



McNair Research Journal



TAMU-CC



PRESIDENT/CEO DR. KELLY M. MILLER



Inspired by the momentous achievements of Ronald E. McNair, the TAMUCC McNair Scholars Program continues to honor his legacy by equipping underrepresented under-graduate students with the tools necessary to realize their highest aspirations.

The ability to conduct scholarly research is central to success in a variety of academic fields and vital to the attainment of a graduate degree. Through faculty mentorship and the assistance of program staff, the McNair Scholars Program is helping students develop these essential skills as evidenced by the work presented in this research journal.

I would like to congratulate the McNair Scholars on their accomplishments and extend my sincerest appreciation to the McNair staff, Faculty Mentors, and the campus community for their continued support of the scholarly growth of our students.

A handwritten signature in black ink that reads "Kelly M. Miller". The script is fluid and cursive.

Dr. Kelly M. Miller
President/CEO

PROVOST DR. CLARENDA PHILLIPS



Texas A&M University-Corpus Christi is honored to host the McNair Scholars Program. Because the McNair Scholars Program prepares underrepresented students to pursue graduate degrees by emphasizing academic achievement, scholarly inquiry, and mentorship, we are excited to partner with the Program to develop the next generation of researchers. Research is a key activity for McNair scholars who seek to make a difference in the world by exploring an array of topics to find solutions for the problems that face our world.

From educating our children to managing ocean resources, our scholars provide an in depth perspective on education, psychology, health, technology, engineering, marine science and other scientific fields. The scholars included in this journal are among the most talented students at the Island University. They are our future leaders in higher education, and we are proud of what they have already accomplished.

I am grateful for the students' commitment to scholarly inquiry and discovery of new knowledge, the faculty mentors who have worked alongside these scholars, and the McNair Scholars Program staff. Reading through this journal, you too will see that the culmination of their efforts are exemplary.

A handwritten signature in black ink that reads "Clarendia Phillips". The signature is fluid and cursive, with the last name "Phillips" being more prominent.

Dr. Clarendia Phillips

Provost and Vice President for Academic Affairs

EXECUTIVE DIRECTOR D'ANGELO SANDS



In an era driven by knowledge and innovation, research plays a pivotal role in shaping the world we live in. Engaging in research fosters intellectual growth and critical thinking skills. By immersing oneself in the process of formulating research questions, conducting literature reviews, designing experiments, and analyzing data, scholars develop a deep understanding of their chosen field. This in-depth exploration not only expands their knowledge but also equips them with the skills necessary to navigate complex problems and contribute original insights.

By generating new knowledge, challenging existing theories, or proposing innovative approaches, researchers play a pivotal role in advancing their fields. Publishing research findings in esteemed journals like the McNair Scholars Research Journal amplifies their impact, ensuring that their work reaches a wider audience of scholars, professionals, and policymakers who can benefit from their contributions.

Publishing research also allows scholars to establish credibility and build a professional reputation. When their work undergoes a rigorous peer-review process and is accepted for publication, it serves as a testament to the quality and significance of their research. Moreover, it enables them to become recognized experts within their fields, opening doors to collaboration opportunities, funding prospects, and career advancements.

The McNair Scholars program, with its commitment to showcasing the achievements of undergraduate researchers, plays a vital role in supporting aspiring scholars on their academic journey. By providing a platform to disseminate their research, this journal not only validates their efforts but also encourages them to continue pursuing excellence in their chosen fields.

I commend the McNair Scholars program for their dedication to promoting undergraduate research and providing an outlet for scholars to showcase their work. This journal serves as a catalyst for inspiration, fostering a culture of intellectual curiosity and encouraging students to make significant contributions to their disciplines.

Thank you for your unwavering commitment to nurturing young scholars and providing them with a platform to share their research findings.

Sincerely,
D'Angelo Sands
Executive Director, College Access and Outreach

TRIO

R O N A L D E . M C N A I R
P O S T - B A C C A L A U R E A T E
A C H I E V E M E N T P R O G R A M



TEXAS A&M UNIVERSITY
CORPUS CHRISTI

DR. PEGGY VALDES



Program Director



Journal Redesigned and Edited by
fellow McNair Scholar Noah Melendez



ANABEL HERNANDEZ

Assistant Director



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BIOGRAPHY OF

DR. RONALD E. MCNAIR

specialist aboard the 1984 flight of the shuttle Challenger.

HE WAS RESPECTED AND COMMENDED.

For his achievements, Ronald McNair received three honorary doctorate degrees and many fellowships and accommodations. These distinctions include: Presidential Scholar, 1967-71; Ford Foundation Fellow, 1971-74; National Fellowship Fund Fellow, 1974-75, Omega Psi Phi Scholar of the Year, 1975; Distinguished National Scientist, National Society of Black Professional Engineers, 1979; and the Friend of Freedom Award, 1981.

HE EXCELLED IN MANY ASPECTS OF LIFE.

Ronald McNair also held a fifth degree black belt in karate and was an accomplished jazz saxophonist. He was married and was the dedicated father of a daughter and a son.

After his death in the Challenger explosion in January 1986, members of Congress provided funding for the Ronald E. McNair Post Baccalaureate Achievement Program to encourage college students with similar backgrounds to Dr. McNair to enroll in graduate studies. Thus, the program targets students of color and low income, first generation college students. This program is dedicated to the high standards of achievement inspired by Dr. McNair's life.

HE OVERCAME OBSTACLES.

Dr. Ronald Erwin McNair, Physicist & Astronaut, dared to dream. As an African American growing up in a poor community in the South, he encountered discrimination early in his youth. Yet this did not stop him from pursuing his dream of becoming a scientist.

HE ACHIEVED ACADEMIC EXCELLENCE.

In 1971, he graduated magna cum laude from North Carolina AT&T State University with a B.S. degree in physics. Ronald McNair then enrolled in the Massachusetts Institute of Technology. In 1976, at the age of 26, he earned his Ph.D. degree in laser physics.

HE BECAME A LEADER IN HIS FIELD.

Dr. McNair soon became a recognized expert in laser physics while working as a staff physicist with Hughes Research Laboratory. He was selected by NASA for the space shuttle program in 1978 and was a mission

ARTICLES

2021



Vegan Diet for Athletic Performance: Myths and Reality

By: Valentina Campos

ABSTRACT

The purpose of this qualitative study was to explore perceptions of the effects of plant-based diets on athletic performance for vegan athletes. The study recruited ten participants that followed a vegan lifestyle, trained at a specific activity level, and had been vegan for at least six months. This qualitative study has found that the vegan diet causes very beneficial effects towards the bodies of the ten participants. This qualitative study also found that the majority disadvantages

of attaining a vegan lifestyle had to do with the outer world and being perceived differently compared to others. Being treated as an outcast to the food options and personal opinions makes the vegan lifestyle difficult, but the physical results are said to be worth it to the participants.

INTRODUCTION

The purpose of this qualitative study is to explore perceptions of the effects of plant-based diets on athletic performance for vegan athletes. This study

explores whether participants have experienced perceived benefits or perceived disadvantages from a vegan diet while performing at an athletic level. The vegan diet is a plant-based diet that abstains from all animal products, such as meat, dairy, eggs, and honey (Smith, 2020). Research has found that utilizing a vegan diet can improve athletic performance and enhance athletic abilities, but there is not enough research about athletes with plant-based diets (Ewing-Chow, 2020). This study aims to add to the body of literature. Utilizing a vegan diet is not very common in the United States, since only less than 3% of the U.S. population is vegan (Meyer, 2021), and less than 1% of the world's population is vegan (Meyer, 2021). While the vegan diet is generally considered to provide the average person

MENTOR

Nikola Grafnetterova, Ed.D.

Doyeon Won, Ph.D

DEPARTMENT OF EDUCATION AND
HUMAN DEVELOPMENT

with the proper nutrients, there are specific concerns about the vegan diet in people who are highly physically active, particularly athletes. As Foster (2018) noted, U.S. society holds the stereotype that all athletes need to eat certain foods to perform at their best, but there are athletes that choose a plant-based lifestyle to perform at their own highest-level. The number of vegans in the United States is growing and this research study explores the lifestyle of vegan athletes that explain why they perform their lifestyle and why they think others have not done the same.

METHODS

This section discusses (1) research design, (2) participants, (3) data collection, and (4) data analysis of this qualitative study.

RESEARCH DESIGN

This study utilizes a qualitative research methodology. The goal of this methodology is to explore in-depth information about the experiences of the participants, while receiving and listening to certain levels of detail in the vegan athletes (Bailey, 2008). The researchers performed semi-structured interviews and collected demographic information from the participants. We asked the vegan athlete participants their age, gender, race/ethnicity, type of training, type of sport activity, how long have you been vegan, and pseudonym name. The participants were

also asked what made them decide to transition to a vegan diet while training as an athlete, their vegan journey, if they wish other athletes should utilize a vegan diet while training, if they would change their lifestyle or keep it, reasoning for non-vegans not utilizing a vegan diet for training, disadvantages while utilizing a vegan diet, advice they have for people who are wanting/thinking of transitioning to a vegan diet, myths/discouragements that they have heard from others while utilizing a vegan diet, and any additional details they would like to add to help with the results of the study. This qualitative study aims towards athletes who are utilizing the full plant-based lifestyle to discover effective qualities about their journey. The two research questions are: (1) What are the perceived advantages of a vegan diet for athletic performance? (2) What are the perceived disadvantages of a vegan diet for athletic performance?

PARTICIPANTS

To select the participants for this study, a purposeful sampling was utilized. Purposeful sampling is widely used in qualitative research for the identification and selection of information-rich cases that has to do with the topic of interest (Palinkas, 2015). Participants were eligible based on the following inclusion/exclusion criteria: (1) be at least 18 years of age; (2) train at least 4 times

a week for at least 45 minutes at a moderate (70%-80% heart rate max) and/or high intensity (80-90% heart rate max); (3) have been following a vegan diet for at least 6 months. Ten participants volunteered to take part in the study.

The research participants engaged in multiple athletic activities including: 4 triathlons, 1 ultramarathoner, 1 marathoner, 2 recreational runners, 1 tennis player, and 1 weightlifter. Most of the participants in this study were white females, compared to men and non-white participants. Also, most of the participants were involved in running activities compared to the athletes that do not use running as their main source of physical activity. To maintain confidentiality, all participants were given the option to choose their pseudonym. Table 1 provides the participants' pseudonym, age, gender, race/ethnicity, type of training, sport activity, and duration of vegan diet.

Name	Age	Gender	Race/Ethnicity	Type of Training	Duration of Vegan lifestyle
Heather	46	Female	White	Running/Yoga	6 Years
Barbara	30	Female	White	Strength Training	1 Year
Elizabeth	51	Female	White	Triathlon	6 Years
John	48	Male	Romanian	Marathoner	5 Years
Karen	46	Female	White	Triathlon	5 Years
Holly	49	Female	White	Triathlon	5 Years
Kim	47	Female	Asian	Running	8 Years
Mike	44	Male	White	Ultramarathoner	9 Years
Sunny	55	Female	White	Tennis	15 Years
Sean	49	Male	White	Triathlon	5 years

DATA COLLECTION

The research team in this study recruited participants through Facebook and Instagram advertisements, referrals, and snowball sampling, which is defined as the research participants recruiting other participants for a test or study (Glen, 2021). The Facebook and Instagram posts encouraged friends and followers from the research team to share the ad as well. Social media recruitment is a recruitment strategy that combines elements to connect with and attract active and passive participants on the digital platforms (Reiners, 2018). Social media is a popular tool that people are using as the

Demographic Information of Participants

number of users are only starting to increase. For example, it is found that 73% of millennials found their last job on a social network (Reiners, 2018). After social media participants had been recruited, the referrals, such as potential future participants, sent their personal information to the research team from the previous participant following their one-on-one interview.

Once the participants have emailed or contacted the research team about joining the study, the participants were then emailed a copy of the consent form. The participants were instructed to read the document, sign it, and send

it back to the research team. The one-on-one meetings were scheduled following those steps. At the start of the interview, the research team reviewed the consent form then proceeded asking the same open-ended interview questions through the meeting. The interviews were completed virtually via Zoom, while the researcher asked the questions outlined in the attached interview protocol (see Appendix A).

DATA ANALYSIS

All the interviews were audio recorded and then transcribed. Data transcription is the action of receiving a written account of spoken words and to capture how things are said through Rev (Bailey, 2008). The transcriptions were unitized and coded with Dedoose (Medelyan, 2021). We have generated themes using content analysis. Researchers use content analysis to discover more information about the purposes, messages, and effects of communication content (Luo, 2021). It is also used to quantify the occurrence of certain words, phrases, subjects, or concepts in a set of historical or contemporary texts (Luo, 2021).

FINDINGS

Three themes emerged from the data analysis. They were: (1) Maintaining Lifestyle Among Society Barriers (2) Eating for Peak Athletic Performance, and (3) The Advantage of Plant-Based Knowledge.

MAINTAINING LIFESTYLE AMONG SOCIETY BARRIERS

Participants have faced many obstacles and barriers in their lives that they still deal with today as vegan athletes, such as the locations the participants live, restaurant meal options, inability to find vegan products in stores, etc. For example, Holly explained in her interview that she travels to compete for her triathlon races and struggles to find vegan meals at restaurants.

Holly said:

When I went to Europe, I ended up eating some stuff. I just had to accept that I couldn't be a strict vegan while I was over there, because I wasn't exactly sure what was in stuff. The main thing I knew to check for was meat. But there was probably some dairy in some of the stuff that I ate, because I just didn't know how to ask. Meat is easier to look for, but sometimes they cut it up into little, tiny pieces. You just never know. Sometimes I just couldn't tell.

Holly did not feel comfortable being a vegan around people who eat animal products, since there are more animal-based meal options available to the public. More participants faced similar barriers as Holly did during their time in public. For further instance, Sean explained his similar unpleasant experience at a restaurant, and Sean would not

take no for an answer.

Sean explained: We used to get those [Stromboli in the restaurant], and they were always vegan. They make them for us without cheese so that they could be vegan. And then one time we called to order, and they're like, "Oh, the chef said that it doesn't cook the same without cheese. And so, we have to put cheese in it." I'm like, "I've had it a bunch of times with you guys. We don't need the cheese, and we don't want it." And they wouldn't make it without it. So, weird things like that happen.

Sean went through a disadvantage and inconvenience at a restaurant, and it became difficult for him to receive a meal without animal products included into it, since vegan meals are not very common. Elizabeth also spoke about being unable to find vegan products in certain locations.

For example, Elizabeth stated: It is rough when we go on a family trip or a road trip, and we're going through these little West Texas [towns] and everything's chicken fried whatever and barbecue. And they're like, "Oh, but they got a little blah blah blah..." Sometimes that gets a little annoying. But if there's an H-E-B nearby, that's fine. The main findings of the participants consisted of several health benefits towards their body due to the plant-based diet.

EATING FOR PEAK ATHLETIC PERFORMANCE

The participants continue their vegan lifestyles due to their improved athletic performance times, faster recovery, weight loss, longer life span, nutrient benefits, and overall physical health. There have been disadvantages from the outside world for vegan athletes, such as inability to find full plant-based meals and being known to be different, but when it comes to their health, there have only been advantages. Although the lifestyle is rather difficult, it is worth it to the lives of the participants. The participants had multiple reasons to become vegan, such as for their health, environment, or the animals. However, the primary reason included the participants' health.

For example, Elizabeth stated: If we're talking about athletes, it's [the benefit of vegan diet] going to be the health stuff and how they feel. It's going to be energy levels. It's going to be not bonking in the afternoon. That's what they're going to like. Some might be ethical or give moral reasons, but I think it's going to be the recovery times, the feeling lighter, feeling faster. Who doesn't like that?

Elizabeth believes the reason athletes follow the vegan lifestyle is for the health benefits and explained that it gives vegan athletes improved recovery times along with a lighter and faster feeling. This is true for John who improved

his marathon time in the process of becoming a vegan. John stated, “After two months of being vegan, my time at the marathon was better by almost three minutes.” This positive statement is also true for Barbara. Barbara shared, “I would say that my body does recover better. Like I said, I’m 30 years old, so I’m not old, but also not young anymore. But I feel great, like I feel I’m honestly in the best shape of my life. And I think a lot of it has to do with my training, but I would say 80% of it has to do with our diet.” Barbara explained in her interview how she felt after being on the diet from watching documentaries about it. Barbara is in the best shape of her life, and it is mostly due to the vegan diet.

One of the most interesting plant-based stories in this study came from Mike. Mike explained in the interview how the vegan diet had flipped his whole life completely.

Mike stated: It [being vegan] was a never-ending performance enhancing drug because you’re just on this high. You can recover and train harder. Just kind of loved running and running longer distances, and I was never a runner. Even as an athlete, I hated running. I like to tell people I was a varsity soccer player on a pretty competitive team in high school, and our DNF-ed our two-mile timed run that was a requirement for preseason to make the varsity

team. I couldn’t finish two miles, because I just wasn’t a runner. And now I think about two miles, and it’s like it’s not even a warmup. I don’t even know I’m running when I’m two miles in. Yeah, it’s just been a really interesting journey, one I couldn’t have predicted, and most definitely the vegan diet is the foundation of it for me.

Mike said in his interview that the vegan diet gave him several health benefits and had turned him into a runner when he used to be an unhealthy person. The vegan diet had changed his life and had turned Mike into an ultramarathoner. This positive statement is also true for Holly.

