis of the common nephric duct will also maintain patency of the ureter with the Wolffian duct (Mathers et al., 2017).

Case

The patient was a Caucasian male who presented to a tertiary referral center in the United States at 17 years of age complaining of hematuria, hematospermia, and testicular discomfort. The patient had a history of right sided dysplastic kidney at birth and renal ultrasound at 3 years old confirmed absence of the right kidney on prior imaging. Physical examination of the patient showed no causes of his symptoms. The patient was placed on empiric antibiotics for possible infection and his testalgia and hematuria resolved. However, he was still experiencing hematospermia and painful ejaculations. The patient then underwent cystourethroscopy with cannulation of the ejaculatory duct, retrograde seminal vesiculography (figure 1), retrograde ductusogram, and left retrograde pyelogram. Pelvic MRI was then performed which demonstrated the cystic collection in the posterolateral aspect of the prostate, but unable to differentiate exactly the course and position of the ureter, ductus deferens, and SV duct (figure 2). No other causes of the hematospermia were found. At this point, his symptoms were intermittent and not bothersome, so the decision was made to delay surgical treatment until the patient finished college.

Figure 1. Retrograde seminal vesiculography
The patient presented again at 22 years old with continued mild, intermittently painful ejaculations and hematospermia. Before transitioning to surgery, the patient underwent complete semen analysis which showed normospermia, but the results were confounded by the large amount of blood present in the sample. The patient then underwent robotic-assisted laparoscopic nephroureterectomy. The ureter was identified at the level of the iliac vessel bifurcation and dissected proximally until the nonfunctional renal structure was identified. The ureter was then dissected distally tracking medially to the medial umbilical ligament. The right ductus deferens was identified and noted to be abnormally tortuous, the right SV was noted to be in the orthotopic position. The dissection of the ureter was carried until its insertion came into question as possibly posterior to the prostate. Concern for disrupting the external urethral sphincter dictated that the ureteral dissection had been carried to the furthest point possible. The ureter was clamped proximally and transected distally. The transection revealed the dilated cavity through the ureteral stump and was examined closer. Dark masses were noted to be present within this cavity and were extracted freely with graspers (figure 3). The duct of the SV was identified within the cavity and cannulated with a 4 Fr. open-ended catheter to ensure patency. The catheter was removed, and the confluence was sutured closed tightly in a running fashion.

Final pathology of the kidney showed diffuse cystic dysplasia and no signs of malignancy. The ureter only had signs of chronic inflammation. The masses grossly resembled stones and were sent for stone analysis which showed 100% mucin composition with no crystal nidus.

**Conclusions**

The constellation of ipsilateral renal agenesis, seminal vesicle cyst, and ipsilateral ejaculatory duct obstruction is a rare congenital abnormality of the mesonephric duct referred to as Zinner’s syndrome that has been recorded in approximately 100 cases (Mehra et al., 2016). The patient presented with painful hematospermia consistent with complaints associated with Zinner’s syndrome. The entrapment of mucinous secretions has also been described previously as seen here. Various imaging modalities revealed a patent ejaculatory tract with proximal dilation in this patient. The use of retrograde seminal vesiculography via cannulation showed that this technique is a valuable imaging modality that can assess patency of the ejaculatory duct, ductus deferens, and examine for filling defects or communications without risking possible scarring of the ductus deferens with antegrade vasography, especially in young men. Carbone et al. reported two similar cases of renal dysplasia with associated ectopic ureter implantation into the Wolffian tract (Parnham & Serefoglu, 2016). Contrary to our case, MRI was able to determine the communication of the ureter with the seminal vesicle. Such a communication was not found in our patient but was seen during vesiculography at the time of endoscopic evaluation. Various treatments have been suggested for the symptomatic Zinner syndrome patient (Scarcia et al., 2016). One of the cases reported by Carbone et al. demonstrated a potential concern that was discussed both pre-operatively with the patient and intra-operatively: implantation of the ectopic ureter possibly occurring caudally in the prostate. Implantation at this site may prohibit excision due to risk of urinary incontinence. If excision is not possible, the SV cyst can be treated with transrectal aspiration or transurethral unroofing without significant recurrence. Considering the exact implantation of the ureter will be important for future clinicians offering operative management for anatomic aberrations such as these. In all, robotic-assisted laparoscopic surgical management has become the preferred treatment option for these rare patients with positive outcomes. In this case, the presence of
the ectopic ureter added to the volume of the SV cyst and allowed for easier operative technique within the cyst. In cases without this additional volume, it would be more difficult to relieve duct obstruction and ensure recapitulation of the orthotopic anatomy to attempt fertility preservation. Our decision to incise the SV cyst, remove the obstructing mucin balls, and restore the SV appears to be a less explored technique than complete excision of the SV or the SV cyst (Uetani & Bouchard, 2009). Future research can be done into developing such preservative techniques and then following these patients for recurrence of symptoms and successful conception.

References


Abstract - Introduction: Muscle strength and power are key elements to enhance sports skills and activity daily living. Minerals play an important role in muscle contraction, bone metabolism, and other physiological function in the human body. The importance of calcium has been well studied in bone metabolism, however, there is still a research gap in understanding the relationship between calcium intake and muscle performance. Purpose: This study aimed to investigate the relationship between dietary calcium intake and muscle performance in college-aged students. Methods: This was a non-randomized cross-sectional study participated by 70 college-aged students age ranges from 18-24 yrs old. The dietary calcium intake questionnaire was used to estimate the amount of calcium consumed daily based on the content of the specific foods. Lower and upper body strength were assessed by vertical jump test and handgrip dynamometry, respectively. Results and Conclusion: The average calcium intake was found to be 1098 mg/day. A statistically significant positive relationship was observed between jump velocity (r= 0.31; p<0.01), and relative power (r=0.35; p<0.01) with calcium intake. The result suggests that calcium intake was related to lower body muscle performance.

Keywords — calcium intake, muscle performance, jump power, relative power

Introduction

It has been well established that an increase in muscle strength can enhance general sports skills and activity daily living by lowering the risk of sarcopenia (Suchomel et al., 2016). The etiology of sarcopenia is multifactorial including deficiency of dietary calcium intake. The extant literature supports that minerals play an important role in muscle metabolism, muscle function, and physical performance (Williams M., 2005; Dronkelaar et al., 2018). Calcium is a key mineral and is involved in energy metabolism, bone health, muscle contraction, and other physiological processes in the human body (Dressendorfer et al., 2002). Additionally, participating in vigorous exercise intensity increases calcium loss and can be reversed following the tapering phase. Handgrip strength and countermovement jump assessment are important measures to gauge upper and lower body strength, which can aid in the development of training programs and implementation of dietary intervention among different populations. Although the importance of calcium has been well studied in bone metabolism, there is still a wide research gap in understanding the relationship between calcium intake and muscle performance, especially in young adults. Therefore, the purpose of this study is to investigate the relationship between dietary calcium intake and muscle performance in college-aged students.

Methods

In this non-randomized cross-sectional study, 70 college-aged students age ranges from 18-23 years participated and completed the protocols. This study was approved by the Lander University Institutional Review Board. During the first visit to the laboratory, participants completed the inform consent form, health screening questionnaire, physical activity readiness questionnaire, calcium intake questionnaire, international physical activity questionnaire (IPAQ), and bone-loading physical activity questionnaire (BPAQ). The calcium intake questionnaire consisted of daily calcium intake information based on certain foods that are consumed in a day or a week by participants. The data allowed the researcher to calculate an estimation of the amount of calcium consumed daily based on the content of the specific foods. Participants provided information on any type of calcium supplements they were consuming along with their doses and generic names. The dietary calcium intake questionnaire was derived from a validated and quantitative food frequency questionnaire (Musgrave, 1989). Prior to the neuromuscular performance test, each participant’s height and weight were measured. The participant’s lower and upper body strength was assessed by the vertical jump test (Just Jump Mat, Tendo Sports Machine) and a handgrip (HG) test using handgrip dynamometry (Takei, Japan), respectively. The participants were asked to step on the mat, stand with feet shoulder-width apart, and perform 3 countermovement vertical jumps, each separated by a 1 minute rest. The 3 trials were averaged for further analyses. Participants performed handgrip strength by flexing elbow 0-30 degrees
and dorsiflexion, and 0-15 degrees ulnar deviation in both dominant and non-dominant hands each separated by one-minute rest for three consecutive trials.