Holly stated: Yeah, I definitely noticed a difference because I was able to go from just doing sprint distance racing and shorter training to Ironman racing. And I felt like I had more energy, and I had no problem working out two, three times a day. So yeah, when I was doing it right, I definitely noticed a difference.

Holly has been doing ironman racing after feeling amazing from the vegan lifestyle. All the participants had a similar great feeling in training while following the vegan lifestyle. The vegan lifestyle is an action the participants do not regret doing and would very much continue.

THE ADVANTAGE OF PLANT-BASED KNOWLEDGE

Throughout the interviews, the participants had addressed the reasons why they transitioned to a plant-based diet and how they perceive others for not transitioning to a vegan diet. The participants’ voices were heard about potential controversy of the United States food system. They expressed why they believe that a vegan diet is great for today’s society and the reasons for others to potentially do the same. There are many beliefs that speak about health benefits, environment benefits, and animal life. For example, Mike explained how a vegan diet is a smarter way to eat compared to an animal diet, without the added animal products to it.

Mike stated: We’re using animals as the middleman in the people’s educational system. The calcium that we’re getting in the milk the cows got from the grass, and so we can eat the leafy greens. We don’t need it to go through the animal and get all the other things in it that we don’t want. The vegan lifestyle for the participants solves all the issues, and we just need it on a larger scale. It’s better for our planet, it’s better for animals, it’s better for the environment, it’s better for ourselves as individuals. For our physical health, for our mental well-being, all of it...I was trying to sell everyone on it, especially with family members, with older family members that I can see that have diabetes and heart disease, high cholesterol. And

I'm trying to tell them, "Here's the answer. You don't need to go to your doctor, you don't need those pills. You don't need that prescription. Just do this. You'll reverse it all."

Mike explains that you can find the same nutrients in a vegan diet, without adding animal products into the meals. Mike believes the vegan diet is an improvement for physical health, animals, and the environment. Mike believes that a plant-based diet can reverse negative health issues. It is found from the participants that people only eat what they have learned from the start. Eating what you have only known is what Kim believes and stated during her interview.

For instance, Kim stated: People are so set because of how they were raised. It just takes something to break people from it. I never talk like this with people who aren't vegan because it turns them away from it; it turns them off. But as soon as someone expresses interest in me, then I go 100% trying to get them... you know what I mean?

Kim and Mike believe that what people have learned growing up is false information. The educational food triangle includes dairy and milk, but they believe that the nutrients in those animal-based products can also be found in full plant-based foods. Everyone must explore into the unknown to change your lifestyle. Participants believe that it is the people's government that is keeping

the animal diet lifestyle in the government's educational system.

For example, Sunny said: Have you heard anyone in the media, the president, or the government telling people they need to eat better? That's not really been a thing that they've been telling people, has it?"

Sunny believes the vegan diet would reverse all the health issues that people today are dealing with, while something very important is not talked about. The participants agreed that eating healthy is a very important topic to discuss, but the standard American diet in the educational food system has raised some suspicions.

DISCUSSION

This study explored perceptions of the effects of plant-based diets on athletic performance for vegan athletes. The study found that the participants have faced many obstacles and barriers in their lives that they still deal with today as vegan athletes, such as the locations the participants live, restaurant meal options, and inability to find vegan products. These results go with research stating that being a vegan is not as sustainable a "normal diet" as a diet with animal products (Lawler, 2020), but it is a more ethical choice to make (Lawler, 2020). Although vegan options are more difficult to find and can be challenging while dining out in public, vegan athletes can still modify meals to be made vegan if the restaurant

allows it (Turnbull, 2021).

The participants continue their vegan lifestyles due to motivation of their improved athletic performance times, faster recovery, weight loss, longer life span, nutrient benefits, and overall physical health benefits. The health benefits are also a result of improved blood viscosity, lower risk of heart disease, improved oxygen towards the muscles, and increased antioxidants in the body (Esposito, 2019).

The participants then addressed the reasons they transitioned to a plant-based diet and why they perceive others to have not transitioned. The participants expressed why they believe that a vegan diet is great for the people's society and the reasons for others to potentially do the same, such as reducing the risk of negative health hazards, improving the overall environment, and saving the lives of the animals. There are many beliefs about health benefits, environment benefits, and animal life.

In this study, the research team has the goal to explore the perceptions of the effects of plant-based diets on athletic performance for vegan athletes. Research has found that utilizing a vegan diet can improve athletic performance and enhance athletic abilities, but there are many myths and stereotypes that people believe today that exist and say otherwise (Bernard, 2019). This was known to be true for multiple participants,

such as John, Mike, and Holly while feeling improvements in their physical abilities.

The study has found that the vegan diet has given the participants physical and athletic advantages in their sports and overall lifestyle, but it is also found that there are many disadvantages plant-based athletes can face in the real-world outside their bodies, just as Sean had explained his unpleasant experience at a restaurant when there was no vegan meal choice. There are two sides to every coin, and the disadvantages range from little access to plant-based foods in certain locations, inconvenience in restaurants, dealing with criticism, no access to plant-based foods at a sporting event, lack of B12 vitamins, and not being as calorie dense. Although, the found research of the benefits of a plant-based diet had been exposed by the participants who had taken part in this study, such as: increased energy levels, faster recovery, weight loss, faster race time, clearer skin, nutrient dense, and improved overall strength and performance.

Each participant in this study is shown to be motivated to continue their plant-based lifestyle for as long as they live and would remain unchanged. The expected outcome of the advantages was shown and spoken about Mike, John, Holly, Elizabeth, Sean, Heather, Karen, Kim, Sunny, and Barbara, but it only matches the number of

disadvantages shown in the study as well. To this day, most of the population in the world does not follow a vegan diet, so exposing yourself to a different world is perceived to be a life challenge to the participants. The participants in this study choose to maintain their lifestyle beyond the barriers and limitations that society can have on them, and the number of people following a plant-based diet and plant-based options are only increasing, because Sunny has explained how she believes the vegan diet is the proper nutrition for everyone due to health benefits. In each country, roughly 1-3 percent of the population are vegan, and the numbers are continuing to accelerate (Meyer, 2021). The numbers are increasing, veganism is still the outcast.

CONCLUSION

As a conclusion, the purpose of this study was to explore perceptions of the effects of plant-based diets on athletic performance for vegan athletes. This study aims towards athletes who are utilizing a full plant-based lifestyle for us to discover effective qualities about the journey of the participants. The research team in this study had interviewed ten participants to discover if their journey gave the athletes advantages, disadvantages, or both while utilizing a vegan diet. There have been many advantages that have been said towards the health aspects of the participants

from the vegan diet, the lives of the animals they plan to save, and the overall environment. The participants faced many disadvantages while living in a world that practices a predominately animal-based lifestyle. The health benefits consisted of increased energy, weight-loss, increased recovery time, faster race times in competition, reduced the risk of potential heart diseases, and much more! The disadvantages ranged from little access to plant-based foods in certain locations, inconvenience in restaurants, dealing with criticism, no access to plant-based foods at a sporting event, lack in B12 vitamins, and not being as calorie dense.

REFERENCES

- Akers, W. (2019, November 14). Elite athletes are going vegan. Will it help you? Healthline. [https://www.healthline.com/health-news/pro-athletes-are-going-vegan-will-it-help-2#Will-a-vegan-diet-make-someone-a-better-athlete?](https://www.healthline.com/health-news/pro-athletes-are-going-vegan-will-it-help-2#Will-a-vegan-diet-make-someone-a-better-athlete?sh=16cae4607664)
- Bailey, J. (2008, February 27). First steps in qualitative data analysis: transcribing. OUP Academic. <https://academic.oup.com/fampra/article/25/2/127/497632>.
- Ball, M. (2020, February 26). What to eat when you're a vegetarian or vegan athlete. News | UW Health. <https://www.uwhealth.org/health-wellness/what-to-eat-when-youre-a-vegetarian-or-vegan-athlete/47019>.
- Barnard, N. D., & Goldman, D. M. (2019, January 10). Plant-based diets for cardiovascular safety and performance in endurance sports. *Nutrients*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6356661/>.
- Bernard, N. (2019, January 10). Six reasons athletes Are running toward a vegan diet. Physicians Committee for Responsible Medicine. <https://www.pcrm.org/news/blog/six-reasons-athletes-are-running-toward-vegan-diet>
- Busetto, L., Wick, W., & Gumbinger, C. (2020, May 27). How to use and assess qualitative research methods. *Neurological Research and Practice*. <https://neurolrespract.biomedcentral.com/articles/10.1186/s42466-020-00059-z>.
- Esposito, L. (2019, January 11). Athletes can thrive on plant-based diets | fitness | us news. U.S. News & World Report. <https://health.usnews.com/wellness/fitness/articles/2019-01-11/athletes-can-thrive-on-plant-based-diets>.
- Ewing-Chow, D. (2020, March 1). Five Reasons Why Sport Is Going Vegan. *Forbes*. <https://www.forbes.com/sites/daphneewingchow/2020/02/29/five-reasons-why-sport-is-going-vegan/?sh=16cae4607664>.
- Foster, A. (2018, August 23). Veggie Happy: Guiding you to your happy place. Veggie Happy. <https://www.veggiehappy.com/nfl-players-debunk-stereotypes/>.
- Glen, S. (2021, May 22). Snowball sampling: Definition, advantages and disadvantages. Statistics How To. <https://www.statisticshowto.com/probability-and-statistics/statistics-definitions/snowball-sampling/>.
- Jitchotvisut, J. (2019, April 25). 5 potential drawbacks of following a vegan diet. *Insider*. <https://www.insider.com/the-potential-risks-of-being-vegan-2019-4>.
- Lane, Cudmore, D., Claiman, Kat, Bansal, R., & Basheer, S. A. M. (2020, January 1). How Many Vegans in The World? In the USA? (2020). *Vegan Bits*. <https://veganbits.com/vegan-demographics/>.
- Lawler, P. (2020, September 23). Opinion: Veganism isn't necessarily the most ethical or sustainable option. *The Pitt News*. <https://pittnews.com/article/160250/opinions/opinion-veganism-isnt-necessarily-the-most-ethical-or-sustainable-option/>.
- Luo, A. (2021, February 15). Content analysis: A step-by-step guide with examples. *Scribbr*. <https://www.scribbr.com/methodology/content-analysis/>.
- Maziarz, B., Chojęta, D., Zygmunt, E., Wróblewski, H., & Zimna, A. (2020, July 1). Directory of Open Access Journals. *Journal of Education, Health and Sport*. <https://doaj.org/article/e331583deb184e869f41b405e249e3c0>.
- McGowan, C. (2020, September 11). SA health. The Risks Of Poor Nutrition. <https://www.sahealth.sa.gov.au/wps/wcm/>

connect/public+content/sa+health+internet/
healthy+living/is+your+health+at+risk/
the+risks+of+poor+nutrition.

Medelyan, A. (2021, May 31). Coding Qualitative Data: How To Code Qualitative Research (2021). Thematic. <https://getthematic.com/insights/coding-qualitative-data/>.

Meyer, M. (2021, March 23). This Is How Many Vegans Are In The World Right Now (2021 Update). WTVOX. <https://thevou.com/lifestyle/2019-the-world-of-vegan-but-how-many-vegans-are-in-the-world/>

Palinkas, L. A. (2015, September). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Administration and policy in mental health. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4012002/>.

Petre, A. (2021, February 12). 37 Foods and Ingredients to Avoid on a Vegan Diet. Healthline. <https://www.healthline.com/nutrition/things-vegans-dont-eat>.

Petre, A. (2019, August 26). What Is Veganism and What Do Vegans Eat? Healthline. <https://www.healthline.com/nutrition/what-is-a-vegan>.

Petre, A. (2019, October 15). 7 Supplements You Need on a Vegan Diet. Healthline. <https://www.healthline.com/nutrition/7-supplements-for-vegans>.

Petre, A. (2021, May 19). 6 Science-Based Health Benefits of Eating Vegan. Healthline. <https://www.healthline.com/nutrition/vegan-diet-benefits>.

Reiners, B. (2018, October 15). Social Media Recruiting: Everything You Need to Get Started and 17 Examples. Built In. <https://builtin.com/recruiting/social-media-recruiting>.

Smith, A. (2020, February 27). Vegan diet: Health benefits, foods, and tips. Medical News Today. <https://www.medicalnewstoday.com/>

[articles/149636#vegan-vs-vegetarian](https://www.healthline.com/health/vegan-diet/articles/149636#vegan-vs-vegetarian).

Turnbull, S. (2021, March 24). How to eat vegan at any restaurant (and not Order Salad). It Doesn't Taste Like Chicken. <https://itdoesnttastelikechicken.com/eat-vegan-restaurant-order-salad/>.



Ingroup/Outgroup Differences in the Perception of Rudeness during the COVID-19 Pandemic

By: Jesus Quintanilla

ABSTRACT

Ingroup favoritism and outgroup derogation are a common phenomenon occurring between opposing groups that people highly identify with. The present study attempted to examine such ingroup/outgroup biases in the context of people's identification with political groups. Democratic and republican participants read polite and impolite oppositional responses to a fictional Facebook post advocating for a democratic or republican candidate running for political office. It was

predicted that participants would rate impolite responses as ruder when they were directed toward an ingroup member than when they were directed toward an outgroup member. Similarly, polite oppositional statements directed toward an outgroup member were predicted to be viewed as less rude than those directed toward an ingroup member. An ingroup/outgroup bias was found only for polite oppositional responses, but the bias was opposite from what was expected. Participants judged polite oppositional responses ruder when they were

directed toward an outgroup candidate. Results suggest that there may be a hidden bias in which ingroup members, despite demonstrating polite behavior, may be assumed to hold more negativity toward outgroup members than evidenced by their behavior.

As the COVID-19 pandemic continues to affect our mental health and daily lives, efforts continue to discover the true origins of the deadly virus. While debates will likely continue as to whether the virus was man-made or resulted naturally from an infected animal, there is little doubt that the origin of the virus was China (Bloom et al, 2021). Unfortunately, a lack of clarity regarding how this virus began has led to an ugly prejudice aimed at Asian American citizens where they have become scapegoats

MENTOR

Steven Seidel, Ph.D.

DEPARTMENT OF PSYCHOLOGY

for problems caused by the pandemic. This prejudice has increased concerns regarding the safety and wellness of the Asian American population. Indeed, the United States has seen a spike in hate crimes against the Asian Americans that began once the Covid-19 virus entered the country (Tessler, Choi, & Kao, 2020). Tajfel and colleagues (1971) have demonstrated that people in even the most minimal groups quickly act in ways that favor the ingroup will disparaging outgroups. According to social identity theory (Tajfel & Turner, 1979), people's self-esteem is tied to the groups we belong to (social identities). To maintain a positive view of self and the groups we belong to, we show favoritism toward ingroups, and we may show disrespect and even hatred toward outgroups. That is why the topics of ingroup, and outgroup bias are important to trying to explain the sudden surge in crimes against the Asian community. Recent research has demonstrated that minority groups tend to be the ones subject to the hostility once COVID-19 thoughts were brought up in the context of an experiment (Bartos et al., 2020). In addition, Bavel and colleagues (2020) suggested that the higher perceived fear and threat in an individual/community, the more likely it is that ethnocentrism and intolerance towards outgroups may occur. The current study

attempted to explore evidence of ingroup/outgroup biases in the perception of rudeness. More specifically, the present study attempted to explore whether people's identification with a particular political party would affect their perception of polite and impolite comments made about an ingroup or outgroup member. In particular, the present investigation focused on perceptions of rudeness of polite and impolite comments.

Ingroup and outgroup effects appear to be easily replicated in laboratory settings. Hartstone and Augoustinos (2006) suggest that the mere notion of a dichotomy is likely to contribute to a more hostile and combative environment within the context of ingroup biases and favoritism. Research using the minimal group paradigm (Tajfel and colleagues, 1971) has found such "us-versus-them" biases occurring even when the assignment to a group is purely arbitrary. With this in consideration, the present study, which utilized peoples political party preferences as a basis of group assignment, expected even greater evidence of ingroup/outgroup effects.

Hart and colleagues (2020) suggest that due to the increased politization of the COVID-19 pandemic, more attention is paid by the public to the politicians opposed to scientists regarding COVID-19 precautionary measures such as mask wearing, and social distancing. This results in an

extensive polarization between Democrats and Republicans about beliefs in the COVID-19 virus, as well as support in scientists. Similarly, politization of the issue of climate change led to a similar phenomenon where people judge the validity of theories of climate change based on the political party of the source of such information (Chinn, Hart, & Soroka, 2020). Additionally, Hoffner and Rehkoﬀ (2011) add to these political oppositions as they state the hostile news influence was more present in individuals who identify with Republican ideologies, most specifically viewers of Fox News. The present study aims to examine these polarizations more extensively as we determine whether republicans encompass ingroup biases against democrats, and vice-versa regarding COVID-19 precautionary measures.

The mere presence of outgroup members can affect people's perception of safety. For example, Cruwys and colleagues (2020) suggest that in the presence of outgroup members, we have the tendency to encompass an increased perceived risk of COVID-19 in comparison to the ingroup biases we hold for those who we trust. Forsyth (2020) also reported a similar notion of shared psychological trust that increased stress arising from health pandemics can lead to groupthink, which is best characterized as the notion

of thinking based on group thinking, opposed to individual creativity or responsibility. Further, Harper & Rhodes (2020) suggest that during the COVID-19 pandemic, many individuals have internalized biases favoring themselves and members of ingroups, most specifically those within the same political affiliation, and unfavorable attitudes towards different political affiliations (outgroups) related to social gatherings. This ultimately suggests that in-group bias is also correlated to groupthink regarding COVID-19 mandates such as social distancing and mask utilization.

The scapegoating of Asian Americans during the pandemic is well established. For example, Dhanani and Franz (2020) found that individuals with increased fear of COVID-19 and lack of accurate data encompassed at least one discriminatory attitude against people of Asian descent. Further, Fuochi and colleagues (2020) add to this concept by suggesting that many individuals who encompass negative and discriminatory attitudes towards outgroups such as minority groups and immigrants do so to fulfill their need for cognitive closure. In general, unfavorable attitudes towards outgroups and minority groups appear to occur when people participate in social groupings (ingroup favoritism) to maintain a feeling of control (Roberto and colleagues, 2020). Moreover, it appears that

people who do this are more likely to not take accountability with COVID-19 precautionary measures. The ongoing study predicted a correlation between anxiety levels of COVID-19 and projection of discrimination against people of Asian descent.

Ingroup/outgroup biases may be moderated by the degree people feel threatened. Jonas and colleagues (2013) suggest that discrepancies present in threats can contribute to the activation of anxiety and defense mechanisms. More specifically, the threats can range from either absence of control, or conflicts in one's goals, as well as uncertainty. Jutzi and colleagues (2020) found that participants would encompass increased ingroup bias, need for control, as well as passive party support if they encompassed a higher perceived threat to the COVID-19 virus.

The present study hopes to add to literature on people's identification with political parties and the level of personal threat imposed by the COVID-19 pandemic interact resulting in ingroup/outgroup biases that might be used to give people a sense of control over their lives. It is predicted that ingroup members will perceive oppositional commentary made by outgroup members more negatively regardless of its actual level of politeness. The present study also attempts to examine the relationship between anxiety and attitudes towards out-

group members regarding the COVID-19 pandemic. The present study hypothesizes that ingroup/outgroup biases will be maximized under conditions of higher anxiety or threat.

METHODS

The participants were recruited using Amazon Mechanical Turk (MTURK). Participants received a payment of \$2.00 in exchange for completing a 30-minute survey conducted between June 1 and June 9 of 2021. Participants were eligible if they provided consent, complete information, and followed the directions to a validity item which was imbedded in the survey as a check to see if participants were reading the survey questions. A total of 185 participants completed the survey. Participants ranged in age from 20 to 69 years of age with an average age of 36.75 years. Of the 185 participants, 72 identified themselves as female and 113 as male. The sample included 133 White/Caucasian, 21 Asian/Pacific Islander, 14 Black/African American, 13 Hispanic/Latino, and 2 Native American/Alaskan Native participants. Two participants identified themselves and multiracial or biracial. Participants were also asked to choose which political party (Democrat or Republican) they most identified with. Most participants identified as Democratic ($n = 118$) compared to Republican

($n = 66$). Interestingly, there were 99 participants who identified themselves as “conservative” and 86 that identified as “liberal.” Of democratic participants, 44 identified themselves as “conservative” and 12 of the republican participants identified themselves as “liberal.”

MATERIALS AND PROCEDURES

Data was collected using an online Qualtrics survey. The survey consisted of demographic items which included sex, race, age, and 2 measures of political identification (democrat/republican, liberal/conservative). In addition to the demographic items, the survey included measures of pandemic anxiety (the COVID-19 Anxiety Scale (Silva, et al., 2020), a series of items designed to assess anxiety caused by ingroup and outgroup members, the Rosenberg Self-Esteem Scale (Rosenberg, 1965), and several items designed to assess how much blame participants place on Asian people for the pandemic. To assess perceptions of rudeness, participants were presented with a list of 5 polite (example: “I will not be voting for your candidate, but I understand that we can have separate views while remaining civil about it. Everyone is entitled to their own opinion even if it differs from my own opinion”) and 5 impolite responses (example: “Go to hell! Voting for that

candidate is un-American and if you do not like it here you should leave!”) to a fictional Facebook post advocating for political candidate described as being from either a republican, democrat, or unknown party. Participants were asked to indicate the degree to which they thought each response was rude, hostile, divisive, or biased using a 1 to 5 scale with higher scores indicating greater negativity.

Attitudes toward China was measured using 3 items. Participants rated their agreement of whether they had favorable feelings toward China and its people, if they agreed that China released the virus intentionally, and if they agreed that the catchphrase “Kung Flu” was an appropriate name for the virus.

To assess ingroup-outgroup differences in perceptions of anxiety due to the pandemic, half of the participants were asked to imagine that their near family and close friends where ingroup members were not practicing recommended pandemic guidelines. The other half were asked to imagine a gathering where strangers were not practicing proper pandemic guidelines. Participants made 5 ratings of how anxious the lack of protocol exhibited by ingroup, or outgroup members would make them.

THE COVID-19 ANXIETY SCALE

The COVID-19 Anxiety Scale (Silva, et al., 2020) is a 7-item scale designed to measure anxiety-related physiological arousal symptoms in an individual using a 4-point scale (higher scores indicate greater endorsement of negative symptoms. The scale has a reported Content Validity Coefficient well above .8 as well as good internal consistency reliability ($\alpha = .86$).

THE ROSENBERG SELF-ESTEEM SCALE

The Rosenberg Self-esteem scale is a 10-item Likert scale with items answered on a four-point scale - from strongly agree (4) to strongly disagree (1). Total scores range from 10 to 40, with higher scores representing lower self-esteem. The scale measures state self-esteem by asking the respondents to reflect on their current feelings. The reliability and structure of the scale is sound (Sinclair, et al., 2010).

RESULTS

The COVID-19 Scale ($\alpha = .91$), Ingroup Anxiety items ($\alpha = .93$), Outgroup Anxiety items ($\alpha = .92$), Rosenberg Self-Esteem Scale ($\alpha = .86$), polite response items ($\alpha = .96$), and impolite items ($\alpha = .84$) were found to have high internal consistency reliability. The items designed to measure attitudes toward China ($\alpha = .43$), however, were not found to have good reliability. These items, therefore, were not

combined for analysis.

Rudeness, Hostility, Divisiveness, and Bias ratings for the Facebook response items were highly correlated (see Table 1) with one another and therefore combined to form a composite measure of rudeness. This combined score was used for any further analysis. As a manipulation check, the composite measure of rudeness was compared for the 2 response politeness groups. As expected, a paired samples t-test confirmed that the impolite items ($M = 3.6$) received higher rudeness scores than polite items ($M = 2.5$), $t(df = 184) = 12.8$, $p < .001$. Rudeness composite scores were not found to differ between males and females, $t(df = 183) = .42$, $p = .678$. As a result, sex was dropped from the overall analysis.

The correlations were examined between composite rudeness, Covid-19 Anxiety, Participant Age, Self-Esteem, Feelings toward China, appropriateness of naming the Covid-19 virus “The Kung-Flu Virus,” and belief that the Covid-19 virus was intentionally released by China (see Table 2). Composite rudeness was found to be negatively related with Covid-19 Anxiety ($r(n = 185) = -.31$, $p < .001$), participant age ($r(n = 185) = -.18$, $p = .015$), and positive feelings toward China ($r(n = 185) = -.34$, $p < .001$). Rudeness scores were found to be positively related with Self-Esteem ($r(n = 185) = .36$, $p < .001$), belief that China

Table 1. Means, standard deviations, and correlations of composite rudeness

	M	SD	1	2	3
1. Rudeness	2.98	0.74			
2. Hostility	2.90	0.81	.838*		
3. Divisiveness	3.08	0.74	.785*	.823**	
4. Biased	3.20	0.81	.730*	.749**	.838**

** Correlation is significant at the .01 level.

* Correlation is significant at the .05 level.

Table 2. Means, standard deviations, and correlations

	M	SD	2	3	4	5	6	7
1. Rudeness-C	3.04	0.62	-.312**	-.178*	.356**	.365**	.449**	-.341**
2. Covid-19 Anxiety	2.78	1.09		.237**	-.238**	-.167*	-.306**	.202**
3. Age	36.75	10.89			-.144	-.083	-.031	.147*
4. Self-Esteem	2.12	0.62				-.026	.096	-.128
5. Intentional Release	3.30	1.35					.517**	.019
6. Kung Flu	2.8	1.48						-.170*
7. Positive China Attitudes	2.23	1.22						

** Correlation is significant at the .01 level.

* Correlation is significant at the .05 level.

intentionally released the virus ($r(n = 185) = .36$, $p < .001$), and agreement that “Kung-Flu” virus was an appropriate name ($r(n = 185) = .45$, $p < .001$). In addition to composite rudeness, Covid-19 anxiety was found to be negatively related with self-esteem ($r(n = 185) = -.24$, $p = .001$), belief that China intentionally released the virus ($r(n = 185) = -.17$, $p = .023$), and agreement that “Kung-Flu” virus was an appropriate name ($r(n = 185) = -.31$, $p < .001$). Covid-19 anxiety was positively related with age, ($r(n = 185) = .24$, $p < .001$), and positive feelings toward China ($r(n = 185) = .20$, $p = .006$).

To test the main hypothesis regarding an ingroup-outgroup bias in perceptions of rudeness,

a 3 (Candidate’s Political Identification: Republican, Democrat, Unknown) x 2 (Political Party of Participant: Democrat vs. Republican) x 2 (Response Politeness: Polite vs Impolite) Mixed ANOVA with Response Politeness serving as a repeated measures variable was performed. This analysis yielded a small 3-way interaction between the candidate’s political identification, the participant’s political identification, and the level of politeness of the critic responses, $F(2, 178) = 3.13$, $p = .046$, $\eta^2 = .034$. As can be seen in Figures 1 and 2, a 2-way interaction between the candidate’s and participant’s political identification was evident for the polite critic response items in which

participant’s judged ingroup member responses (critics stating that they were opposed to a candidate of a different political party than their own) as ruder than outgroup member responses.

To compare reported anxiety levels experienced by

participants in the presence of ingroup or outgroup members who failed to adhere to COVID-19 safety standards, an independent samples t-test was conducted comparing ingroup and outgroup anxiety levels reported by participants. This analysis failed to find a

difference between the self-reported anxiety of participants who were imagined being in the presence of ingroup ($M = 2.15$) or outgroup ($M = 2.28$) members, $t(df = 183) = .76, p = .447$.

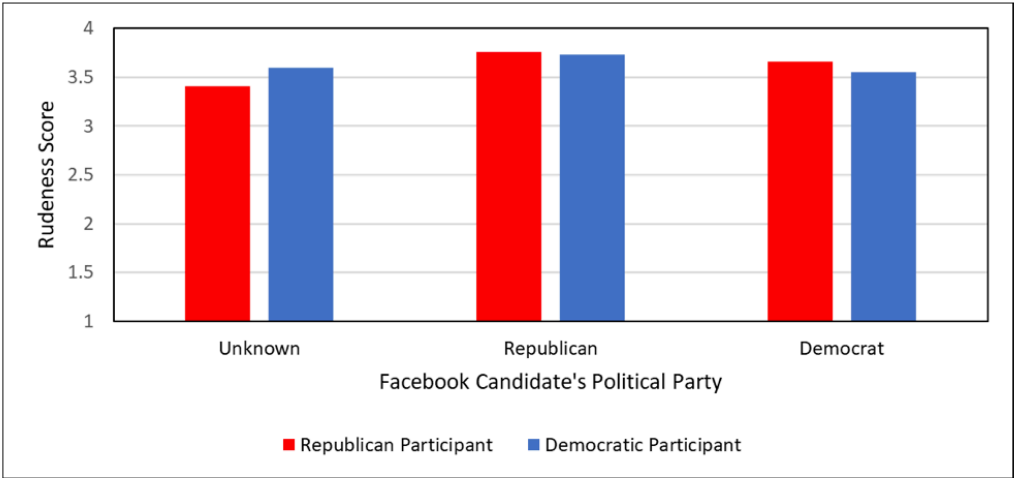


Figure 1. Response ratings for impolite responses as a function of participant’s and Facebook candidate’s political identification.

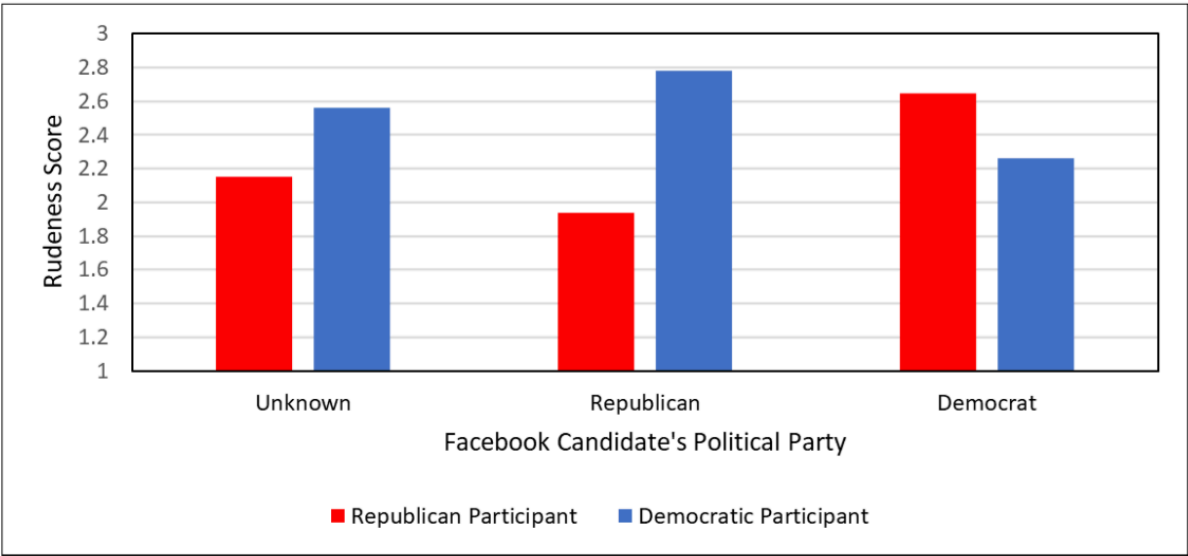


Figure 2. Response ratings for polite responses as a function of participant’s and Facebook candidate’s political identification.

DISCUSSION

The present study attempted to examine ingroup/outgroup biases in the context of people's identification with political groups. The main hypothesis of the present study predicted that participants would rate impolite responses as ruder when they were directed toward an ingroup member than when they were directed toward an outgroup member. Similarly, polite oppositional statements directed toward an outgroup member (polite statements assumed to be made by an ingroup member) were predicted to be viewed as less rude than those directed toward an ingroup member. Inconsistent with the findings of Tajfel and Turner (1979), the results of the present study failed to support this hypothesis. The results from the present study suggest that ingroup/outgroup biases do not exist when judging impolite responses. Regardless of whether a participant was democrat or republican, impolite comments were judged to be ruder than polite comments. Apparently, people view impoliteness with a substantial amount of objectivity. For polite comments, however, an ingroup bias appeared to operate, albeit inconsistent with expectations. It was expected that polite comments would be judged as less rude when they were made by an ingroup member. The results of the present study suggest the opposite. Participants judged polite

comments as ruder when they were assumed to be made by an ingroup member. We suggest the reason for the ingroup bias may have something to do with polite statements made toward outgroup members being inconsistent with their belief systems. That is, when ingroup favoritism and outgroup derogation is the rule underlying interpersonal perception, outgroup politeness may have been viewed as disingenuous and therefore less believable. Such perceptions that responses lacked sincerity may have prompted participants to adjust their perceptions more in line with their expectations, resulting in seeing more negativity in the polite oppositional responses of ingroup members. Future studies should explore such possibilities.

We predicted that the increased perceived amount of COVID-19 anxiety present in a participant, the more likely they are to encompass unfavorable attitudes and composite rudeness towards out-group members about the COVID-19 pandemic. The result of the present study did not demonstrate support for this hypothesis. The findings are different to previous research (see Dhanani and Franz (2020)) suggesting that anxiety and rudeness are positively related. While Dhanani and Franz (2020) suggest that fear and limited information regarding COVID-19 can correlate to increased outgroup discrimination against people of

Asian descent, the present study suggests composite rudeness and COVID-19 anxiety are negatively correlated. Perhaps people with high anxiety regarding COVID-19 have such high anxiety due to their lack of being able to justify such anxiety. It may be the case that people who are able to blame someone for the virus (perhaps scapegoating Asian people) experience less anxiety because they have targeted, albeit inappropriately, a group responsible for the virus. Perhaps future studies might explore such a possibility.

It was also predicted that higher the rudeness score present in a participant, the more likely it is for them to display beliefs that the COVID-19 virus was intentionally released by China and that "Kung Flu" is an appropriate name for COVID-19. The result of the present study was found to have strong reliability for this hypothesis. The findings are like the results of Hart and colleagues (2020) as the correlation between rudeness scores was deemed positively correlated to self-esteem scores, the belief that China intentionally released the virus, as well as the agreement that the "Kung Flu" virus was an appropriate name. We suggest the reason for this finding may be that those who possess more anger are likely to project their hatred to others and deflect accountability and blame others for the COVID-19 virus.