Data were analyzed using IBM SPSS 23.0 (SPSS Inc., Chicago, IL). All descriptive statistics are reported as means ± standard deviation (SD) unless otherwise stated. All dependent variables were tested for normality using the Kolmogorov-Smirnov test. Pearson Product Moment correlation coefficients were computed to determine the relationships between calcium intake and neuromuscular performance variables. The level of significance was set at p ≤ 0.05.

Conclusions

The average calcium intake was found to be 1098 mg/day. A statistically significant positive relationship was observed between jump velocity (r=0.31; p<0.01), and relative power (r=0.35; p<0.01) with calcium intake, which is in line with the previous study done in an older population (Seo et al., 2009). According to recent studies, the underlying mechanism to explain the relationship between calcium intake and muscle performance could be due to decreased calcium absorption that altered the calcium homeostasis and potentially led to a decrease in muscle performance. We did not find any significant relationships between calcium intake with jump height, time in air, and upper body muscular strength (p>0.05). Although participants’ dietary calcium intake was found to be at the recommended level, the results suggest that calcium intake was related to lower body muscle performance. Future studies should investigate the relationship between calcium, vitamin D, exercise adaptation and muscle performance among large sample sizes.

Acknowledgments

We would like to thank all the participants who participated in this study.

References


Tables & Figures

Table 1. Physical Characteristics of participants (Mean ± SE)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SE (n=70)</th>
</tr>
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<tbody>
<tr>
<td>Age (yrs)</td>
<td>20.81 ± 0.19</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>173.59 ± 1.23</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>79.88 ± 2.01</td>
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<tr>
<td>BMI (kg/m²)</td>
<td>26.43 ± 0.52</td>
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<tr>
<td>IPAQ (Mets/Min)</td>
<td>6757.0 ± 4832.5</td>
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<tr>
<td>Calcium Intake (mg/day)</td>
<td>1098.09 ± 72.05</td>
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<tr>
<td>tBPAQ</td>
<td>28.8 ± 8.7</td>
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Table 2. Muscle Performance Variables of Participants (Adjusted Mean ± SE)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SE (n=70)</th>
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</thead>
<tbody>
<tr>
<td>Time in the air (s)</td>
<td>0.64 ± 0.01</td>
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<tr>
<td>Jump Height (inches)</td>
<td>20.72 ± 0.62</td>
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<tr>
<td>Velocity (m/s)</td>
<td>1.34 ± 0.02</td>
</tr>
<tr>
<td>Power (Watts)</td>
<td>1058.26 ± 36.18</td>
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<tr>
<td>Relative Power (Watts/kg)</td>
<td>13.10 ± 0.20</td>
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<tr>
<td>Right-Hand Grip (Kg)</td>
<td>52.73 ± 2.52</td>
</tr>
<tr>
<td>Left-Hand Grip (Kg)</td>
<td>48.22 ± 2.26</td>
</tr>
</tbody>
</table>

Figure 1. Correlation between Calcium Intake and Jump Velocity. *p<0.05

Figure 2. Correlations between Calcium Intake and Relative Power. *p<0.05
Addressing Community Needs Through Medical School and Community Partner Collaborations

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Abstract - The UofSC School of Medicine Greenville created a monthly health fair, Root Cause, to address the health needs of their local community, Dunean. This fair provides attendees with education on healthy eating, access to healthcare, and allows for community cohesiveness. Attendees were surveyed regarding their community cohesiveness, and community partners were tracked to determine event participation and resources available to the community. Results indicate that community members who attend Root Cause feel more connected to their community. In addition, community partners have provided health resources and education to more than 207 community members. Collaboration between an academic health center and community members to develop a monthly health fair can increase community cohesiveness and perceptions of access to healthcare.

Keywords — Community Outreach, Primary Care, Medical Education, Access

Introduction

The University of South Carolina School of Medicine Greenville (UofSCSOMG) is a medical school that is working to improve population health, identify health challenges in our community, and seek potential solutions. In 2018, the Community Engagement Task Force at UofSCSOMG reviewed available data from the 2016 Greenville Health System Community Health Needs Assessment, the American Health Rankings 2017 Annual Report, and Furman University’s 2018 Needs Assessment to better understand the needs of communities served by Prisma Health (Greenville Health System, 2016; “United Health Rankings”, 2017; “Furman Medical Legal Partnership”, 2018). These data demonstrated that the community adjacent to UofSCSOMG was an at-risk community with a high rate of poverty, diabetes, and obesity and low rates of perceived access to healthcare. This community, Dunean, inspired us to work within the missions of both UofSCSOMG and Prisma Health to improve the health of the Dunean community.

Dunean has a population of 4,158 people (68% white, 27% African American, 4% Hispanic or Latino). In 2010, the median household income was $25,319, with over 20% of residents living in poverty (“Geographic Identifiers”, 2010). In 2017, South Carolina ranked 44 out of 51 states for population health, with high premature death and high rates of diabetes leading the list of concerns (“South Carolina County Health Profile”, 2017). Disparity in health status rank was the 14th highest in the United States (“United Health Rankings”, 2017). Many of these statewide problems are exacerbated in the Upstate of SC, and the Dunean community performs lower than much of the region on access to healthcare and health measures (Greenville Health System, 2016).

The UofSCSOMG Community Engagement Task Force met with members of the Dunean community (the Neighborhood Association, the Historical Society, United Way, the sheriff’s department, and members of two church congregations) to identify specific needs within the community that could be addressed by UofSCSOMG. Two main concerns of the community were lack of community cohesiveness and community members’ barriers to health care and preventative care access. Root Cause was developed to help address these specific needs.

Root Cause is a monthly health and public services fair that engages UofSCSOMG students, residents, and faculty with our neighbors in Dunean and aims to address the root causes of disease by increasing access to health care and promoting healthy lifestyle choices. The Root Cause initiative is an interdisciplinary collaboration between Prisma Health and UofSCSOMG to help our local Dunean community. In addition to promoting access to medical resources in the Dunean community, another goal of Root Cause is to improve education about various medical topics. To
address this, we have assembled a team of more than 25 community partners who focus on topics ranging from diabetes education to the prevention of gun violence in the home.

This project is designed to assess two main research questions. First, does participating in Root Cause increase community member engagement in the community and awareness of healthcare resources? And second, does Root Cause increase community partner access to the Dunean community in which they otherwise would have had limited access?

Methods

Subjects:

34 community partners and 207 community members from the greater Greenville County area and the Dunean, SC neighborhood were studied.

Materials:

Community members were assessed using 11 Likert-style questions (offered in both English and Spanish) to determine perceptions of community cohesiveness and awareness of access to healthcare information and resources in their community. Community partners were assessed to determine the number of partners at each event, total number of community partners participating in Root Cause, number of community members interacting with community partners at each event, and total number of resources provided to community members.

Procedure:

Prior to each monthly Root Cause event, Dunean community members who attended were asked to complete a survey about their perception of access to healthcare and how connected to their community they felt. Community partners were recruited and placed into categories at the event based upon the resources they provide: Healthy Meals and Nutrition, Student Interest Groups, Preventative Initiatives, Medical Clinics, and Advocacy/Informative Resources. To determine which resources community members sought out the most, community partners tracked the number of community members that visited their booth. In addition, community members and partners were provided with a meal and opportunities to interact with each other during each event.

Results

Based on the five Root Cause events that have been hosted, approximately 207 community members have attended, with 74 participants completing the surveys. Survey results indicate that those community members who have attended more Root Cause events rate their community cohesiveness as higher, r(68) = .220. Community partners have steadily increased at each event, with 36 community partners now having engaged members of the Dunean community through Root Cause. As part of their outreach, community partners have had 1,237 total interactions with Dunean community members. The numbers of community members accessing community partner resources can be found in Table 1 and Figure 1.

Conclusions

Booths that received the highest attendance by community members are those related to food (healthy cooking demonstrations, free meals, etc.) and interactive activities from student interest groups (CPR training, virtual reality grocery tour, blood pressure checks, etc.). Results indicate that collaboration between the medical school, academic health center partners and community members to develop a monthly health fair can increase community cohesiveness and perceptions of access to health care. In addition, this collaboration provided a forum for community partners to make connections in the Dunean community, a community that they may not have otherwise had access to. This Root Cause health fair model can thus be used to promote access to health and healthy behaviors in communities, and it also can be used to increase the community impact by partnering community partners with a medical school.

Acknowledgements

Dr. Angela Sharkey and Dr. Amy Ramsay for pioneering the Root Cause initiative; The Root Cause Taskforce and Leadership Team that built this event from the ground up; The 36 community partners that give their time and resources to Root Cause each month; and Kamron Hamedi, BS (MS1) for event photography.

References

Geographic Identifiers: 2010 Geographic Profile Date (G001): Dunean CDP, South Carolina (n.d.).

Furman Medical Legal Partnership, 2018 Greenville Health System Community Health Needs Assessment 2016

South Carolina County Health Profile, 2017

United Health Rankings of America’s Health, 2017
Figures & Tables

Table 1. Educational Opportunities and Community Member Numbers for Root Cause.

<table>
<thead>
<tr>
<th>Number of Community Members</th>
<th>Skill/Educational Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>Learned hands-only CPR</td>
</tr>
<tr>
<td>514</td>
<td>Educated about healthy lifestyle, exercise, and cost-effective meals</td>
</tr>
<tr>
<td>99</td>
<td>Learned about gun safety</td>
</tr>
<tr>
<td>132</td>
<td>Received information on addiction and recovery</td>
</tr>
<tr>
<td>75</td>
<td>Learned about or left a Root Cause event with an appointment with a Primary Care Physician</td>
</tr>
</tbody>
</table>

Figure 1. Number of community members accessing community partner resources
Nursing Continuing Education: Simulation or E-Learning

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Abstract – Obtaining continuing education units (CEU) in the nursing profession is a condition of licensure to ensure the nurse is using the most current practice that is evidence-based. While there are many delivery formats for CEUs, this paper focuses on whether nurses who participate in the innovative practice of high-fidelity simulation (HFS) provide safer patient care versus the nurses who engage in electronic learning (e-learning) to satisfy their CEU requirements. HFS allows nurses to provide patient care to mannequins and practice technical skills without the use of an actual patient but evidence of its benefits is limited due to small sample sizes and lack of power analysis studies. E-learning provides accessibility, flexibility, and decreases travel time yet is constrained due to low technology literacy and reduction in social contact. HFS has shown to be the innovative educational tool that hospitals can integrate into their repertoire to offer nurses fulfilling CEU requirements. The research of peer-review literature is a form of scholarship in the nursing discipline.

Keywords – simulation, continuing education, e-learning, nursing

Introduction

The path of a professional nurse begins with a strong educational foundation. Each state’s board of nursing requires nurses to obtain continuing education units (CEU) as a condition of licensure to ensure that nurses are current with research and developments in the nursing field (“RN CEU,” 2019). Two most common CEU formats are high-fidelity simulation (HFS) and electronic learning (e-learning). E-learning content provides current information to be accessed at one’s convenience while HFS offers a hands-on experience (Sofer, 2018). The employers may pay for CEUs because they benefit (e.g. reduction of healthcare costs and improvements in patient outcomes) when their nurses stay current. With technological advances and continually emerging evidence-based practice (EBP) methods, it is crucial for a nurse to regularly refresh his or her education and knowledge to ensure quality and safe patient care.

The study’s aim is to answer the research question: Do registered nurses who participate in high-fidelity simulation scenarios provide safer patient care than nurses who engage in e-learning when satisfying their CEU requirements? The goal of this research question is to determine if the newer educational approach, HFS, will prepare nurses to provide better quality and safer patient care than the historical use of e-learning. This paper studies peer-reviewed papers as a form of research in the nursing field. Since it is the legal obligation of the nursing profession to provide quality, competent care, it is of utmost importance to highlight the benefits of and difference between these two delivery formats (Apple, 2018).

Critical Appraisal

E-learning

E-learning offers many advantages that are enticing to professional nurses: reduced travel time, flexibility, accessibility, and self-paced learning. It can be tailored to the individual since there are a variety of multimedia options (e.g. text, audio, still and motion visuals) to aid in “acquisition of knowledge and skills” (Rouleau et al., 2017, p. 2). Nurse participants report feeling an increase in knowledge relating to reducing falls, administering medications, and preventing medication errors (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017). Some have described an upsurge of their technical skills, specifically in CPR preparedness, interviewing techniques, medication preparation, patient-nurse discussions, and assessing more carefully and accurately high-risk fall patients (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017).

Nevertheless, nurses still face hurdles with e-learning in the continuing education context pertaining to “skill requirement of a device, low technological literacy, loss of time with system freezes, and reduction in social contact” (Rouleau et al., 2017, p. 2). Nurses have difficulty navigating through various computer modules; there are interruptions when the modules are completed at work; and the courses take up more time than they anticipate (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017).

In addition, it is still unclear how the knowledge from an e-learning module transfers to clinical practice changes, effects patient outcomes, or “how permanent the knowledge transfer is” (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017).
Cost-effectiveness, patient improvement, and wellness are vital, yet more difficult, outcomes to measure, hence the necessity for more research (Lahti et al., 2015). Nurses may prefer hands-on experience to simply participating in e-learning with no other continuing education interventions (Rouleau et al., 2017).

**High-fidelity Simulations**

High-fidelity simulation has many benefits and is currently used in healthcare for “onboarding, CEU, staff development, high-risk low-volume scenarios, team training, testing new equipment, and hospital design” (Rutherford-Hemming & Alfes, 2017, p. 79). HFS scenarios are an important educational tool for new and seasoned nurses, because it immerses the nurse in a high-risk or emergency activity in a safe and effective manner. Previously, the high-risk situations were taught in theory but not put into practice until an actual patient situation arose (Cooper, 2015). When nurses are placed into high anxiety-inducing situations that are safe, since it is instructor or faculty controlled, they can build their knowledge base and technical skills. Moreover, because participants report feeling an increase in confidence and clinical judgement, they are more likely to speak up and be proactive in an actual patient situation to prevent patient injury (Cooper, 2015; Jeong et al., 2017; Kaldheim et al., 2019; Letcher et al., 2017; Lewis et al., 2019; Linn et al., 2019; Sarfati et al., 2018; Usher et al., 2015; Villemure et al., 2016).

The closing activity for a simulation is the debriefing, because it furthers learning and improves technical skills, such as teamwork, clinical decision-making, and communication (Linn et al., 2019). After some time, participants can grow their understanding of the debriefing process and learn to guide themselves through reflection (Letcher et al., 2017; Linn et al., 2019). This final activity is what makes it possible for nurses to “transfer principles of learning from the simulation to their clinical practice” and drives the nurses’ ability to retain and use the knowledge from simulation education into the clinical patient area (Kaldheim et al., 2019; Letcher et al., 2017; Linn et al., 2019).

Despite all the benefits, there is a lack of research studies related to the use of simulation-based training involving nurses. Between 2012 and 2015, only 45 research studies were found associated with simulation-based training for nurses in the hospital setting. This number is small since nurses “comprise not only the nation’s largest health care profession but also the largest single component of hospital staff and primary providers of hospital care” (Rutherford-Hemming & Alfes, 2017, p. 85). Since simulation has become essential in postgraduate nurse orientation, it is anticipated that additional studies will evolve in this area in the coming years (Rutherford-Hemming & Alfes, 2017, p. 85).

**Findings**

In nursing, clinical practice is continuously evolving, and it is ever more important to utilize a continuous education program that enhances clinical techniques. Nurses have reported satisfaction with using e-learning as an educational format in a continuing education context (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017). The studies show more of the nurses’ learning satisfaction, such as improvement in knowledge about skills, but not much on their change or evolvement of practice. The studies do not show how nurses apply the e-learning knowledge into real-life clinical situations or whether patient safety outcomes improve as a result (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017). E-learning is a fast-growing field for nursing education but lacks the ability to change nursing practice in the context of continuing education (Johnson et al., 2015; Lahti et al., 2015; Rouleau et al., 2017).

High fidelity simulation is a pioneering concept in a continuing education context for professional nurses. It offers nurses an opportunity to practice hands-on skills, prevent patient harm by allowing nurses to practice skills on mannequins before actual patients, and improve self-efficacy (Kaldheim et al., 2019; Letcher et al., 2017). Nurses can immediately apply the knowledge and skills from the HFS setting into real life patient scenarios. However, there is insufficient evidence to establish its impact on improving patient safety as compared with e-learning. Additional research with larger sample sizes and including other, more high-risk, areas of the hospital, will “increase the rigor of the studies” to provide stronger evidence of HFS advantages in patient safety (Cooper, 2015; Jeong et al., 2017; Kaldheim et al., 2019; Letcher et al., 2017; Lewis et al., 2019; Linn et al., 2019; Rutherford-Hemming & Alfes, 2017; Sarfati et al., 2018; Usher et al., 2015; Villemure et al., 2016). Without these high-level studies, the impact of simulation-based education within the hospital setting may not fully be understood.