It must be noted that the data collected for this study contained a large amount of error variability. As such, the generalizability of results may be somewhat limited. To begin with, the present study utilized a sample that lacked diversity with 133 of the 185 participants identifying themselves as White/Caucasian. The use of MTURK to collect data has some advantages and disadvantages. The convenience and speed of data collection are two of MTURK's greatest advantages. For the present study, collection of data utilized some of MTURK's filters to select participants identifying as "liberal" or "conservative." Future studies utilizing MTURK should be cautious when applying such filters. Data obtained in the current study found that about 10% of participants identifying as "liberal" or "conservative" based on MTURK's filter identified themselves as the opposite on a self-report item inserted into the survey.

The present study sheds light on the ingroup and outgroup biases present in both the COVID-19 virus as well as the political divisions between Democrats and Republicans. This study is important in discussing how these ingroup/outgroup biases are present and similar in both the discrimination against the Asian community as well as the polarization between Democrats and Republicans. This could be applied to real life as it can help the population as a

whole understand why certain people with higher composite rudeness scores have a higher likelihood of projecting their insecurities into minority groups as well as speaking on how these biases also affect and divide us further politically.

We hope this research can help further provide insight and prevent further discrimination against people of Asian descent as well as help discuss the biases that many of us encompass politically in hopes of uniting the country while still discussing how politicization of health epidemics such as COVID-19 can be potentially harmful.

These issues are vital to the future of the wellness of the country and as such should be necessary to study further.

REFERENCES

- Bartos, V., Bauer, M., Cahlikova, J., & Chytilová, J. (2020). Covid-19 crisis fuels hostility against foreigners. Retrieved March 02, 2021, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3618833
- Bavel, J.J.V., Baicker, K., Boggio, P.S. (2020). Using social and behavioral science to support COVID-19 pandemic response. *Nature Human Behavior*, 4, 460–471. <https://doi.org/10.1038/s41562-020-0884-z>.
- Bloom, J.D., Chan, Y.A., Baric, R.S., Bjorkman, P.J., Cobey, S., Deverman, B.E., Fisman, D.N., Gupta, R., Iwasaki, A., Lipsitch, M., Medzhitov, R., Neher, R.A., Nielsen, R., Patterson, N., Sterans, T. van Nimwegen, E., worobey, M., & Relman, D.A. (2021). Investigate the origins of COVID-19. *Science*, 372, pp. 694. <https://doi.org/10.1126/science.abj0016>.
- Chinn, S., Hart, P. S., & Soroka, S. (2020). Politicization and Polarization in Climate Change News Content, 1985-2017. *Science Communication*, 42(1), 112–129. <https://doi.org/10.1177/1075547019900290>
- Cruwys, T., Stevens, M., & Greenaway, K. (2020). A social identity perspective On COVID-19: Health risk is affected by shared group-membership. *British Journal of Social Psychology*, 59, p. 584-593. <https://doi.org/10.1111/bjso.12391>
- Dhanani, L.Y., Franz, B. (2020). Unexpected public health consequences of the COVID-19 pandemic: a national survey examining anti-Asian attitudes in the USA. *International Journal of Public Health*, 65, 747–754. <https://doi.org/10.1007/s00038-020-01440-0>
- Forsyth, D. R. (2020). Group-level resistance to health mandates during the COVID-19 pandemic: A groupthink approach. *Group Dynamics: Theory, Research, and Practice*, 24(3), 139–152. <https://doi.org/10.1037/gdn0000132>
- Fuochi, G., Voci, A., Veneziani, C. A., Boin, J., Fell, B., & Hewstone, M. (2020). Is negative mass media news always associated with outgroup prejudice? The buffering role of direct contact. *Group Processes & Intergroup Relations*, 23(2), 195–213. <https://doi.org/10.1177/1368430219837347>
- Harper, C. A., & Rhodes, D. (2020). Ideological responses to the breaking of COVID-19 social distancing recommendations. Retrieved March 02, 2021, from <https://psyarxiv.com/dkqj6>.
- Hart, P. S., Chinn, S., & Soroka, S. (2020). Politicization and Polarization in COVID-19 News Coverage. *Science Communication*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7447862/>.
- Hartstone, M., & Augoustinos, M. (2006). The minimal group paradigm: Categorization into two versus three groups. *Wiley Online Library*. <https://onlinelibrary.wiley.com/doi/abs/10.1002/ejsp.2420250205>.
- Hoffner, C., & Rehkoff, R. A. (2011). Young voters' responses to the 2004 U.S. Presidential election: Social identity, perceived media influence, and behavioral outcomes. *Journal of Communication*, 61(4), 732–757. <https://doi.org/10.1111/j.1460-2466.2011.01565.x>
- Jonas, E., McGregor, I., Klackl, J., Agroskin, D., Fritsche, I., Holbrook, C., Nash, K., Proulx, T., & Quirin, M. (2013). Threat and Defense: From Anxiety to Approach. *Advances in Experimental Social Psychology*, 49, pp. 219-286. <https://doi.org/10.1016/B978-0-12-800052-6.00004-4>
- Jutzi, C. A., Willardt, R., Schmid, P. C., & Jonas, E. (2020). Between Conspiracy Beliefs, Ingroup Bias, and System Justification: How People Use Defense Strategies to Cope with the Threat of COVID-19. *Frontiers in Psychology*, 11, 578-586. <https://doi.org/10.3389/fpsyg.2020.578586>

Roberto, K. J., Johnson, A. F., & Rauhaus, B. M. (2020). Stigmatization and prejudice during the COVID-19 pandemic. Retrieved March 02, 2021, from <https://www.tandfonline.com/doi/full/10.1080/10841806.2020.1782128>

Rosenberg, M. (1965). Rosenberg Self-Esteem Scale (RSES). APA PsycTests. <https://doi.org/10.1037/t01038-000>

Sinclair, S.J., Blais, M.A., Gansler, D.A., Sandberg, E., Bistis, K., LoCicero, A. (2010). Psychometric properties of the Rosenberg Self-Esteem Scale: Overall and across demographic groups living within the United States. *Evaluation & the Health Professions*. 33(1):56-80. doi:10.1177/0163278709356187

Silva, W.A., de Sampaio Brito, T.R., & Pereira, C.R. (2020). COVID-19 anxiety scale (CAS): Development and psychometric properties. *Current Psychology (New Brunswick, N.J.)*, 41, 5693 - 5702.

Tajfel, H., Billig, M.G., Bundy, R.P., & Fament, C. (1971). Social categorization and intergroup behavior. *European Journal of Social Psychology*, 1, 149-178.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), *The Social Psychology of Intergroup Relations* (pp. 33– 47). Monterey, CA: Brooks/Cole.

Tessler, H., Choi, M. & Kao, G. (2020). The Anxiety of Being Asian American: Hate Crimes and Negative Biases During the COVID-19 Pandemic. *American Journal of Criminal Justice*, 45, 636–646. <https://doi.org/10.1007/s12103-020-09541-5>



A Methodology to Determine the Efficacy of Design Variations in Wearable Airbags Using Finite Element Analysis

By: Krystal Garza

ABSTRACT

The methodology suggested in this study enables evaluation of the effect of expandability and shock absorption properties of the wearable airbag prototypes upon overall performance. The test results suggest a correlation between drop tests through computer simulation and physical drop tests performed in a controlled environment. This methodology can be used and expanded upon to study the optimum airbag dimensions to minimize impact and protect the proximal femur. Additionally,

the novel airbag design specifications to minimize air leakage can be determined, and an air bag material with high durability against external impact can be manufactured or selected. The methodology will facilitate a way to optimize proposed designs without necessitating costly production of various prototypes in the planning and development stages.

INTRODUCTION

Falls in the elderly population account for a significant burden

on the healthcare system, costing the United States approximately \$20.2 billion annually. [1] Falls are also the leading cause of accidental death in those over 85, and in one Korean study it was found that in populations over 65, 47.4% of those who suffered a fall were left with a permanent disability. [2] [3] A lack of force reduction at impact can lead to severe injuries, and even amongst younger populations there is a notable need for impact attenuation in the event of falls or high impact collisions. [4] In construction, falls can lead to permanent disability or death, and accidents sustained during active sports such as skiing or snowboarding can lead to severe injuries. [5] Motorcyclists are also 28 times more likely to be killed in a roadway collision than someone inside a passenger vehicle, and made up 5,286

MENTOR

Byung Cheol Lee, Ph.D.

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of the overall traffic deaths in 2016. [6] Development of wearable airbags is a relatively new solution for these accidental injuries, and there are several applications for these safety devices such as wearable belt-style airbags for the elderly, safety vests for construction workers, and motorcycle jackets with airbags worked into the design, all of which inflate when a fall or collision is detected. [7]

Previous studies using impact testing have validated that energy absorbing devices have a greater impact attenuation capability than energy shunting devices at higher impact forces. [9] As such, a wearable airbag is presumed to be more effective than the current hard-shell protectors currently on the market. The purpose of this research is to evaluate the designs and structures of wearable airbags in order to improve force attenuation capabilities as well as to determine whether or not computer simulation is an accurate representation of the force attenuation capabilities of a wearable airbag device.

Using a prototype, impact testing using a drop tower will be performed upon an anatomical model of a femur and the surrounding tissues in order to evaluate the impact force attenuation capabilities of this wearable airbag. Finite element analysis will then be conducted using a geometrically simplified CAD model of an osteoporotic femur, the



Figure 1. MRI scan of a fracture at the proximal femur [8]

surrounding soft tissues, and the average effective mass of the target consumer analyzed with and without a simplified model of the airbag geometry. Material properties will be applied to the models using computer simulation software to gain insight on whether or not computer-aided simulation is an effective method of evaluating these devices. If proven, this method could then be used as a preliminary step in the design of wearable airbags to optimize design iterations in a quick, cost-effective way. Ideally, the experimental data and the simulation data should be correlated to show a reduction in the peak compressive force. [10]

METHODS

Physical Drop Test

The current standardized testing method for wearable airbag

systems is a drop tower using an effective mass traveling at a velocity of 3.4 m/s using IMU (inertia measurement unit) sensors and impacting a mechanically correct model of a human hip equipped with a force plate (Figure 1). The force plate is placed at the critical impact point to attain the impact energy, and drop tests are performed both with and without the airbag to determine the peak compressive forces acting upon the anatomical hip model. The force attenuation capabilities of these devices can then be determined. [9] The standard testing procedures and internationally agreed upon values of the effective mass, effective pelvic stiffness, minimal thickness of surrogate soft tissue, impact velocity, and peak compressive force were set forth by Robinovitch et al. [10] (see Table 1).

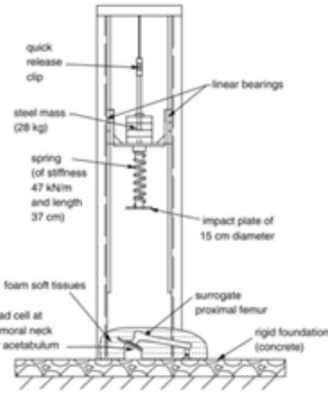


Figure 2. Drop Tower Design [10]

The proposed drop test equipment consisted of an effective mass of 28.476 kg which sits upon a drop plate fitted with linear bearings as well as a GSR (galvanic skin response) sensor which features an accelerometer and gyroscope. An impact plate was fastened to the drop plate using a spring with a stiffness of 47.004 kN/m which was meant to simulate the stiffness of the soft tissue and bone being impacted upon, and the vertical supports guided the drop plate straight down along the vertical axis to create a free fall condition. [10] Due to an inability to measure the velocity at impact, an impact velocity of 3.4 m/s was assumed and utilized along with the velocity equation to calculate an effective drop height of 0.589 m which was measured from the top of the surrogate hip and airbag assembly to the bottom of the impact plate (eq. 1). This height was used in each of the drop tests.

The hip assembly was made up of a Sawbones

Table 1. Recommended Design Parameters of Biomechanical Test Systems for Measuring the Force Attenuation Provided by Hip Protectors [10]

PARAMETER	RECOMMENDED VALUE OR TYPE
Basic Design	Impact Pendulum or Drop Tower
Effective (Drop) Mass	28 kg (Acceptable Range, 22-33 kg)
Effective Pelvic Stiffness	47 kN/m (Acceptable Range, 39-55 kN/m)
Soft Tissue Covering	Polyethylene or Polyurethane Foam
Minimal Thickness of Soft Tissue Covering Over the Greater Trochanter	Rubber ^a 18 mm
Impact Velocity	3.4 m/s ^b
Peak Compressive Force in Unpadded Case	3.5-4.5 kN ^c
Time to Peak Compressive Force in Unpadded Case	30-50 ms
Filtering of Force Signals	Low Pass Recursive, Cut Off Frequency = 50 Hz

Notes:

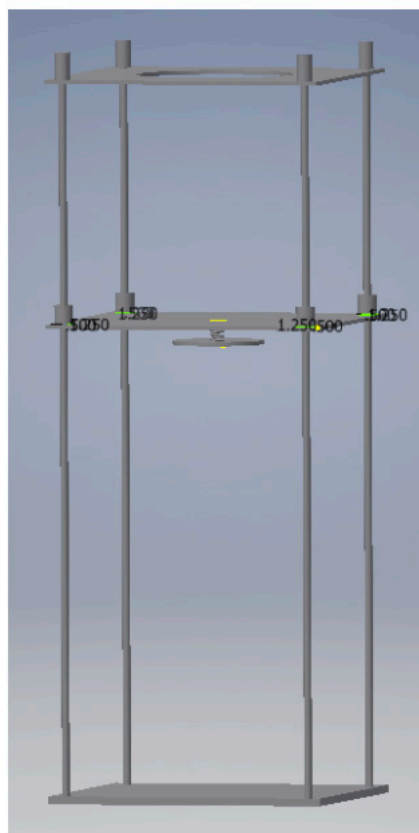
^aThe anatomy and surface geometry of the pelvic model should mimic the pelvic anatomy of older adults.

^bImpact velocities of 2 m/s and 4.5 m/s can be used to simulate a soft fall and a more severe fall, respectively. Peak force will scale accordingly.

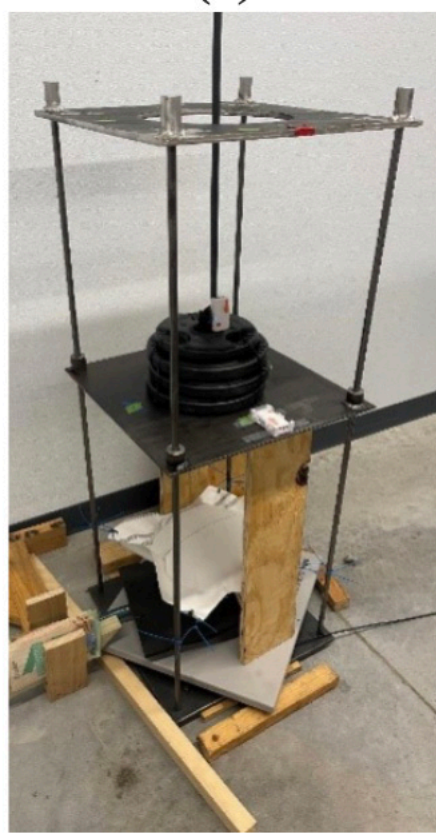
^cIt is likely that in severe sideways falls of tall individuals, or in falls from considerably greater than standing height (e.g., downstairs), the peak force applied to the proximal femur will exceed 4.5 kN. However, the group's philosophy was to assess the protective value of hip protectors when worn by a typical older woman, falling from standing height.

osteoporotic femur surrogate, multiple sheets of polyethylene foam which made up a thickness of 18.256 mm, and the prototype airbag filled to capacity using compressed air. The assembly was set into a stabilizer to maintain appropriate positioning and set onto a Bertec load plate. Shimmer3 GSR+ sensors were attached to the vertical rod on the drop plate as well as fastened to the plate itself. The Bertec load plate was set to filter output force signals at 125 Hz, the lowest available setting, and using the Bertec Digital Acquire 4.0 software, low-pass filtered uniaxial force data in the vertical direction was output to a computer, and a force-time diagram was produced. From the output graphs, the peak compressive forces in

each trial were attained. The Shimmer GSR sensors were configured to obtain data using low-noise accelerometer and gyroscope functions. Data was collected and imported using ConsensusPRO software, and a time-response graph of the tri-axial acceleration was output and used to analyze the effects of rebounding during and immediately after impact. Three drop tests were performed with the airbag included in the analysis, and three drop tests were performed while excluding the airbag from the analysis.



(a)



(b)

Figure 3. Drop tower design: (a) CAD rendering of proposed drop tower design without implementation of effective mass (b) Drop tower set-up with effective mass, sensors, and hip surrogate installed

FINITE ELEMENT ANALYSIS

For this study, the Drop Test feature within Solidworks simulation software was used. A multibody model was assembled using modified geometries of an effective mass, the upper half of an adult's left femur, a model of the soft tissues at the hip, and the airbag prototype at full capacity. The material properties of these components were imported into the Solidworks library, and assumptions were implemented to aid in ease of simulation.