**Conclusion**

Continuing education for registered nurses is vital in an ever expanding and advancing healthcare system. This paper investigates whether registered nurses who participate in high-fidelity simulation scenarios provide safer patient care than nurses who engage in e-learning when satisfying their CEU requirements. The innovative HFS training is a
valuable teaching method that increases self-confidence and provides hands on experience but is still underutilized in healthcare for continuing education. HFS is a clinically controlled environment where a nurse educator or facilitator focuses the scenarios on learner-outcomes, mimic reality, and can include individual (nurse), team, and work unit to “augment clinical learning and improve patient safety and quality care” (Boyde et al., 2018). Integration of HFS can be implemented on a medical-surgical floor using the Jeffries Simulation Model where two four-hour training sessions are scheduled every six months (Boyde et al., 2018). The inclusion of the high-fidelity mannequin allows educators to teach and assess skills in patient care while allowing nurses to practice patient care strategies without an actual patient.

References


Use of Supplemental Nursing Staff Influences on Patient Outcomes

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Abstract — The question was asked whether the utilization of float nurses contribute to adverse patient safety outcomes during the inpatient hospital stay, when compared to the use of permanent nursing staff. An evidence review was conducted that searched for research on the effects of non-permanent nursing staff on patient health outcomes. Research literature reviews are seen as a form of research and scholarship in the field of Health Sciences. A critical appraisal of eight articles were conducted to assess relevance, reliability, validity, and applicability. Findings were consistent in seven articles that reported that no significant correlation between adverse patient events and the use of non-permanent nursing staff. Findings did suggest that poor patient outcomes were associated with poor nursing and environmental factors which included limited resources (i.e. short staffing), low employee morale, nurse burnout, and high patient acuity. Findings suggest that utilization of float nurses improves patient outcomes by providing needed resources to shorted units.

Keywords — Floating, float nurse, patient outcomes

Introduction

Quality patient care is directly impacted by healthcare work environments and safe nurse staffing levels (Straw, 2018). An issue impacting staff satisfaction and patient outcomes is "Floating" a type of internal resource sharing that hospitals implement to temporarily utilize staff on units where there is greater need during an eight or twelve-hour shift. Nurses who are floating are staff that has been moved from a unit with less patient care need to one with greater need; than the one they were permanently hired to staff. The term “float nurses” also refers to any temporary supplemental nurse from internal resource-pool, or external nursing agency. Many nurses are reluctant to float, expressing concerns that it is an unsafe practice that effects patient safety. There has also been concern that the use float nurses are associated with poor patient outcomes due to the nurses' unfamiliarity with the unit and providing care to an unfamiliar patient population (Mazurenko et al., 2015).

Patient safety is of the upmost concern and is measured by “patient outcomes” which includes the number of adverse events, such as patient falls, patient infections, medication errors, decline in patient condition, and patient dissatisfaction with their care (Faller et al., 2017). Nurses have expressed that floating evokes personal stress, anxiety, and frustration when floating to a unit where the nurse is unfamiliar with the specific needs of the patient population, and unfamiliar with the structure, resources, policies and procedures of the new unit (O’Connor & Dungan, 2017). It has been suggested that this “unfamiliarity” is associated with adverse events and negative patient outcomes (O’Connor & Dungan, 2017).

The purpose of the review was to answer the question ‘Does the use of supplemental nursing staff influence patient’s health outcomes, when compared to the use of permanent nursing staff, during inpatient hospital stay’. Scholarly article reviews are considered to be a form of evidence-providing research in the Nursing and Health Science field. Results from the review will provide evidence to assist in implementing best practice, and to assist in decision making regarding floating nursing staff and patient safety.

Methods

A literature/key word search was preformed using key words that included “float nursing,” “supplemental nurse,” “temporary nurse,” “adverse patient,” “negative event,” and “outcomes.” Databases utilized include CINAHL Complete, EBSCOhost Nursing Databases, MEDLINE Complete, Nursing & Allied Health Database, PubMed, and SAGE Journals Online. Articles found were sorted using a critical appraisal process for determining their level and strength of evidence, the quality and soundness of the research design, and the study’s relevance and applicability to practice. Articles for potential use were further refined by closely examining content to determine the purpose of the study, sample size, validity and reliability, presence of confounding variables, the type of data analysis, how the results coincide with previous research, and how the research is applicable to current clinical practice. Studies that were deemed to be of quality design and sound evidence outlined in the appraisal process were utilized in this review. Results were then limited to
eight evidence-based articles to answer the question of whether using supplemental nurses influenced patient health outcomes.

Results/Discussion

All eight selected studies focused their subject content on the use of supplemental nurses and their effect on patient outcomes. Seven out of eight of the selected studies were of high/mid-range level evidence, case-control studies, with one lower-level evidence study that summarized qualitative evidence combined with expert opinion (O'Connor & Dugan, 2017), but provided valuable insight into the personal experiences surrounding floating which prompted the evidence investigation. All case-control studies used large sample sizes which reduced the influence of extraneous variables and were more representative of the diverse inpatient population. Measures used consisted of comparing the proportion of supplemental nurses used on a unit during a defined time period to the number of occurrences of negative patient outcomes during that time period (Faller et al., 2017). Extraneous variables were controlled for, and degree of error was incorporated to ensure validity of the findings. Raw data was statistically analyzed using computerized software to provide reliable and valid results.

O'Connor & Dugan (2017) suggested that floating nurses from their home unit can “evoke stress, anxiety, and frustration” and can “put patients and health care organizations at risk.” Floated nurses may be unfamiliar with the medications, policies and procedures, and other specifics of the unit’s patient population that decreased patient’s safety and increase their risk for adverse outcomes. The author stated that nurses may have difficulty answering patient and family questions, leading to feelings of discreditation of the nurse and hospital. This study served as a hypothesis that floating and use of temporary nursing staff leads to an increase in adverse patient events and poorer care. In support of the hypothesis that supplemental nurses are associated with negative patient outcomes, Bae et al. (2010) reported that an increase in patient falls was associated with a high proportion of supplemental nurse.

Despite the objection to floating voiced by nurses, and the concern that it contributes to poor patient outcomes, most of the evidence points out there is no correlation between the use of supplemental float nurses and adverse patient events. Instead, the use of float nurses helped to improve patient outcomes. Several studies reported that the use of supplemental nurses was associated with fewer medication errors (Aiken et al., 2007; Bae et al., 2010; Mazurenko et al., 2015).

Bae et al., (2014) reported that the use of temporary nursing staff was not associated with nosocomial infections, and Aiken et al., (2007) found no significant difference in the reported incidences of patient infection, falls, or complaints. Aiken et al., (2013) found no correlation between the use of supplemental nurses and the incidence of patient mortality or decline in patient condition. These studies additionally suggest that adverse events and poor patient outcomes are not related to the use of float staff, but instead poor environmental variables such as inadequate staffing and resources, high patient acuity, and low employee morale (Thériault et al., 2019).

Limitations of the review included variation in use of controls for environmental variables that differed in the individual studies, therefore findings had the potential to differ between studies. Environmental variables may have included factors such as unit size, patient acuity, Magnet status, available resources, nurse education level, and nurse experience. Though each study aimed to identify and control various environmental variables, they were not consistent among studies.

Implications/Conclusion

Evidence gathered from this literature review correct the misconception that floating nurses is a risky and potentially unsafe practice of resource sharing. Instead, the use of supplemental nurses was found to help compensate for shortfalls by correcting inadequate staffing, and alleviating workload on unit staff so that nurses are better able to focus their efforts on the needs and safety of their patients. Aiken et al. (2007) suggest that flawed hospital environments may be the reason of poor patient outcomes. Variables such as poor work environments, inadequate staffing, inadequate resources, nurse burnout, high patient acuity, and low employee morale are more strongly associated with adverse patient outcomes; than patient falls, medication errors, nosocomial infections, patient mortality, and decline in health status during inpatient hospitalization (Thériault et al., 2019). There is often a perception that patient care by supplemental nurses is of a lesser quality, but there is little research evidence to support this belief (Faller et al., 2017). Nurses, managers, and hospital administrators can be assured that ‘floating’ is a safe means for addressing staffing deficits across hospital units and for providing safe patient care.
References


Exercise Counseling in Pregnancy: Are Women Receiving the Information They Need?

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Abstract — The American College of Obstetricians and Gynecologists (ACOG) recommends that women exercise throughout their pregnancy unless they have a contraindicated diagnosed condition. Nevertheless, many healthy women remain sedentary throughout pregnancy. Therefore, the goal of this study was to determine if pregnant women perceive receiving the recommended counseling for exercise. Women in the postpartum care units of two regional hospitals were invited to complete a voluntary, anonymous 5-minute survey regarding whether they received exercise counseling during their prenatal care. The survey results of 224 participants were descriptively reported and analyzed using Fisher's exact tests. Of 224 participants surveyed, 130 (58.04%) participants perceived being counseled on exercise counseling during their prenatal care. Participants who were insured via private insurer were advised to exercise at a significantly higher rate (70.09%) than those on Medicaid (44.78%) or uninsured (40%; p = 0.004). Our data suggests a missed opportunity in patient education to reduce the rates of gestational diabetes, obesity, and postpartum depression, especially in high risk populations. This information will be used internally to implement changes emphasizing exercise education in the clinics studied and may also be informative on a national scale to improve exercise counseling rates during pregnancy for known benefits in the mother-child dyad.

Keywords — Pregnancy, Exercise, Lifestyle, Prenatal Care, Fitness

Introduction

Researchers at the University of North Carolina have estimated that approximately 23% of pregnant women meet the national recommendations of 150 minutes of moderate intensity exercise per week (Outlaw, 2010). There are a multitude of reasons why pregnant women are less likely to exercise, but regardless of these reasons there is plenty of evidence to suggest exercise is healthy for both the mother and future child. However, the United States Department of Health and Human Services (HHS) states that exercise in pregnancy reduces the risk of excessive weight gain, gestational diabetes, and postpartum depression, all of which have damaging impacts on morbidity and mortality for both the mother and baby (U.S. Department of Health and Human Services, 2018). In addition, the American College of Obstetrics and Gynecology (ACOG) recommends exercise to all pregnant women as long as they do not meet established high-risk criteria. They state, “If you are healthy and your pregnancy is normal, it is safe to continue or start regular physical activity. Physical activity does not increase risk of miscarriage, low birth weight, or early delivery.” (American College of Obstetricians and Gynecologists, 2017) They also recommend OB/GYN providers explain the health benefits of exercise as well as proper risk factors in order to ensure the best information is available to these women early in the course of their pregnancy. A 2011 study showed massive reductions in smoking, caffeine, and alcoholic beverages during pregnancy (Crozier et al., 2009). That same study concluded that younger women were particularly benefited by “targeted health initiatives,” giving hope that physician involvement with patient lifestyle modifications can be especially useful during pregnancy (Crozier et al., 2009). This evidence along with the fact that physicians have significant access to pregnant patients over the course of their pregnancy (approximately 14 visits over 40 weeks) suggests that proper education by providers about exercise to pregnant women could be profoundly beneficial in improving long-term health outcomes. Furthermore, there is an increased likelihood that long-term exercise habits may continue throughout the family structure to include and influence children. The purpose of this study was to determine whether women in the upstate of South Carolina perceive receiving adequate exercise information from their OB/GYN providers during pregnancy. With diseases such as obesity, preeclampsia, eclampsia, and gestational diabetes still left uncured and unmanaged for so many women, we hope to provide baseline data for implementing new, innovative initiatives to lower the aforementioned co-morbid rates and improve the health of our pregnant mothers.
Methods

Postpartum women at two regional hospitals, Greenville Memorial and Patewood Memorial Hospitals, were selected at random and invited to complete anonymous surveys about their exercise counselling history as well as demographics. These surveys were collected from February 2019 to May 2019 and used an electronic branching logic, 15-item survey using REDCap©. REDCap© is a secure web based online application that is used to collect, analyze, and store research data. It is user friendly and designed to comply with HIPPA regulations and can be accessed from anywhere. Results were descriptively reported, stratified by demographic variables, and analyzed using Fisher’s exact tests. Comparisons across demographics were examined using frequencies, associations, and stratification on associations using SPSS v21.0. Analyses examined exercise counseling perception, pre-pregnancy exercise status, exercise information obtained by a source other than medical providers, and demographics.

Results

Two-hundred and twenty-four women participated in this study. Fifty (22.42%) participants were under the age of 25; 145 (65.02%) were between ages 26 and 35; and 28 (12.56%) were above age 35. In terms of ethnicity, 164 (73.54%) identified as White/Caucasian, 34 (15.25%) identified as African American, 13 (5.80%) identified as Latino, 5 (2.23%) selected Other, and 1 (0.45%) chose not to answer. Annual household income included 66 (29.60%) reporting less than $40k, 62 (27.80%) between $40k and $80k, 75 (33.63%) greater than $80k, and 20 (8.97%) who chose not to answer. Education level was stratified as 55 (24.66%) reporting High School/GED or less, 58 (26.01%) Some College/Associates, 65 (29.15%) Bachelor’s degrees, and 45 (20.18%) Advanced degrees. Preconception body mass index (BMI) was stratified as 101 (45.91%) between 18.5 and 25 (Healthy weight), 58 (26.36%) between 25 and 30 (Overweight), and 61 (27.73%) 30 and higher (Obese Class I and above).

Of the 224 that participated, 118 (52.68%) reported that the provider recommended the patient begin or continue exercising while 82 (36.61%) reported that the provider did not give a recommendation. An additional 12 (5.36%) stated that they received recommendations after they asked and 11 (4.9%) stated that they “did not remember.” In all, 58% of women remembered receiving information on exercise, and 42% did not remember receiving information on exercise. Of those that were counseled on exercise, 102 (78.56%) were counseled to walk and 29 (12.95%) reported that their provider “did not specify” the type of exercise in which to participate. Additionally, 119 (91.53%) of patients counseled reported that the provider “did not specify” how many days per week to exercise. Sixty-three patients (48.46%) stated that the provider “did not specify” how long to exercise. Eighty-two (63.07%) of patients who were recommended to begin or continue exercise were counseled on warning signs to stop exercise, meaning that 48 (36.92%) were not counseled on warning signs. The most common warning signs counseled on were feeling weak or dizzy (n=55, 67.07%), difficulty breathing (n=53, 64.63%), and vaginal bleeding (n=44, 53.66%). Of the 224 surveyed, 165 (73.66%) reported exercising prior to becoming pregnant, with the vast majority (138, 83.64%) reporting walking as their form of exercise. Of those who exercised prior to pregnancy, 64 (38.79%) reported that they did not continue to exercise while pregnant. When asked if the patient would have liked to receive information about exercise while pregnant, 90 (40.18%) stated “yes.” When asked if they have received information about exercise while pregnant from a source other than a healthcare professional, 88 (39.29%) stated “yes.” The vast majority reported receiving information from the internet (68, 77.27%), a friend (32, 36.36%) or a family member (19, 21.59%).

As we compared our data across various demographic variables, there were several statistically significant results. When asked if the patient exercised prior to becoming pregnant, there was a statistically significant difference between White/Caucasian, African-American, and Other groups (p = 0.004) and between household income (p = 0.006). When asked if the patient had received information about exercise while pregnant from any source besides their healthcare provider, there was a statistically significant difference among education levels (p = 0.045). Finally, there was a statistically significant difference between insurance providers when patients were asked about whether or not their provider recommended them to begin or continue exercise (p = 0.004) with those on Medicaid (33, 44.78%) and those designated “other/not insured” (6, 40.00%) the least counseled.

Conclusions

In conclusion, our data suggest a direct correlation between socioeconomic status (SES) and the perception of exercise counseling among
postpartum women, suggesting that already “high-risk” SES populations may be especially vulnerable with respect to preventative care counseling. Furthermore, such populations may benefit from additional counseling efforts due to the fact that previous studies have shown counseling efforts in pregnant women are more likely to yield positive long-term results (Crozier et al., 2009). These findings should prompt immediate recognition of the vulnerable nature of already “high-risk” SES populations with respect to counseling and preventative care by medical providers. Future studies should evaluate additional factors regarding the perception of exercise counseling among women in the prenatal period, including psychosocial and implicit biases toward patients of lower SES among medical providers. We also identified a large percentage of women receiving advice from non-healthcare professionals and sources, possibly contributing to nearly two-thirds of women who were previously exercising to stop completely.