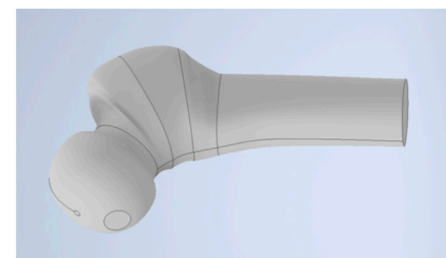
The femur model was treated as exhibiting linear

isotropic behavior, and it was assumed that the material properties of the proximal femur were the same as those of cortical bone. [11,12] The geometry of the femur was simplified during modeling to aid in assembly of the components, however critical dimensions of the femoral neck and head were kept intact. Soft tissue was modeled using low density polyethylene foam as recommended in several studies, and an 18 mm thick square foot of material was used to model the surrounding tissue at the hip. An effective mass was modeled using Aluminum-6061, as the

only consideration for this component was the applied load. For the airbag, the company that produced the prototype provided the material properties of Nylon 6/6, and the thickness was modeled after a material sample of the textile used. A simplified geometry which was closely correlated to the actual airbag prototype filled to capacity was



(a)



(b)

Figure 4. Proximal femur (a) Anatomically correct model of a adult human femur (b) CAD drawing of the upper half of an adult human femur

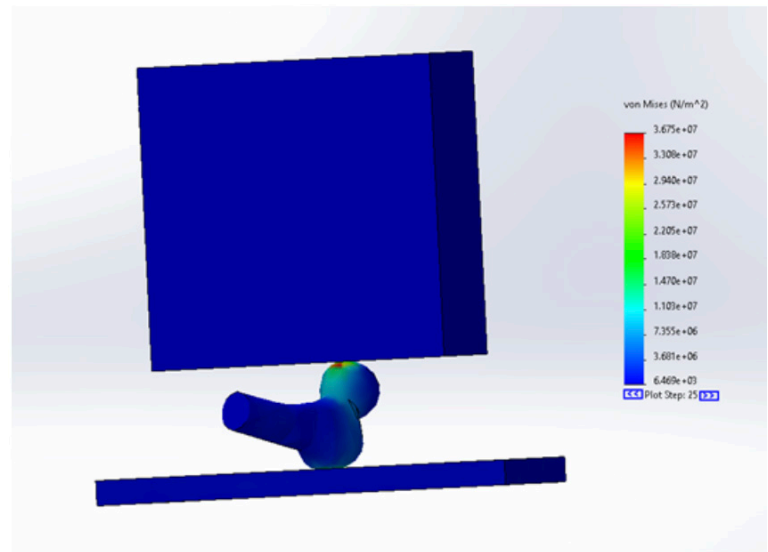
An assembly using bonded connections was created, and a curvature-based mesh was implemented to perform the finite element study. The drop test parameters were set to an impact velocity of 3.4 m/s at the lower plane of the soft tissue surrogate, and a preliminary drop test was performed while excluding the airbag part from the analysis. The location of greatest acting stress was obtained, and a probe was placed at the node to record a

time history chart of the stresses acting at the specified point. Two more iterations of the drop test were performed, one with the airbag included in the analysis and one without. The time history graphs were obtained for each at the sensor and using the cross-sectional area of the femur in the XY plane at the sensor location, the peak compressive force was calculated for each case and compared to the fracture threshold of 3.47 kN. [4]

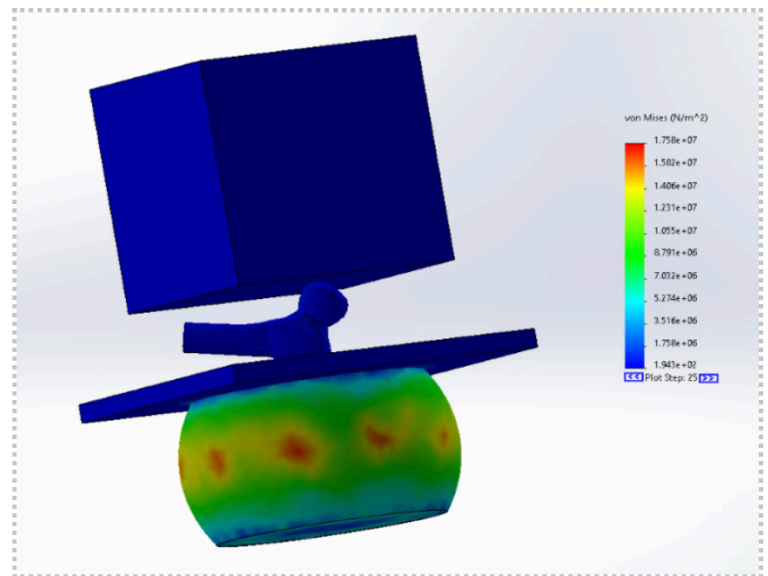
SIMULATION

Simulation data was taken at the node upon which the acting stress was the greatest and the stress was then used to determine the peak compressive forces (eq. 2). Considering all forces acting upon the full assembly, the peak compressive force was 10.053 kN without the airbag included in the analysis and 4.809 kN with the airbag. When considering the peak forces acting only upon the femur, the peak compressive force was 10.053 kN when the airbag was not included indicating a point of peak compressive stress but was reduced to 168 N in the case with the airbag. The agreed upon fracture threshold of an elderly adult's femur is 3.47 kN. The simulations demonstrate the efficacy of wearable airbags' force attenuation capabilities, and the results demonstrate that most of the impact energy is absorbed by the wearable airbag device, preventing those forces

from acting upon the femur. Peak compressive forces acting at the femur in the analysis which included the airbag are far below the fracture threshold, validating the efficacy of these devices. [10]



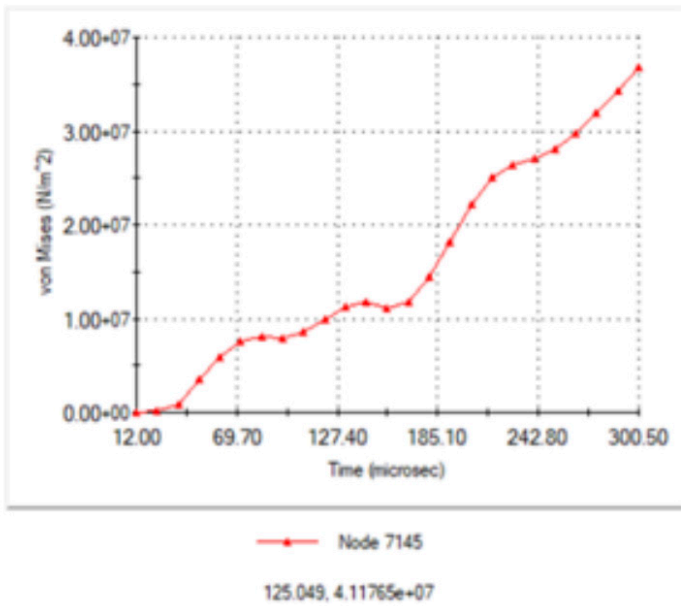
(a)



(b)

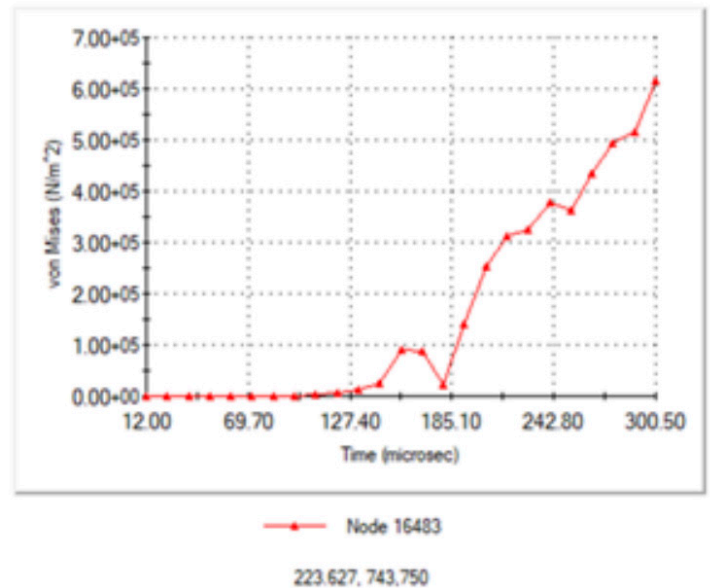
Figure 5. Drop test simulation (a) Drop test simulation without the airbag prototype included in the finite element analysis (b) Drop test simulation with the airbag prototype included in the analysis

Stress-Time History - Hip Surrogate Only



(a)

Stress-Time History – Hip Surrogate and Airbag



(b)

Figure 6. Simulation results at node of greatest acting stress upon femur (a) Stress-time graph taken during simulation without airbag included in analysis. (b) Stress-time graph taken during simulation with airbag included in analysis.

Table 2. Peak compressive forces acting at any point within the assembly

Peak Compressive Force Acting Upon Full Assembly			
	σ [MPa]	A [m ²]	F_{peak} [kN]
Without Airbag	36.749	273.5E-6	10.053
With Airbag	17.580	273.5E-6	4.809

Table 3. Peak compressive forces acting only at proximal femur

Peak Compressive Force Acting Upon Proximal Femur			
	σ [MPa]	A [m ²]	F_{peak} [kN]
Without Airbag	36.749	273.5E-6	10.053
With Airbag	0.615	273.5E-6	0.168

Drop Tests

Data for the drop tests with the airbag show peak compressive forces of 2.698 kN, 3.501 kN, and 3.889 kN. The average peak compressive force with the airbag included in the analysis was 3.362 kN, which falls below the fracture threshold of 3.47 kN. In the case of the drop tests without the airbag included in the assembly, peak compressive forces were recorded as 6.445 kN, 8.104 kN, and 5.354 kN. Without the airbag included in the analysis, the average peak compressive force recorded was 6.638 kN which is well above the fracture threshold of 3.47 kN. This is also validated by the fact that the Sawbones femur surrogate suffered fracture upon the second trial without an airbag and a catastrophic failure upon the third trial.

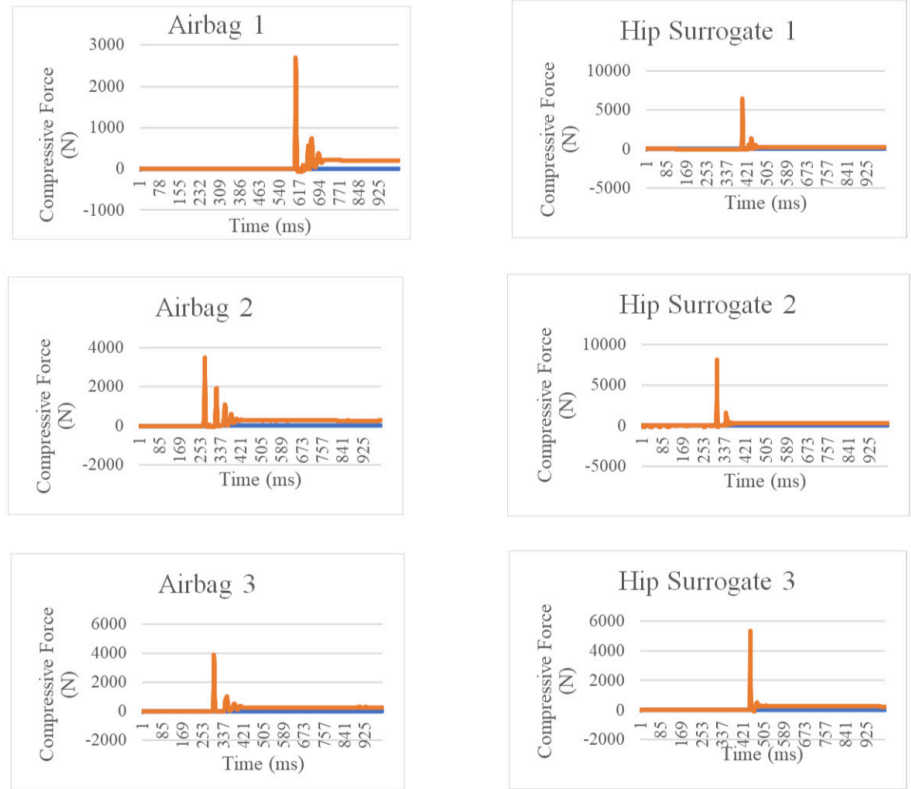


Figure 7. Force-time graphs of peak compressive forces acting upon the proximal femur surrogate during physical drop test trials both with and without airbag

Table 4. Drop test analysis of peak compressive forces upon hip surrogate fitted with airbag

Trial	Peak Compressive Force (kN)	
	Airbag and Hip Surrogate	Hip Surrogate Only
1	2.698	6.455
2	3.501	8.104
3	3.889	5.354
$F_{peak,avg}$	3.362	6.638
Fracture Threshold: 3.47 kN		



(a)



(b)

Figure 8. Sawbones surrogate femur (a) Fracture after second trial without airbag. (b) Catastrophic failure after third trial without airbag.

Accelerometer Data

The accelerometer data obtained using the Shimmer3 GSR+ sensors shows the rebound behavior at impact. In the trials with the airbag equipped, the length of time in which rebounding occurred was nearly twice as long as that in the trials without the airbag. Peak accelerations were similar in both cases indicating that the free fall condition achieved was similar in both instances throughout the trials.

DISCUSSION

The results obtained through experimental tests were unable to validate computer simulated drop tests as a reliable method of testing design iterations of wearable airbags, however the variation between the simulated results and the experimental results appears to be similar in range. This implies that with calibration and small changes, there is still a possibility that this methodology can be used to accurately model and optimize wearable airbag designs. Standard deviation between data was less than 2 kN in the cases with the airbag as well as the cases without, which shows a closely grouped data set. Although the percent error between simulations and the experimental data was large, this is likely due to several simplifications within the experiment that had to be made to make reverse engineering the assembly possible. Pressure variations were also neglected in

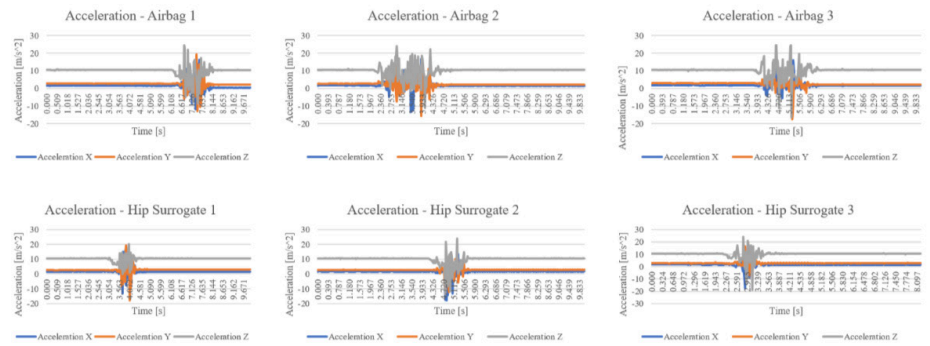


Figure 9. Accelerometer data for drop tests performed with the airbag equipped (top) and without the airbag equipped (bottom)

the analysis, which affects the rebounding directly after impact. In continuations of this experiment, it would be beneficial to begin with a proposed design which is able to be modeled and simulated before the actual prototype is built based on the design configuration. This prototype could then be tested with greater accuracy as the geometries of the simulated airbag model and the experimental prototype would be more accurate. Improvements to the CAD model of the bone should also be considered as well as attempting to model the anisotropic behavior of the human femur. In the future, the drop test should be performed with the addition of linear bearings in order to confine the movement to the vertical axis as well as

a quick release mechanism to allow an initial free fall condition without the possibility of applied force due to human error. In expansions of this experiment, analysis of the accelerometer data can be used to determine the optimal peak pressure to reduce rebounding and can be expanded upon through in-depth computer simulation.

Table 5. Standard Deviation Between Trials
Standard Deviation
(kN)

With Airbag	0.496
Without Airbag	1.130

Table 6. Percent Error Between Experimental Values and Simulated Values

Percent Error (%)	
With Airbag	30.08
Without Airbag	2
Airbag	0

APPENDIX

When modeling the assembly in the simulation, the following assumptions were made:

- 1) The couplings between individual parts are rigid.
- 2) The effective mass applied force only in the vertical dimension.

To calculate the height at which to perform the physical drop tests, the velocity equation was used, and height was solved for:

[Equation]

eq. 1

The peak stress output was used along with the cross-sectional area in the plane perpendicular to the vertical axis at the point of greatest acting stresses to determine the peak compressive forces acting on the femur in the simulated drop tests:

[Equation]

eq. 2

Standard deviation and percent error between the experimental results and the results obtained through finite element analysis were determined using the following equations:

[Equation]

eq. 3

[Equation]

eq. 4

CONCLUSION

Most of the errors in this study can be attributed to simplification of parts within both the testing equipment and the computer simulation. Some other considerations for error are the fracture and subsequent failure of the Sawbones surrogate that occurred in the second and third iterations of the drop tests without the airbag, the hardness of the spring being affected by the mig welding process, and placement of the assembly parts that had slight variations due

to being positioned by hand. The standard deviation in the physical drop tests was 0.496 kN when including the airbag in the analysis and 1.130 kN when only considering the surrogate hip assembly (eq. 3). Percent error between the theoretical values obtained through simulation and the experimental values obtained using the drop tower was 30.082% when considering the airbag and 18.190% when only considering the hip surrogate (eq. 4). In the future, this study can be expanded upon by using

computer simulation as well as analysis of acceleration data to study the effects of pressure variations on the reduction of rebound. Side by side comparisons of the acceleration changes at impact in drop tests as well as simulation can be used to determine if this is a valid method to determine the optimal volume at impact to achieve the greatest attenuation of peak compressive forces. Analysis of the effect of microvents in the airbag textile upon rebound effects can also be performed.

REFERENCES

- [1] Shen, G., and Zhang, X., and Meng, M., and Wilde, B., 2017, “A Biomechanical Study for Developing Wearable-Sensor System to Prevent Hip Fractures Among Seniors,” *Applied Sciences*, 7, pp. 771.
- [2] Tamura, T., and Yoshimura, T., and Sekine, M., and Uchida, M., and Tanaka, O., 2009, “A Wearable Airbag to Prevent Fall Injuries,” *IEEE Transactions on Information Technology in Biomedicine*, 13(6), pp. 910-914.
- [3] Jeon, E., and Kim, H., 2016, “Hip Protector Design Process for the Korean Elderly,” *Fashion & Text, Res. J.*, 18(4), pp. 520-530.
- [4] Madrecka, A., 2012, “Biomechanical and Computational Investigation of the Hip Protector Design and Function,” Ph.D. thesis, Department of Mechanical, Aeronautical and Biomedical Engineering, University of Limerick.
- [5] Dellinger, A.J., 2016, “Meet the World’s First Wearable Personal Airbag,” from <https://www.dailydot.com/debug/inemotion-airbag-vest-wearable/>.
- [6] Powell, T.C., 2018, “Motorcyclist Traffic Fatalities by State 2017 Preliminary Data,” from https://www.ghsa.org/sites/default/files/2018-05/ghsa_motorcyclists18.pdf.
- [7] Crucius, S., 2016, “Wearable Airbags to Protect Seniors, Motorcyclists, Skier and Cyclists,” from <https://www.wearable-technologies.com/2016/03/wearable-airbags-to-protect-seniors-motorcyclists-skier-and-cyclists/>.
- [8] Pejic A., Hansson S., Rogmark C., Magnetic Resonance Imaging for Verifying Hip Fracture Diagnosis Why, When and How? *Injury*. 2017 Mar; 48(3), pp. 687-691. DOI: 10.1016/j.injury.2017.01.025
- [9] Derler, S., and Spierings, A.B., and Schmitt K.-U., 2004, “Anatomical Hip Model for the Mechanical Testing of Hip Protectors,” *Medical Engineering & Physics*, 27, pp. 475-485.
- [10] Robinovitch, S.N., and Evans, S.L., and Minns, J., and Laing, A.C., and Kannus, P., and Crompton, P.A., and Derler, S., and Birge, S.J., and Plant, D., and Cameron, I.D., and Kiel, D.P., and Howland, J., and Khan, K., and Lauritzen, J.B., 2009, “Hip Protectors: Recommendations for Biomechanical Testing – An International Consensus Statement (Part I),” *Osteoporosis International*, 20, pp. 1977-1988.
- [11] Morgan EF, Unnikrisnan GU, Hussein AI. Bone Mechanical Properties in Healthy and Diseased States. *Annu Rev Biomed Eng*. 2018; 20:119-143. DOI:10.1146/annurev-bioeng-062117-121139
- [12] Vulovic, A., and Filipovic, N., 2020, “The biomechanics of lower human extremities,” *Computational Modeling in Bioengineering and Bioinformatics*, pp. 179-210.
- [13] Schmid Daners, M., and Wullschlegel, L., and Derler, S., and Schmitt, K.U., 2008, “Development of a New Design of Hip Protectors Using Finite Element Analysis and Mechanical Tests,” *Med Eng Phys.*, 30(9), pp. 1186-1192.
- [14] Ballester, O.C., and Llari, M., and Honoré, V., and Masson, C., and Arnoux, P.J., 2019, “An Evaluation Methodology for Motorcyclists’ Wearable Airbag Protectors Based on Finite Element Simulations,” *International Journal of Crashworthiness*, DOI: 10.1080/13588265.2019.1687218
- [15] Jo, B., and Lee, Y., and Kim, J., and Jung, S., and Yang, D., and Lee, J., and Hong, J., 2017, “Design of Wearable Airbag with Injury Reducing System,” *ICT4AgeingWell*, 1, pp. 188-191.
- [16] Mubashir, M., and Shao, L., and Seed, L.,

- 2011, “A Survey on Fall Detection: Principles and Approaches,” *Neurocomputing*, 100(2013), pp. 144-152.
- [17] Yao, M., and Zhang, Q., and Li, M., and Li, H., and Ning, Y., and Xie, G., and Zhao, G., 2015, “A Wearable Pre-Impact Fall Early Warning and Protection System Based on MEMS Inertial Sensor and GPRS Communication,” *IEEE 12th International Conference on Wearable and Implantable Body Sensor Networks (BSN)*, pp. 1-6. DOI: 10.1109/BSN.2015.7299397
- [18] Nyan, M.N., and Tay, F., and Murugasu, E., 2008, “A Wearable System for Pre-Impact Fall Detection,” *Journal of Biomechanics*, 41(2008) pp. 3475-3481.
- [19] Pannurat, N., and Thiemjarus, S., and Nantajeewarawat, E., 2014, “Automatic Fall Monitoring: A Review,” *Sensors (Basel)*, 14(7), pp. 12900-12936. DOI: 10.3390/s140712900
- [20] Zhou, H., and Zhong, Z., and Hu, M., 2018, “Design and Occupant-Protection Performance Analysis of a New Tubular Driver Airbag,” *Engineering*, 4(2), pp. 291-297.
- [21] Tamura, T., and Yoshimura, T., and Sekine, M., and Uchida, M., 2011, “Development of a Wearable Airbag for Preventing Fall Related Injuries,” *Human Centered Design*, 6776, pp. 335-339.
- [22] Chaffin, D., 2007, “Human Motion Simulation for Vehicle and Workplace Design,” *Human Factors and Ergonomics in Manufacturing & Service Industries*, 17(5), pp. 475-484.
- [23] Laing, A., and Robinovitch, S., 2008, “Effect of Soft Shell Hip Protectors on Pressure Distribution to the Hip During Sideways Falls,” *Osteoporosis International*, 19(7), pp. 1067-1075.
- [24] Schiller, B., 2015, “This Wearable Airbag Protects the Elderly When They Fall,” from <https://www.fastcompany.com/3040932/this-wearable-airbag-protects-the-elderly-when-they-fall>.
- [25] Dadourian, M., 2018, “High-tech Airbag Could Save Seniors from Breaking Their Hips,” from <https://www.foxnews.com/health/high-tech-airbag-could-save-seniors-from-breaking-their-hips>.
- [26] Weiss, C.C., 2015, “Hedgehog-Inspired Full-Body Airbag Would Inflate into a Personal Safety Cocoon,” from <https://newatlas.com/hedgehog-inspired-full-body-airbag/35994/>.
- [27] Threewitt, C., 2019, “Wearable Air Bags Save Lives,” from <https://auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/wearable-air-bags-save-lives.html>.



Navigating Heteronormativity and Negotiating Allyship: A Study of LGBT+ Allies in South Texas

By: Meagan Pendleton

Abstract

While allies to marginalized groups are generally perceived as positive agents of social change at the conceptual level, members of privileged groups are often able to claim an “ally identity” without having to necessarily engage in efforts that challenge systems of oppression. Much of the research on heterosexual and cisgender allies of the LGBT+ community has aimed to identify beneficial qualities and experiences associated with ally behaviors but lacks a

constructive critique of allyship. This research questions what qualifies an individual to claim the identity of an ally while simultaneously questioning how allies themselves determine the conditions of their allyship. Examining the processes through which allies construct and perform what it means to be an ally – including the implications of self-identification – could provide insights into the ways in which inequality is maintained and justified within our society. Previous scholarship has largely focused on the experiences of

white heterosexual allies to the LGBT+ community but has done little to explore the intersectional nature of allyship and the ways in which different social locations can shape the interpretation and construction of allyship as well as allyship engagement. Drawing from in-depth semi-structured interviews of allies in majority Latinx South Texas, I examine the ways in which allies of the LGBT+ community negotiate their allyship and identify the impact allies have in both fighting against and (unintentionally) furthering LGBT+ inequalities. I also consider how allies make sense of and respond to the inequalities they seek to combat and to what extent.

MENTOR

Daniel Bartholomay, Ph.D.

DEPARTMENT OF SOCIOLOGY

Introduction

Although there have been positive strides in recent years

that suggest an increasing social acceptance of sexual and gender minorities, the LGBT+ community still exists as a marginalized group in our society. To foster acceptance and promote social change, many heterosexual individuals claim an ally identity in order to support marginalized groups. Washington and Evans (1991) defining an ally as “a member of the dominant group or majority group who works to end oppression in his or her personal or professional life through support of, and as an advocate for, the oppressed population” (p. 195). Allies are also often regarded as crucial figures in eliminating prejudice and inequality in the realms of sexuality (Duhigg 2010), race (Brown and Ostrove 2013), and gender (Messner, Greenberg, and Peretz 2015). Scholars have noted that while good intentioned, allies often act in ways that reproduce inequalities experienced by marginalized groups (Mathers, Sumerau, and Ueno 2018; Pierotti, Lake, and Lewis 2018; Sumerau et al. 2020). Oftentimes, in order to gain legitimacy from others, allies privilege their heterosexuality in an attempt to deflect stigma away from sexual minorities (Mathers et al. 2018). While his “power for patronage” (see Schwalbe et al. 2000) can provide temporary benefits for the LGBT+ community, such as mainstream support, this elevation and normalization of

heterosexuality comes at the cost of reproducing the same sexual inequalities allies seek to combat (Broad 2011; Mathers et al. 2018). An ally identity is aspirational and requires perpetual and continuous work on the part of the ally (Edwards 2006; Myers 2008) and is not merely a label or status symbol or moral identity (Mathers et al. 2018). Members of privileged groups are often able to claim the identity as an ally without having to necessarily engage in efforts that challenge systems of oppression. Examining the processes through which allies construct and perform what it means to be an ally could provide insights into the ways in which inequality is maintained and justified (Sumerau et al. 2020).

This exploratory study draws on in-depth interview data to examine how allies of the LGBT+ community construct and carry out allyship as well as investigating the roles allies play in combatting and unintentionally furthering LGBT+ inequalities. This research asks the following: What roles to heterosexual allies play in the LGBT+ community? How do heterosexual allies of the LGBT+ community navigate heteronormativity while simultaneously endorsing equality? What impact do heterosexual allies have in both fighting against and (unintentionally) furthering LGBT+ inequalities?

Literature Review

Previous research on heterosexual allies of the LGBT+ community often highlights the importance of allies’ roles in social movements and has also aimed to identify beneficial qualities and experiences associated with ally behaviors, but there has been little examination of the potentially negative effects of allyship (Duhigg et al. 2010; Fingerhut 2011; Stotzer 2009). Russell and Bohan (2016) assert that often heterosexual and cisgender ally activism has “been characterized by an unreservedly positive view of both the process by which such activism occurs and the change potential it embodies” (p. 335). Recent scholarship has begun to identify the potentially problematic behaviors of allyship, such as when straight allies unconsciously promote heteronormativity (Lapointe 2012; Mathers, et al. 2018; Montgomery and Stewart 2012). Others have also identified varying expectations of allies in identity-based movements, complicating allyship (Forbes and Ueno 2020). Scholars calling for future research to question the racial dynamics of allyship around the common occurring concepts of homonormativity and neoliberalism (Duggan 2003; Elliot 2014; Grzanka, Adler, and Blazer 2015) as well as increasing attention to understanding the social construction of allies (Mathers et

al. 2018).

Other scholarly conversations regarding LGBT+ allyship have given inadequate attention to racial minority LGBT+ allies. Much of the research on LGBT+ allyship has utilized majority white samples, creating a lack of representation of racial minority groups, calling attention to the intersectional nature of allyship and the ways in which different social locations can shape the interpretation and construction of heterosexuality and heterosexual allies (Mathers et al. 2018; Grzanka 2019). Those who hold intersecting social identities, granting them privilege in some areas of their life and subordination in others, are likely to develop a sense of solidarity that fuel efforts to challenge inequalities facing our society (Case 2012; Iyer, Leach, and Pedersen 2004; Montgomery and Stewart 2012). This suggesting that because racial minority groups are likely to experience stigmatization based on their race, they are particularly likely to draw on their marginalized status to recognize the privilege they hold elsewhere (Cole 2008; Cole and Luna 2010; Rojas, Heaney, and Adem 2020). Studying allies of the LGBT+ community— particularly those with intersecting social identities— can provide a deeper understanding of the complex ways people choose to navigate and negotiate their allyship.

Methods

The present study examines data collected from semi-structured in-depth interviews with self-identified allies of the LGBT+ community residing in South Texas. I have interviewed five self-identified allies of the LGBT+ community and I plan to interview 25 more, totaling 30 participants. To be eligible for this study, participants were required to be age 18 or older, identify as an ally to the LGBT+ community, and needed to reside in the southern region of Texas for the past year. Participants were asked to complete a brief online survey to collect general background/ demographic data before their interview. Once completed, I reached out to the participants to schedule an interview. Participants were provided with the option to hold their interview over the phone or online via Zoom. In conjunction to individual interviews, I will also be using a focus group to gather follow-up data. This method will foster interaction between participants and allow for participants to develop ideas from each other while identifying trends in their experiences. After the conclusion of the individual interviews, participants will be asked if they would be willing to participate in a focus group. Focus groups are optional, and the number and size of the focus group(s) will depend on the level of participation. Combining methods such as individual interviews and focus groups

can point to greater depth in the findings from the individual interviews (Morgan 1996). Interviews will be recorded with participants consent and will then be transcribed and uploaded into NVivo, a qualitative analysis software. Drawing from techniques and procedures of Glaser and Strauss' (1967) grounded theory, I will analyze the interviews and focus groups utilizing line-by-line coding, assigning a code to every line or idea presented in the data (Charmaz 2006; Straus and Corbin 1998). Once line-by-line coding is complete, I will then implement the strategy of focused coding wherein the most significant or frequently codes are organized to conceptualize the main themes of the data (Charmaz 2006; Glaser 1978).

Preliminary Findings and Discussion

This project aims to understand the contributions of allyship to social equality and will strive to provide a better understanding of how heterosexual allies can use their heterosexual privilege in productive ways. Given the geographic region of this study and its conservative reputation, exploring allies could offer ways in ways in which we can foster a positive relationship between allies and the LGBT+ community. Similar to research on the roles in which white people and males play in combatting racism and sexism, my research will draw from previous theoretical

frameworks to contribute to our understanding of how heterosexual allies combat inequalities related to the LGBT+ community. My study can point to how specific social locations (and potentially geographic locations) shape heterosexuals' experiences with sexual-minority ally engagement and what role heterosexual allies play in the construction, reproduction, and deconstruction of heterosexual privilege. This research will contribute to the growing body of literature of allies of the LGBT+ community and seeks to extend theoretical concepts of symbolic interactionism, queer theory, and doing gender.

Preliminary findings from five completed interviews of this study reveal that while allies seek to combat inequalities, they do so at their own comfort. Many of the allies I interviewed expressed that they set the conditions of their allyship and their efforts in combating social inequalities were dependent on situational factors. One participant saying, "I'd be outspoken but to a point where I'd ensure my safety first." This finding aligns with previous scholarship that identifies that although allies acknowledge their privileged heterosexual identity, they often express concerns about being viewed or treated negatively by other heterosexuals for outwardly expressing their support of the LGBT+ community (Goldstein and Davis 2010). Similarly, the

allies I interviewed expressed that they chose to outwardly express their allyship with those that were like minded and not necessarily those who were openly against the LGBT+ community. Participants articulating concerns with "opening that can of worms" or "overstepping." Although not generalizable, these findings begin to provide descriptive accounts of allies of the LGBT+ community in South Texas. Further investigation with more allies will continue to assess the extensiveness of the initial themes as well as findings by other scholars. Future research should address the implications of language and identity labels and whether there is a need different terms for people who merely support oppressed groups versus those that actively work to fight against oppression. Additionally, future research should also explore more diverse locations and samples and employ additional recruitment tactics.