Future studies may be able to use these data to improve patient care and patient outcomes. For example, after studying patient perspectives, it would be beneficial to discover the prevalence of OB/GYN physicians who believe they are adequately counseling patients on exercise. Proper investigation of the physician perspective combined with information from the patients as to whether they felt the information was delivered effectively, could help providers understand the best possible methods for delivering this vital information. With this knowledge, updates on physician training could be tailored to improve adequate delivery of the information so the patient can understand the recommendations efficiently. It would also be prudent to study whether counseled women begin exercising, and if they continue to exercise after giving birth. If the answer to this question turns out to be positive, then it will further validate the desperate need for exercise counseling, as the health benefits of exercise in pregnancy is already well established and backed up by the current CDC and ACOG recommendations. Standardized exercise recommendations at certain prenatal visits would be the end goal, much like other prenatal testing and vaccinations are completed at different points in pregnancy so as to optimize health of the mother and developing fetus. The long-term health implications for both pregnant women and the eventual family unit, is the main factor for why educating and implementing change in this population is so exciting for physicians.

References
Perceptions of the Peanut Ball by Nurses and Nurse Midwives: A Qualitative Study of the Peanut Ball’s Impact on Labor

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Abstract — Purpose: The aim of this qualitative research study was to examine the implementation, experiences, outcomes, and personal opinions of the use of the peanut ball in practice from the perspective of labor and delivery nurses and midwives. Study Design and Methods: A hermeneutical phenomenological approach was used to design a questionnaire and analyze the responses of 16 participants (n=16) regarding the use of the peanut ball. Twelve labor and delivery RNs with various educational backgrounds, nurse midwives, and one nursing administrator participated in the study. Results: Several prominent themes emerged from the data collected. The themes included: RN initiation of peanut ball use, use in specific patient populations, nurse perception of positive impact on labor, positive nurse response to peanut ball use, and barriers to use of the peanut ball. Clinical Implications: The peanut ball is a noninvasive, low-cost tool that can be used with laboring women. Surveyed nurses and midwives noted positive impacts on labor when incorporating the peanut ball in practice. This tool can be beneficial to the patient, nurse, and healthcare organization as a whole. Barriers to use of the peanut ball exist both from patients and providers but can be addressed through education and training. Keywords — Peanut ball, labor tools, labor, dystocia

Introduction

The peanut ball is a peanut shaped vinyl exercise ball that is larger on the two ends. This ball was initially used in physical therapy but was found to be an “inexpensive, nonpharmacological, noninvasive, and reusable” tool for labor (Roth et al., 2016, p. 141). The peanut ball acts to widen and open the pelvic outlet, maximizing the pelvic diameters and allowing the baby to have the greatest capacity to descend for vaginal delivery. Limited research currently exists on the peanut ball, but the research that does exist suggests that is may have positive impacts on the labor process. Research suggests that the peanut ball can reduce the length of labor and pushing time (Alvarado et al., 2017; Payton, 2015; Roth et al., 2016; Tussey et al., 2015), cesarean rates (Alvarado et al., 2017; Evans & Cremering, 2016; Payton, 2015; Tussey et al., 2015), need for operative vaginal birth (Evans & Cremering, 2016; Tussey et al., 2015), and third and fourth degree laceration rates (Evans & Cremering, 2016; Tussey et al., 2015). The aim of this qualitative research study was to examine the implementation, experiences, outcomes, and personal opinions of the use of the peanut ball in practice, specifically from the perspective of labor and delivery registered nurses and nurse midwives.

Materials and Methods

A survey, which consisted primarily of open-ended questions, was developed and offered in two forms: traditional paper and online through Google Forms. Following approval from Lander University’s Institutional Review Board, the primary researcher attended a staff meeting at a local hospital and introduced the purpose of the survey and research, including the intention to increase nursing knowledge, specifically in the field of labor and delivery. The traditional paper survey was offered to this group of staff labor and delivery nurses who attended a staff meeting and received the explanation of the research. The online survey, which was created by the primary researcher, was shared through social media platforms to nurses who lived a distance away from the primary researcher. Informed consent was obtained on paper for participants who completed a paper survey and through a checkbox format for participants who participated in the online survey through Google Forms.

A phenomenological approach was utilized in this research project. The survey began with basic demographic information, including age, degree held, job title, years of experience, and city of employment. After the demographic portion of the survey, open-ended questions, listed in Table 1, were posed to gather information about the use of the peanut ball in practice. Open-ended questions allowed participants to “fully describe their experience” and elicit thick, rich descriptions about the topic being researched (Speziale & Carpenter, 2007, p. 37). Consulting experts in the field, which included a Masters-prepared obstetrics (OB) nurse and a PhD researcher who specializes in qualitative research, developed the survey questions. The principal investigator and co-investigators together...
examined the questions in detail and determined these survey questions sought the information desired for this research study.

The data was continuously examined as participants submitted surveys. Data was collected until saturation was reached. Saturation occurs when there is “repetition of discovered information and confirmation of previously collected data” (Speziale & Carpenter, 2007, p. 31). After data collection was complete, the principal investigator and co-investigators independently examined the data and performed a naïve reading, noting the responses as a whole, and continued to familiarize themselves with the data. The second step was interpretive reading, as the principal investigator and co-investigators began to identify themes and meaningful connections were made. The final step was interpretation of the whole, which involved reflecting on the prior steps and ensuring comprehensive understanding of the data (Speziale & Carpenter, 2007).

Results

After analyzing the data, several themes emerged. Theme #1: Nurses are discovering, initiating, and promoting use of the peanut ball. Nurses were typically the driving force behind hospitals purchasing and using the peanut ball. Theme #2: The peanut ball is an effective intervention for primigravidas and patients with epidurals. Nurses had determined who the peanut ball might be effective for and were using it to decrease labor times and promote descent of the fetus. Theme #3: The peanut ball positively impacted the labor experience. All 16 participants reported at least one positive impact that they could identify. Many reported that they had witnessed a decrease in cesarean rates when the peanut ball was utilized. Theme #4: Nurses and midwives are passionate about incorporating the peanut ball in their practices. Participants reported seeing benefits of using the peanut ball and were very passionate about its effectiveness. Theme #5: Barriers to embracing the peanut ball as a labor intervention still exist. Participants identified several barriers to the use of the peanut ball such as patient refusal, lack of availability or proper size, use in a patient who plans to be mobile in labor, and lack of education. Another barrier was physician support.

Conclusions

In conclusion, the findings from this research study indicate that the peanut ball is a nurse-driven, patient-friendly tool that can be utilized during labor and delivery. The nurse and nurse midwife participants in this study believe that the peanut ball has a positive impact on labor, with a perceived decreased cesarean section rate, decreased length of labor, and decreased operative delivery, along with helping with labor arrest and optimal fetal presentation. These findings are highly pertinent to labor and delivery nurses because they are at the bedside throughout the laboring process, assisting the mother to deliver new life into the world. A low-cost tool that has a positive impact on the labor process is beneficial to the patient, nurse, and healthcare organization as a whole. However, barriers exist that inhibit use of the peanut ball and must be addressed in order for the peanut ball to be used to its maximum benefit.

References


Table 1. Survey Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
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<tbody>
<tr>
<td>Explain how you or your facility began use of the peanut ball.</td>
<td></td>
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<tr>
<td>Describe your experiences using the peanut ball.</td>
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<td>Describe a labor situation that would lead you to use the peanut ball.</td>
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<tr>
<td>Explain outcomes you have observed since the peanut ball has been</td>
<td></td>
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<td>implemented.</td>
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<td>Research has shown that the peanut ball has the potential to reduce</td>
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<td>cesarean rates, length of labor, need for operative vaginal birth</td>
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<td>(vacuums/forceps), and third and fourth-degree laceration rates.</td>
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<td>Have you witnessed any of these outcomes in practice? If yes, please</td>
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<tr>
<td>describe.</td>
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<td>Explain barriers that prevent or limit use of the peanut ball.</td>
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<td>Approximately how many total deliveries does your hospital have per</td>
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<td>month?</td>
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<tr>
<td>• How many deliveries do you participate in each month?</td>
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<tr>
<td>• Of these deliveries, approximately how many included use of the peanut</td>
<td></td>
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<tr>
<td>ball?</td>
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<tr>
<td>Describe your personal feelings about the use of the peanut ball.</td>
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Psychiatric Nursing Intervention to Reduce the Incident Rates of Violence Towards Nurses: De-Escalation Techniques Versus Cognitive Strategies

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Abstract — The purpose of this paper is to review which intervention, de-escalation techniques versus cognitive strategies, is implemented in the psychiatric setting to reduce the prevalence of patient assaults on nurses. Many nurses will experience some form of workplace violence during their careers; however, psychiatric units have greater risks of patient assault on nurses. A research question was constructed using the PICO method to ask how cognitive strategies compared to de-escalating techniques are more commonly utilized in psychiatric nursing. A systematic literature review of articles was performed on psychiatric patient de-escalation and cognitive therapeutic strategies practiced by nurses, evaluating which of the interventions was used more consistently. Five studies supported the use of de-escalation as an effective intervention whereas two studies were inconclusive regarding the intervention. An additional four studies supported the effective use of cognitive therapy strategies and the remaining three studies provided limited evidence. It was concluded that the de-escalation techniques were used more consistently compared to cognitive strategies.

Keywords — De-escalation, cognitive strategies, violence, psychiatric nurses

Introduction

Patient aggression and violence are part of an increasing trend in physical assaults against nurses. Nurses who are physically or sexually assaulted may experience direct effects, such as physical injuries, or indirect effects, such as anxiety or emotional exhaustion (Tonso et al., 2016). Due to the detrimental effects of assaults on nurses, it is important to promote psychiatric nurses’ development of coping skills and interventions for managing different forms of violence (Konttila et al., 2018; Martinez, 2016), cognitive strategies (McTiernan & McDonald, 2015), and de-escalation techniques such as rapid response protocols (Stevenson et al., 2015). This paper will investigate two primary interventions used by psychiatric mental health nurses: de-escalation techniques and cognitive strategies.

To combat violence against psychiatric nurses, the two main interventions are de-escalation techniques and cognitive strategies. Price et al. (2015) defined de-escalation techniques as approaches that cease the escalation of aggression. These approaches can be physically restrictive or verbal to help solve the aggressive patient’s concerns. Specific examples of de-escalation techniques are rapid response teams, restraints, and passive talk (Hallett & Dickens, 2015; Martinez, 2016; Price et al., 2015). Cognitive strategies are defined in this paper as coping mechanisms that help reduce stress and enhance interpersonal skills specifically between nurses and patients (Ramalisa et al., 2018). Examples of interpersonal skills are therapeutic communication, health education, and an explanation of care plans to the patient (Ramalisa et al., 2018). Using the PICO research question format, this paper discusses the use of de-escalation techniques and cognitive strategies to identify which intervention is more successful in mitigating violence toward psychiatric nurses.

Methods

This literature review included 14 articles and was guided by the PICO model to systematically compare the use of de-escalation techniques versus cognitive strategies. Literature reviews are a form of research in nursing to determine evidence-based nursing practices in a variety of fields including psychiatry. The research question was developed using the PICO model, where the population (P) was psychiatric nurses, the intervention of interest (I) was cognitive strategies used by psychiatric nurses, the comparison or control (C) was the use of de-escalation techniques for psychiatric patients, and the desired outcome (O) was a decrease in assaults on psychiatric nurses. Articles pertaining to the PICO were found using the following databases: EBSCOhost Nursing, CINAHL Complete, MEDLINE Complete, Nursing & Allied Health, and PsychiatryOnline. Database searches included the key phrases “psychiatric nurse assault,” “rapid de-escalation for psychiatric patients,” “de-escalation in psychiatric nursing,” “cognitive strategies in psychiatric nursing,” and “cognitive strategies for patient assault.” Only peer-reviewed articles from
2015 to 2020 were reviewed with the interest of comparing the most recent innovations in minimizing assaults on psychiatric nurses. Based on these search criteria, this literature review included seven studies pertaining to patient de-escalation and the same number of studies on cognitive strategies.

Summary of Analysis

De-escalation

The use of de-escalation techniques is historically effective in managing aggressive patients. Hallett & Dickens’ (2015) study resulted in calm talk being the most effective technique for de-escalation, while restraints were the least effective. Martinez (2016) reported that “code green” response teams (rapid response teams) were effective. Price et al’s (2015) study showed that de-escalation training was influential in knowledge and confidence in handling aggressive patients, but having confidence was not effective in working with aggression. Price et al. (2018) additionally placed de-escalation techniques on a continuum varying between support, nonphysical control, and physical control, ranging from passive to active. Snorrason & Biering (2018) found the qualities of an efficient de-escalation team which include trust, information-based decisions, and knowledge-based cohesiveness. One concern expressed by Gaynes et al. (2017) was the lack of empirical evidence supporting the effectiveness of de-escalation in aggressive psychiatric patients using seclusion or restraints in the acute care setting. Lavelle et al, (2016) identified de-escalation as a first-line intervention for managing patient aggression; however, the techniques are less effective in patients with a history of violence. Whiles Gaynes et al. (2017) and Lavelle et al. (2016) identified gaps in efficacy, Hallett & Dickens (2015), Martinez (2016), Price et al. (2015), Price et al. (2016), and Snorrason & Biering (2018) supported the use of de-escalation in the management of aggressive clients.

Cognitive Strategies

Cognitive strategies used to decrease patient aggression are broad and include: improved nurse-patient relationship, resilience-building, and improving personal coping skills. Greenwood & Braham (2018) found that every year violence in nursing increases and an aggravating factor was the use of physical restraints when patients become aggressive, and nurse’s ability to provide therapeutic care would mitigate this risk. Varghese (2020) studied the importance of caring efficacy and its impact on positive patient relationships. This study found that training for all nurses could improve positive relationships and decrease workplace stress (Varghese, 2020). Therapeutic communication, patient education, and explanations of care plans can facilitate nurse-patient relationships (Ramalisa et al., 2018). Building the nurse-patient relationship is now classified as a coping strategy to potentially reduce psychiatric nurses’ risk of assault. (Ramalisa et al., 2018). Establishing nurse-patient relationships that focus on communication and patient education can reduce patient aggression toward nurses while keeping nurses engaged in quality care (Thibeault, 2015).

Resilience and coping strategies are needed by psychiatric nurses to avoid stress build-up when working with acute psychiatric patients. (Ramalisa et al., 2018). Resilience-building promotes positive adaptation to stress and adversity, which is important to avoid nurse burnout and a reduced desire to provide quality patient care. Personal mental health education is recommended to help psychiatric nurses cope with their high risk for patient assaults (Foster et al., 2020). To avoid burnout, problem-focused strategies are recommended during stressful situations instead of using avoidant strategies (McTiernan & Mcdonald, 2015). Due to high levels of stress in mental health nursing, the effective use of coping strategies by nurses is essential, however, there is a lack of effective coping skills, which lead to burnout among nurses because of the high stress (Yang et al., 2018). McTiernan & McDonald (2015) found that many psychiatric nurses are using cognitive strategies ineffectively by avoiding high-stress situations when possible. coping strategies might only successfully reduce episodes of patient violence if nurses can be trained to use active problem-focused strategies, which are recommended as more effective in taking charge of stressful situations (McTiernan & McDonald, 2015). Patient-nurse relationships have also changed because of the occupancy and length of stay pressures; therefore, nurses usually focus on observation and monitoring, and the amount of time spent on meaningful engagement declines (Thibeault, 2015). Foster et al. (2020), Greenwood & Braham (2018), McTiernan & McDonald (2015), Ramalisa et al. (2018), Thibeault (2015), Varghese (2020), and Yang (2018) all explored the impact of cognitive strategies for managing patient aggression; however, these studies did not proved a cohesive set of strategies that showed a decrease in patient aggression.

Conclusions

This paper compared cognitive therapies and de-escalating techniques to determine which intervention more effectively decreased the psychiatric nurse’s risk of physical and/or sexual
assault. Based on the lack of conclusive findings related to efficacy in the use of cognitive therapies in psychiatric nurses, it is difficult to make a determination on the effectiveness of this intervention versus the established use of de-escalation techniques. The implication of this study is the need for ongoing research on cognitive strategies being used by psychiatric nurses. Anecdotally, the method is thought to be highly effective, but the data does not appear in the literature to support this. In the meantime, continuing education on the de-escalation continuum is important to empower psychiatric nurses to confidently use the most passive technique that prevents aggressive patients from physically or sexually assaulting nurses. It can also prevent the unnecessary use of potentially harmful patient restraints before attempting more passive techniques first (Price et al., 2018).