References

- Broad, Kendal L. 2011. "Coming Out for Parents, Families and Friends of Lesbians and Gays: From Support Group Grieving to Love Advocacy." *Sexualities* 14(4):399-415.
- Brown, Kendrick T., and Joan M. Ostrove. 2013. "What does it Mean to be an Ally?: The Perception of Allies from the Perspective of People of Color." *Journal of Applied Social Psychology* 43(11):2211-2222.
- Case, Kim A. 2012. "Discovering the Privilege of Whiteness: White Women's Reflections on Anti-racist Identity and Ally Behavior." *Journal of Social Issues* 68(1):78-96.
- Charmaz, K. 2006. *Constructing Grounded Theory: A Practical Guide through Qualitative Research*. Sage Publications: London.
- Cole, Elizabeth R. 2008. "Coalitions as a Model for Intersectionality: From Practice to Theory." *Sex Roles* 59(5):443-453.
- Cole, Elizabeth R., and Zakiya T. Luna. 2010. "Making Coalitions Work: Solidarity Across Difference within US Feminism." *Feminist Studies* 36(1):71-98.
- Duggan, Lisa. 2003. "The Twilight of Equality: Neoliberalism." *Cultural Politics, and the Attack On*.
- Duhigg, J. M., Rostosky, S. S., Gray, B. E., and Wimsatt, M. K. 2010. Development of heterosexuals into sexual-minority allies: A qualitative exploration. *Sexuality Research and Social Policy*, 7, 2-14. doi: 10.1007/s13178-010-0005-2
- Edwards, Keith E. 2006. "Aspiring Social Justice Ally Identity Development: A Conceptual Model." *NASPA Journal* 43(4):39-60.
- Elliot, S. 2014. "Who's to Blame?" *Constructing the Responsible Sexual Agent in Neoliberal Sex Education. Sexuality Research and Social Policy* 11(3):211-224.
- Fingerhut, A. W. 2011. Straight allies: What predicts heterosexuals' alliance with the LGBT community? *Journal of Applied Social Psychology*, 41, 2230-2248. doi: 10.1111/j.1559-1816.2011.00807.x
- Forbes, TehQuin D., and Koji Ueno. 2020. "Post-Gay, Political, and Pieced Together: Queer Expectations of Straight Allies." *Sociological Perspectives* 63(1):159-176.
- Glaser, B. G. 1978. *Theoretical sensitivity: Advances in the methodology of grounded theory*. Sociology Press.
- Glaser, B., and Strauss, A. 1967. *The discovery of grounded theory*. Aldine.
- Goldstein, Susan B., and Denise S. Davis. 2010. "Heterosexual Allies: A Descriptive Profile." *Equity & Excellence in Education* 43(4):478-494.
- Grzanka, Patrick R. 2019. "With allies like these...": Toward a sociology of straight allies." Pp. 404-418 in *Routledge International Handbook of Heterosexualities Studies*.
- Grzanka, Patrick R., Jake Adler, and Jennifer Blazer. 2015. "Making Up Allies: The Identity Choreography of Straight LGBT Activism." *Sexuality Research and Social Policy* 12(3):165-181.
- Iyer, A., Leach, C.W., and Pedersen, A. 2004. *Racial wrongs and restitutions: The role of guilt and other group based emotions*.
- Lapointe, Alicia A. 2012. "Straight Allies: Combating Homophobia and Interrogating Heteronormativity 'straight' on."

Strauss, Anselm, and Juliet Corbin. 1998. *Basics of Qualitative Research Techniques*.

Sumerau, J. E., TehQuin D. Forbes, Eric A. Grollman and Lain A. Mathers. 2020. "Constructing Allyship and the Persistence of Inequality." *Social Problems*.

Washington, Jamie, and Nancy J. Evans. 1991. "Becoming an Ally." *Beyond Tolerance: Gays, Lesbians, and Bisexuals on Campus*:195-204.

Mathers, Lain A., J. E. Sumerau and Koji Ueno. 2018. "'This Isn't just another Gay Group': Privileging Heterosexuality in a Mixed-Sexuality LGBTQ Advocacy Group." *Journal of Contemporary Ethnography* 47(6):834-864.

Messner, Michael A., Max A. Greenberg, and Tal Peretz. 2015. *Some Men: Feminist Allies in the Movement to End Violence Against Women*. Oxford Studies in Culture.

Montgomery, Samantha A., and Abigail J. Stewart. 2012. "Privileged Allies in Lesbian and Gay Rights Activism: Gender, Generation, and Resistance to Heteronormativity." *Journal of Social Issues* 68(1):162-177.

Morgan, David L., Richard A. Krueger, and Alice U. Scannell. 1998. *Planning Focus Groups*. Sage.

Myers, Daniel J. 2008. "Ally Identity: The Politically Gay." *Identity Work in Social Movements* 30:167-187.

Pierotti, Rachael S., Milli Lake and Chloé Lewis. 2018. "Equality on His Terms: Doing and Undoing Gender through Men's Discussion Groups." *Gender & Society* 32(4):540-562.

Rojas, Fabio, Michael T. Heaney and Muna Adem. 2020. "Black Allies in a Predominantly White Social Movement."

Russell, Glenda M., and Janis S. Bohan. 2016. "Institutional Allyship for LGBT Equality: Underlying Processes and Potentials for Change." *Journal of Social Issues* 72(2):335-354.

Schwalbe, Michael, Daphne Holden, Douglas Schrock, Sandra Godwin, Shealy Thompson and Michele Wolkomir. 2000. "Generic Processes in the Reproduction of Inequality: An Interactionist Analysis." *Social Forces* 79(2):419-452.

Stotzer, R. L. 2009. Straight allies: Supportive attitudes toward lesbians, gay men, and bisexuals in a college sample. *Sex Roles*, 60, 67–80. doi:



Preliminary Observations of the Effect of Range of Motion During Barbell-Bench Press Exercises on Acute Markers of Post-Resistance Exercise Hyperemia of the Pectoralis Major

By: Katrina Garcia

Abstract

Introduction: Full range of motion (fROM) exercise during resistance training (RT) is the traditional approach to increasing muscle strength and hypertrophy. Partial range of motion (pROM) has been used in both rehabilitative and RT environments and there have been some recent reports showing a positive benefit and how it may influence regional muscle growth. However, there is limited evidence examining potential mechanisms of how pROM

may stimulate regional muscle growth. Purpose: The purpose of this study is to investigate the effects of different ranges of motion (ROM) during flat (FB) and incline (IB) barbell bench press exercises, and to identify any potential regional or local differences in regional post-exercise hyperemia of the pectoralis major (PM). Methods: Three male and female subjects (Age: 21.3 ± 0.8 y; Height: 171.5 ± 3.4 cm; Weight: 74.7 ± 6.9 kg; Body Fat %: 25.70 ± 2.8 %) were sequentially randomized to fROM and pROM during FB

and IB (45° inclination) bench pressing exercises utilizing a Smith Machine (SM) barbell bench press. The SM barbell was fitted with an EliteFTS™ shoulder saver pad during pROM bouts, and individuals were instructed to touch the pad to their chests and “not to lockout,” their elbows. 7-days prior to each ROM bout, strength testing (1RM) was completed to determine 75-80% intensity for ROM bouts. Pre-bout (Pre), immediate post-bout (IP), and 24 h post-ROM-bout measures of reactive hyperemia in the regional areas of the right-side PM were collected at 10, 25, 50, and 60 % distal to the suprasternal notch in males and 10 and 25% were used for females. Ultrasound measures cross-sectional area (CSA) collected in duplicate using panoramic capability (LOGIQView®). Discussion/

MENTOR

Daniel E. Newmire, Ph.D., CSCS, CISSN

Ana Elizondo Ugarte

DEPARTMENT OF KINESIOLOGY

Conclusion: Using a 2-way RMANOVA (time x condition), no CSA differences were found at 10 and 25% (n=6) and no CSA differences were found at 10, 25, 50, and 60% (n=3) for the male subjects. Interestingly, one trained female subject showed an average 11.6% increase in CSA at 10% in both the pROM conditions suggesting a potential training effect.

Introduction

It is recommended that full range of motion (fROM) during resistance training is the traditional approach to increasing muscle hypertrophy. Recent literature that examined the impact of partial range of motion (pROM) on muscle hypertrophy found some similar outcomes when compared to fROM. Therefore, the use of pROM during resistance training has gained interest as a viable form of exercise to assist muscle growth. The purpose of this study is to investigate the effects of different ranges of motion (ROM) that may occur during flat and incline barbell bench press exercises and to identify any potential regional differences areas of the PM at 10, 25, 50, and 60% distal the suprasternal/clavicular notch pre-, immediate-post (IP), and 24 h post-ROM bout in blood flow utilizing an ultrasound (US) unit. We hypothesized that pROM may influence greater post-exercise pectoralis major (PM) blood flow than standard

fROM.

In recent studies, there has been evidence of pROM being used in both rehabilitative and strength training settings as a mode of exercise to gain hypertrophy in a local muscle region. However, there is no present solid reasoning to use pROM in the upper body compared to fROM resistance training due to a limitation of the research, because much of past pROM research has focused on leg resistance exercise designs. In a study conducted by Massey, et al., (2005) they compared fROM to pROM and found that both groups improved their 1RM bench press after ten weeks of training twice a week, without a significant difference between groups. On the other hand, a similar study by Pinto et al., (2012) tested fROM against pROM during biceps curl exercise and discovered that after 10 weeks of two meeting times of training, the fROM group developed 1RM strength on preacher curls significantly more than the pROM group. Pinto also observed similar muscle thickness changes in the biceps brachii in both the pROM and fROM groups (Pinto et al., 2012).

There are various reasons why one would choose to perform a pROM over a fROM such as improving weak portions of a movement, injury prevention, enhanced metabolic adaptations, variation in training, and enhanced sports performance. However, we aim to look

at comparing a fROM to a partial range of motion during resistance exercise which may have a similar effect on muscle hypertrophy. This is due to the reason that the movement can allow a participant to carry out more repetitions in a set since the barbell path distance is decreased when performing a flat or incline bench press. Over 8 weeks, we investigated and compared fROM and pROM during both flat bench (FB) and incline barbell bench (IB) press exercises, utilizing a Power System Smith machine (SM). To measure these exercises, we looked at reactive hyperemia, and swelling in the localized PM. In doing so, the aim is to find a clearer and more controlled perspective comparing ROM during bench press resistance exercises. We'd like to discover whether there is any localized or regional PM reactive hyperemia that could assist in explaining regional intramuscular differences found during resistance training (Hirono et al., 2020). Utilizing Ultrasound (US; GE Logiq E9) over the measured cross-sectional areas on the participant's pre-, IP, and 24 h post-ROM.

Exercise hyperemia is defined as the increase in skeletal muscle blood flow that occurs during muscular activity (Korthuis., 2011). Since it occurs in response to increased cell metabolism, exercise hyperemia is referred to as active or functional hyperemia. These

terms also apply to the increase in blood flow to any organ that experiences an increase in parenchymal cell metabolism, affecting the functional tissue of an organ. Exercise hyperemia may be established in muscles that are isolated from neuronal and humoral inputs, implying that tissue-specific variables are crucial in matching blood flow to metabolic rate (Korthuis., 2011).

Ultrasound is a non-invasive piece of equipment that enables sound waves to create images of the inside of the body. Transducers, or ultrasound probes, generate sound waves at frequencies when the probe is applied to the skin. The transducer emits a beam of sound waves into the body when utilized in an ultrasonic scanner. The sound waves are reflected to the transducer by tissue boundaries in the beam’s course (National Institute of Biomedical Imaging and Bioengineering., 2016). Diagnostic ultrasound is generally thought to be safe because it does not emit ionizing radiation like x-rays. Nonetheless, ultrasonography has the ability to cause biological impacts on the body in certain contexts and conditions. As a result, the FDA mandates diagnostic ultrasound equipment to function within certain parameters (Center for Devices and Radiological Health., 2020).

This study utilized Ultrasound (US; GE Logiq E9) to assess

muscle hyperemia of the PM muscle. With this, we see the amount of blood flow that has passed through the muscle Pre, IP, and 24 h post-ROM-bout measures of reactive hyperemia in the regional areas of the right-side PM at 10, 25, 50, and 60 % distal to the suprasternal notch in males and 10 and 25% were used for females. The purpose of this study is to investigate the effects ROM has on the pectoralis major muscle while performing barbell-bench press exercises and evaluate the relationship between post-exercise bouts and regional muscle hyperemia.

Methodology
Participants

Six participants (n=6) were recruited and included in the study, three of which were males and the other three were females. The average age was

Table 1: Participant Characteristics

	Mean ± SEM
n = 6 (3M/3F)	
Age (y)	21.3 ± 0.84
Height (cm)	171.5 ± 3.4
Weight (kg)	74.7 ± 6.9
Body Fat (%)	25.7 ± 2.8
Male (M); Female (F)	

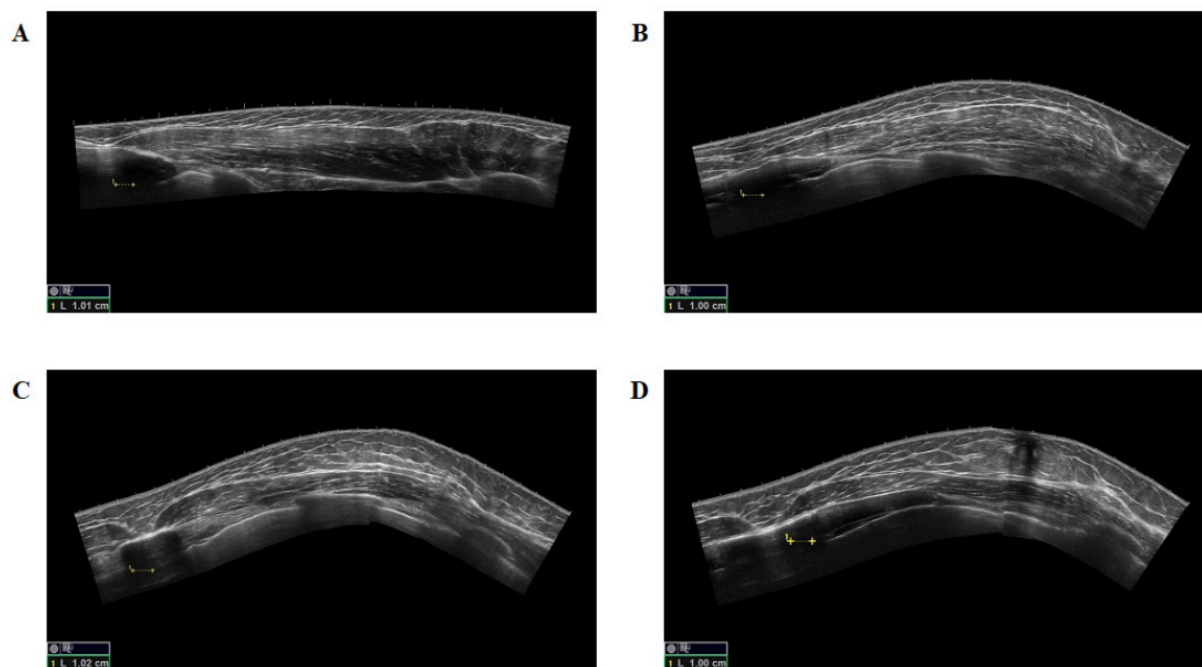
21.3 ± 0.84 years, with an average height of 171.5 ± 3.4 cm, a weight of 74.7 ± 6.9, and body fat % of 25.7 ± 2.8 %. All of the participants declared themselves to be in good health and free of any conditions that would interfere with their performance such as arm or shoulder injuries. Additionally,

all participants were instructed to minimize any exercise of the upper body at least 3 days before 1RM strength testing and the ROM bout, and after the ROM bout to limit the effect of additional muscle activity on hyperemic responses.

Instrumentation

This study utilized Ultrasound (US: GE Logiq E9; GE Healthcare, Wauwatosa, WI) using the LOGIQView® panoramic function to capture images of the cross-sectional area (CSA) of PM: the primary muscle agonist of the bench press exercise. The distance between the sternal or jugular notch and the most inferior point of the body of the sternum (xiphoid process) was recorded with measuring tape in centimeters to standardize CSA measures for each participant. With the participant lying supine on an examination table, we measured 10 and 25% for females and 10, 25, 50, and 60% for males and then drew a line with a surgical marker for the ultrasound probe to follow to assess the CSA. Females were restricted to 10 and 25% of PM due to the impact of more local subcutaneous fat and breast tissue on ultrasound imaging quality. These metrics provide us with the number of their PM’s CSA. We then placed the ultrasound probe on the left side of the participants’ bodies after applying a copious amount of ultrasound gel to their PM. The participant was

Figure 1: A schematic representation of landmarks used to measure sternal length (red dashed line) to identify 10, 25, 50, and 60% (black dashed lines) that were used to assess *pectoralis major* CSA in a standardized fashion.



instructed to maintain their right arm adducted to the midline of their body for the 10% CSA and then the right shoulder will be abducted to $\sim 90^\circ$ for the subsequent CSA scans. Next, the US probe would glide across the skin until we reach the end of the PM, which curves down the torso of CSA. The CSA (Figure 2) was configured following a previous used methodology (Rothwell et al., 2019). All images were analyzed using NIH ImageJ software (<http://imagej.nih.gov/ij/>).

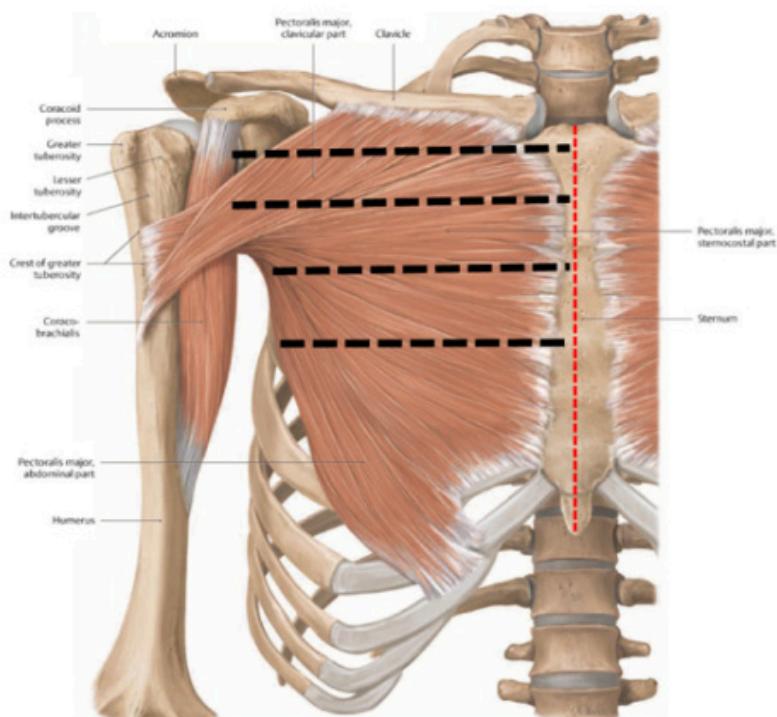


Figure 2: An example of US images collected from the PM CSA at A) 10%, B) 25%, C) 50%, and D) 60%.