References


Responding to Experiences of Child Sexual Abuse in Spartanburg, SC

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Abstract - Many organizations in Spartanburg County are dedicated to responding to and preventing child sexual abuse and adult sexual assault. These organizations span a range of fields, including healthcare, law enforcement, and victim services. While each organization has a specific mission, they must work together to successfully address the needs of victims in our county. In Fall 2019, a service-learning course partnered with SAFE Homes-Rape Crisis Center to conduct original research to determine how well Spartanburg County responds to cases of child sexual abuse and adult sexual assault. Nine representatives from nine relevant organizations were interviewed regarding their views about sexual abuse and assault in the county and how well they believed organizations worked together. They were also asked to make recommendations that could benefit sexual abuse/assault victims in Spartanburg County. Interviews were audio-recorded and transcribed. The qualitative data was coded by 10 students. Overall, our participants believed that organizations work well together, though communication could improve. They also reported higher rates of sexual violence, most of which is familial and part of a cycle of violence. Our findings suggest Spartanburg County agencies are adequately responding to the needs of victims, even as reported rates increase.

Keywords — child sexual abuse, sexual assault, victim services, law enforcement, healthcare

Introduction

Child sexual abuse (CSA) is a major social problem in the United States. Not only does CSA cause trauma at the time of the event, but the effects often persist throughout a victim’s lifetime (King et al., 2015; Walker et al., 2009). In fact, adults who were victimized as children are more likely to be sexually assaulted as adults (Bird et al., 2014; King et al., 2015; Stephenson et al., 2014). In this sense, CSA creates a pattern that increases one’s chances of re-victimization as adults. While there are many reasons this pattern exists, a glaring issue is that CSA is rarely reported and victims often never receive the mental healthcare that could protect them later in life (Walker et al., 2009). Additionally, most of what we know about CSA and adult sexual assault comes from national studies. There is no comprehensive, published report about South Carolinian sexual violence victims, nor does this information exist for residents of Spartanburg County. Given the lack of research, a service-learning course at USC Upstate in the Department of Sociology, Criminal Justice, and Women’s Studies collaborated with SAFE Homes-Rape Crisis Coalition to interview representatives from various organizations around the county that directly work with sexual violence victims.

Literature Review

Nationally, an estimated 22% of the population has experienced CSA, with the mean onset of age being nine years old (Crane & Duggan, 2009; Stephenson et al., 2014; Walker et al., 2009). Researchers have found a direct correlation between experiences of CSA and depression in adulthood. Those who have experienced CSA were more likely to have poorer mental health compared to non-CSA victims. Poor mental health was a greater risk when other adversities were present – specifically family dysfunction and alcohol abuse (King et al., 2015; Walker et al., 2009). This type of poly-victimization often leads to a higher risk of drug abuse as a coping mechanism in adulthood (Butt et al., 2011). Even after childhood, CSA survivors are at higher risk for poly-victimization in adulthood. This can manifest itself in dating patterns. Though research has shown that CSA does not affect physical or sexual health and CSA survivors do not experience any more sexual dysfunction that their counterparts, CSA survivors are shown to exercise more caution with sexual encounters. This is because they express more sexual distress as well as feeling their childhood experiences have altered their ability to experience sexual encounters (Bird et al., 2014; King et al., 2015; Stephenson et al., 2014).

However, CSA survivors feel that they can overcome their past and that their childhood experiences do not define who they are. Those who seek out help (such as counseling) have been shown to make large strides in personal mastery. This is more likely to be seen in people who had early
intervention and therapy, as well as supportive parents (Del Castillo & Wright, 2009; Farber et al., 2014; King et al., 2015; Walker et al., 2009). Those with networks of support were able to change their overall perspective of the traumatic events. Those who believed their past did define their future were less likely to be as adjusted as those who had received support early on (Walker et al., 2009).

Unfortunately, many victims do not disclose the sexual violence they experience. However, once disclosure happens, CSA victims report feelings of relief, being understood, and feeling closer to the person listening. Disclosure most often happens with a therapist, a romantic partner, or a family member and is a reoccurring event in the persons' life (Farber et al., 2014; Walker et al., 2009). However, as an individual becomes comfortable with disclosing, fears of stigmatization lessen and the less important it becomes to their overall journey (Del Castillo & Wright, 2009). In terms of healthcare, emotionally focused therapy has been shown to be most effective when working with adult CSA survivors. This method of therapy involves empathy, listening skills, and requires that the counselor routinely check in with clients during emotionally heavy topics.

**Methodology**

The current study explores agency responses to sexual violence disclosure in Spartanburg County, as well as agency representatives' perceptions of CSA and adult sexual assault locally. In collaboration with SAFE Homes-Rape Crisis Center, Dr. Courtney McDonald’s students enrolled in CRJU U484/WGST U398 “Service Learning: Experiences with Dating and Sexual Violence” in the Fall of 2019 interviewed nine participants who represent the various agencies officially charged with responding to reports of sexual violence. Participants were recruited from law enforcement agencies, victims service organizations, and the medical field. Students conducted 30-minute, audio-recorded interviews with these representatives. Interviews included questions about their perceptions of the changes in reported sexual violence rates, major causes and consequences of CSA in our community, and how well Spartanburg County as a whole is addressing the issue. Interviews were transcribed and all 10 students in the course were given access to them. Students then examined the qualitative data by developing and sharing emergent themes. After all transcripts had been coded using the themes identified, students worked together to analyze the data and produce a final report.

**Findings**

Overall, agencies reported an upward trend in reports of sexual violence against both children and adults. Agencies noted that a cause of this could be that Spartanburg has a growing population. For example, an agency representative stated, “More subdivisions are going up which means more population which results in more crime. [I’ve] never seen a decrease in reports.” Despite the increase in reports, representatives widely believed that underreporting continues to be a severe problem. Similar to national studies, women are more likely to be victimized and men are more likely to perpetrate sexual violence. However, one agency member made an interesting comment: “When I first started, it was mainly men [who were perpetrators]. I’m starting to see more of an increase of women perpetrators.” Though men are still more likely to abuse, more people are disclosing sexual abuse from women too.

Sexual abuse in Spartanburg is most likely to happen at home and by someone the victim knows. An agency member states, “The biggest misconception is what the perp looks like. They think it’s a big bushy man. In reality, it is a family member or someone the child knows.” Stranger danger is still a common belief in the Spartanburg area and something the agencies must battle to dispel.

Often, victims of CSA are experiencing revictimization, or repeated abuse, as children and adults. CSA is not a one-time event and the trauma can cause victims to fall into patterns that leave them vulnerable later in life. Participants largely believed that CSA is generational; they tend to see the same families repeatedly. A member of law enforcement agencies noted that that perpetrators were often sexually abused themselves. An agency explained, “I’ve seen CSA victims turn into teenage perpetrators and doing the same things to other children. This also means there is a strong cycle of abuse in Spartanburg as those who have victimized are [becoming] offenders.” Not only are victims falling into patterns, but so are their offenders.

Participants expressed their concerns that victims are reluctant to report, especially boys and men. This was attributed to a few reasons, such as fear of not being believed, being blamed, and widespread stigmatization. All participants felt that listening to victims’ stories, needs, and concerns was the best way to build trust and help them overcome their fears. Agencies reported that victims benefited greatly from seeing counseling services, victims’ advocates, and having someone within their social circle with whom to talk.
Agencies in Spartanburg County were found to be interconnected and to offer diverse resources. However, some improvements could be made to make strengthen connections. Communication between the agencies and private counselors or therapists should be improved. Possibly, this is because counselors are not typically in the same group settings as other agencies. For the most part, however, the most expressed concerns had to do with “regular” community members and their perceptions of sexual violence.

**Conclusions**

While CSA and adult sexual assault are widely acknowledged to be a significant social problem, very little is known about victims residing in Spartanburg County. This study began to address this gap in the research by analyzing the perceptions of and responses to sexual violence among those working directly with victims. Overall, agencies in Spartanburg County were viewed as meeting the needs of help-seeking victims. Agencies cooperate with one another efficiently, although communication could be improved. Overall, our participants believe more needs to be done to educate the residents of Spartanburg County to help overcome stigma and remove social barriers in reporting. If more victims felt empowered to seek help, the agencies would be in a better position to interrupt the generational cycle of abuse experienced by so many.

**Acknowledgements**

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**References**