Procedures

Initial Session

The Texas A&M University-Corpus Christi Institutional Review Board (IRB) approved all processes and techniques prior to the initial sessions and data collection (IRB# TAMU-CC-IRB-2021-0010). Eligible participants began their participation in the study with an initial meeting in which they were given detailed information regarding the research as well as their responsibility if they chose to continue. Following informed consent, the participant completed a health history questionnaire, which was reviewed for any documentation that would have made the person's involvement in the study risky. If there were no problems with the information given, the participant's height, weight, and body composition were measured. A stadiometer and digital scale (SECA model 769, Hamburg, Germany) was used to measure the participant's height and weight, and dual X-ray absorptiometry was used to determine their body composition (iDXA, Lunar Prodigy; GE Healthcare, Madison, WI). Following these measurements, we utilized a SM barbell bench press, and participants were randomly assigned to fROM and pROM during FB and IB (45° inclination) bench pressing movements. The participant performed a five-minute treadmill warm-up before executing a one-rep maximum

(1RM) testing. The data collecting days were planned for the next 8 weeks after the 1RM for each ROM bout was completed. To guarantee proper rest and recovery, the second data collecting day had to be at least one week after the first.

Bench Press Strength Testing and Range of Motion Exercise Bouts

The bench press ROM bouts (i.e., fROM-FB; pROM-FB; fROM-IB; pROM-IB) were randomized (<https://www.random.org/lists/>) and completed using a standard SM barbell bench press with 0° vertical angle. The SM was selected to protect participants due to the risk of failure and possible injury during both the 1RM testing and the ROM bouts. Each set was completed until volitional, concentric failure was achieved. Therefore, work was not matched between conditions, which is a limitation in our study design. However, from a practical application perspective, we will be able to observe any noticeable volume differences that potentially attribute to findings found comparing fROM and pROM, which may influence hyperemic responses. A standard and mobile bench was used that can elevate to a 45° for the incline bench press bout. The bench placement had been relative to the participant where the barbell decent path is at approximately nipple level for FB and the upper one-third of the chest 3 between

the clavicles and the nipples for IB (NSCA, 2016). Bench placement will be measured and marked for replication for each participant. Grip placement was at 200 % of bi-acromial width (i.e., approximately 2 x shoulder width), which in previous research has shown to be an optimal grip placement for PM recruitment (Wagner et al., 1992). For the pROM bouts, an EliteFTS™ shoulder saver pad will be placed on the SM barbell to limit descent ROM, and the participants were instructed to touch chest to pad and “not to lockout”, or not fully extend elbows. Participants were also instructed to touch the barbell to the chest and attain full elbow extension during the fROM bout.

Strength testing (1RM) followed the (NSCA) protocol (Haff & Triplett, 2015) and be tested 7 d prior to each ROM bout to predetermine 75-80% of the weight that was used for ROM exercise bouts. We had instructed the subject to warm up with a light resistance that allows 5 to 10 repetitions to get used to the barbell path during 1RM. We then calculated a warm-up load that will allow the subject to complete 3-5 repetitions by adding more weight to the barbell in accordance with the participant's strength level. However, 1RM testing procedures for the pROM bout will follow acute pROM bout protocol to ensure relative and accurate intensity (% of 1RM) for all ROM bouts.

Four to Seven days post-1RM testing, the randomized ROM bout of resistance exercise would take place. The intensity selected was 75-80% of the subject's 1RM which was calculated relative to their max strength (1RM) weight on the barbell SM. After pre-ultrasound scans of the PM in the designated areas were completed, the participant performed a 5-minute warmup on a stationary bike before the ROM testing. The bench or incline press ROM resistance exercise was completed in 3 sets until concentric failure was reached within each set. Concentric failure is defined as the inability to continue the motion of the barbell towards the apex of the exercise.

Post-ROM Bout Pectoralis Major Hyperemia

Immediate-Post and 24 h Post-resistance Exercise

After the participant has completed their exercise bouts, they were escorted back to the examination table to acquire the immediate-post (IP) CSA ultrasound scans. Ultrasound images were obtained in duplicate for each assessment. The participant was instructed to lightly wash around the surgical marker lines to minimize the need to remeasure for the following visit 24 h post-resistance exercise bout. After 24 h post-ROM bout, the participant would return to the lab to have a US collection

of images of the PM CSA. If marker lines were washed off by the participant, the sternum was remeasured and permanent marker lines were reapplied.

Statistical Analysis

The statistical power ($1-\beta$ error probability) was set at 0.8, α error probability at $p = 0.05$. The primary statistical analysis was a two-way repeated measure ANOVA (time \times condition) design was used to analyze CSA data. Geisser-Greenhouse testing was used to determine equal variance. The conditions (fROM-FB; pROM-FB; fROM-IB; pROM-IB) on the primary dependent variable pectoralis major CSA at 10, 25, 50, and 60% distal to the sternal notch. Upon identification of a significant main effect (time \times condition) from the RMANOVA, paired differences were evaluated from multiple comparisons if appropriate, using Tukey's post hoc analysis. The statistical analysis. All data were expressed in mean \pm SEM and were analyzed by GraphPad Prism version 9.3.1 for Apple, GraphPad Software, San Diego, California USA.

Results

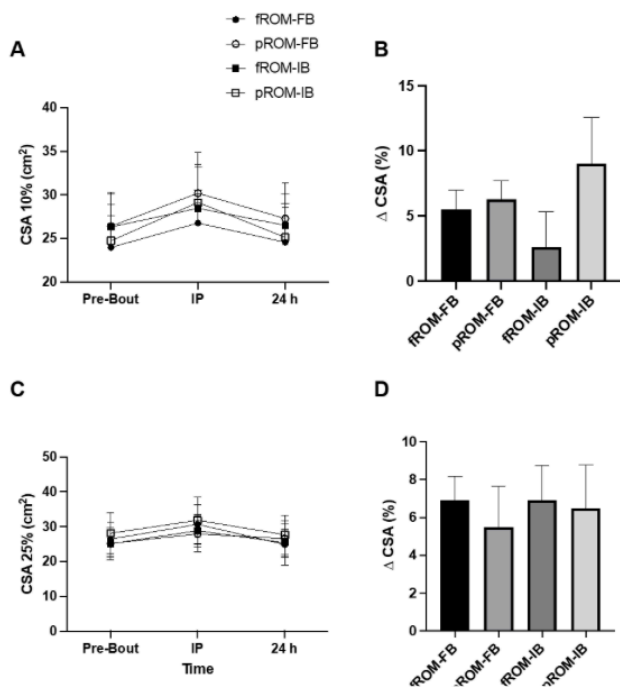
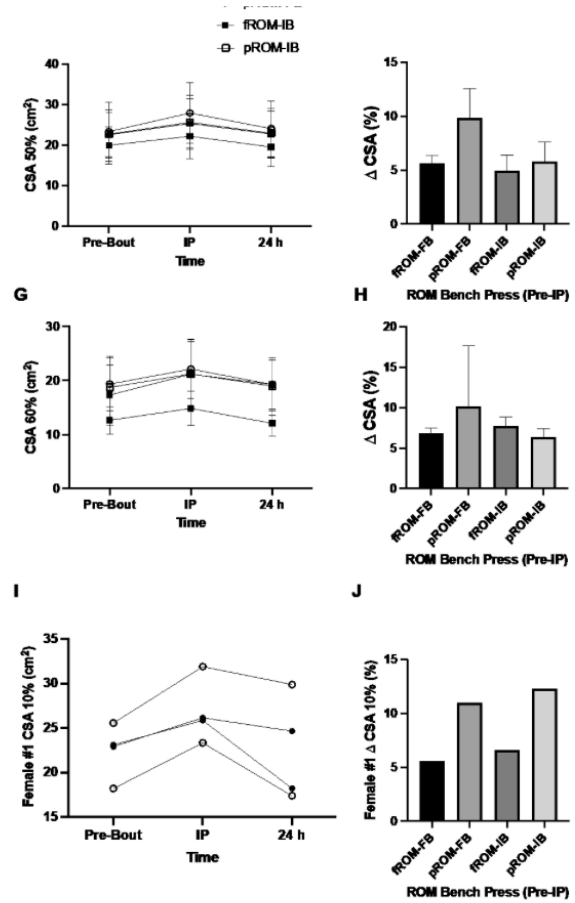


Figure 3 A-D: No difference was found at were found *pectoralis major* (CSA; cm²) 10 or 25% CSA between ROM conditions. A difference was found in time for CSA 25 % ($p = .005$). No differences were found between conditions examining % change (Δ).



Figures 4 E-J: No regional differences were found of the *pectoralis major* (CSA; cm²) at 50 or 60% CSA between ROM conditions (E, G). A difference was found in time for CSA 50 % ($p = .003$). No differences were found between conditions examining (F, H, J) % change (Δ). Interestingly, Female #1 (I and J) showed the greatest $\Delta\%$ change in only the pROM conditions at 10% CSA.

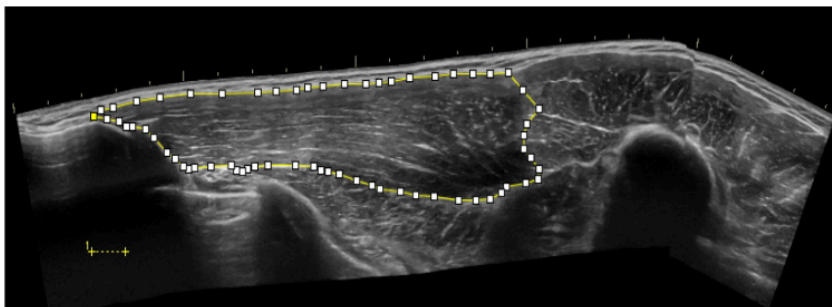


Figure 5: The CSA measure (NIH-ImageJ) of the *pectoralis major* (PM) 10% distal of the sternal notch prior to the exercise bout.

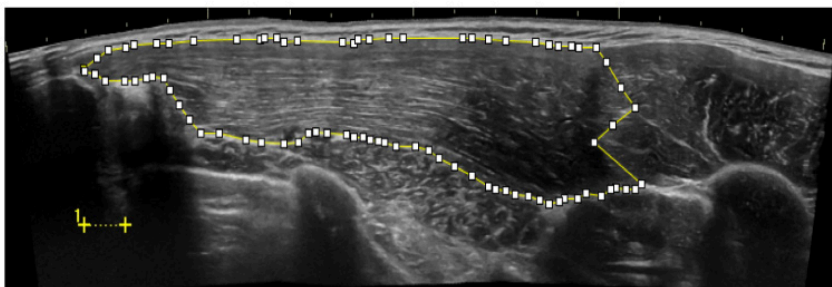


Figure 6: The CSA measure (NIH-ImageJ) of the *pectoralis major* (PM) 10% distal of the sternal notch immediate-post (IP) exercise:

Discussion

Currently, there was no influence of ROM bouts on regional (10-60% CSA) hyperemia (n=6). We did see a time difference in at 25 and 50% conditions increased in PM CSA immediate-post resistance exercise compared to pre-CSA measures. However, this was to be expected to some degree. We are unsure why we did not see a time difference in the 10 and 60% change in CSA. This may be explained in that the majority of the muscle volume is located near the mid-portion of the PM. The PM is separated into the clavicular and sternal heads based on their attachments. In a previous cadaveric study, it has been shown that the majority of the muscle volume was found near in the sternal head of the PM (Fung et al., 2009). Both 25 and 50% CSA measures of the PM were near or directly measuring the sternal head portion of the PM. Interestingly, a trained female (Female #1; Figure I and J) showed the greatest increase during pROM bouts (~11 and 12%) from Pre-bout to immediate post at CSA at 10% of the PM. This was not seen in the other participants to the same magnitude. This outcome may be explained by total work during the set. A shorter distance during the pROM bout may allow greater repetitions to be acquired by the participant and therefore a greater volume (work) accomplished. This may influence a greater hyperemic response of the muscle.

However, the workload data is still being analyzed so this is merely a suggestion. The phenomenon seen with our Female #1 participant during the pROM bout could be explained that greater repetitions that may explain CSA differences. Muscle hypertrophy occurs when there have been periods of positive muscle protein synthesis. In the study of Hirono et al., 2020, the authors discovered that muscle swelling immediately following the first RT session was linked to muscle hypertrophy after a 6-week intervention. Muscle swelling occurs following exercise as a result of metabolic stress to the skeletal muscle. They utilized an ultrasonography device to assess the changes in muscle thickness, which in practical applications, could be used as a possible marker of muscle hypertrophy during chronic conditions. While using US to monitor the swelling hyperemia of the CSA, we can have a better understanding that the greater the muscle swelling following an RT session, the greater the muscle hypertrophy. Looking at the effects pROM has vs fROM there is more literature aiming at the lower body region. According to Schoenfeld & Grgic, et al., (2020), it was concluded that practicing resistance training with a complete range of motion has a positive effect on lower body muscle hypertrophy when compared to training with a partial range of motion.

Alternatively, research on the effects of ROM on the upper limbs is limited and contradictory, making it difficult to draw firm conclusions. The data for partial ROM in the upper body is less conclusive, with one study suggesting an advantage while another reporting similar improvements in muscle size when training with partial versus fROM. It is important to highlight that this study has various limitations that could have influenced the results. First, the small number of participants hindered the capacity to get a larger sample size due to the laboratory's closure due to university procedures in response to the global COVID-19 outbreak. With more participation and compliance, it would have helped in acquiring the needed sample number for an appropriate statistical power to assist in the completion of the ROM story. Another restriction could have been the individuals' different training levels, which could have influenced their tolerance to fatigue throughout their ROM exercise bout.

Conclusion

Our aim with this study was to investigate and compare full range of motion versus partial range of motion during traditional bench press resistance exercises to determine if range of motion has an influence on regional hyperemic (increased blood flow) responses of the pectoralis major, which may

assist in explaining differing regional muscle growth found in previous research. To investigate this phenomenon, we assessed hyperemia utilizing ultrasound images to measure the CSA changes of the pectoralis major pre- and post-resistance exercise. Currently, with our current sample number, we have found no effect of ROM on muscle hyperemia. However, in one participant, we did see a greater CSA change in the partial ROM bout that may be explained by a higher volume of work. Although our female participant's CSA for her pROM bouts increased by ~10%, no difference was found. The study's limitations, as previously stated, may have influenced these results. Previous research has shown that there is a relationship between regional hyperemia and muscle growth. More research is needed to determine whether there is any benefit of a selected range of motion during a resistance exercise bout that has any influence on post-exercise regional muscle hyperemia, which may be a factor in explaining regional muscle growth.

References

- Bazyler, D. (2013). Efficacy of Partial ROM Squat in Maximal Strength Training - ProQuest. [Www.proquest.com. https://www.proquest.com/docview/1614210206?fromopenview=true&pq-origsite=gscholar](https://www.proquest.com/docview/1614210206?fromopenview=true&pq-origsite=gscholar)
- Center for Devices and Radiological Health. (2020, August 28). Ultrasound Imaging. U.S. Food and Drug Administration. <https://www.fda.gov/radiation-emitting-products/medical-imaging/ultrasound-imaging>
- Fung, L., Wong, B., Ravichandiran, K., Agur, A., Rindlisbacher, T., & Elmaraghy, A. (2009). Three-dimensional study of pectoralis major muscle and tendon architecture. *Clinical Anatomy*, 22(4), 500-508.
- Haff, G. G., & Triplett, N. T. (2015). *Essentials of strength training and conditioning 4th edition*. Human kinetics. Haun, C. T., Vann, C. G., Osburn, S. C., Mumford, P. W., Roberson, P. A., Romero, M. A., Fox, C. D., Johnson, C. A., Parry, H. A., Kavazis, A. N., Moon, J. R., Badisa, V. L. D., Mwashote, B. M., Ibeanusi, V., Young, K. C., & Roberts, M. D. (2019). Muscle fiber hypertrophy in response to 6 weeks of high-volume resistance training in trained young men is largely attributed to sarcoplasmic hypertrophy. *PloS one*, 14(6), e0215267. <https://doi.org/10.1371/journal.pone.0215267>
- Hirono, T., Ikezoe, T., Taniguchi, M., Tanaka, H., Saeki, J., Yagi, M., Umehara, J., & Ichihashi, N. (2020). Relationship Between Muscle Swelling and Hypertrophy Induced by Resistance Training. *Journal of Strength and Conditioning Research*, 1. <https://doi.org/10.1519/jsc.0000000000003478>
- Korthuis, R. J. (2011). *Exercise Hyperemia and Regulation of Tissue Oxygenation During Muscular Activity*. Nih.gov; Morgan & Claypool Life Sciences. <https://www.ncbi.nlm.nih.gov/books/NBK57139/>

Massey, C. D., Vincent, J., Maneval, M., & Johnson, J. T. (2005). Influence of Range of Motion in Resistance Training in Women: Early Phase Adaptations. *The Journal of Strength and Conditioning Research*, 19(2), 409. <https://doi.org/10.1519/r-14643.1>

National Institute of Biomedical Imaging and Bioengineering. (2016, July). Ultrasound | National Institute of Biomedical Imaging and Bioengineering. Nih.gov. <https://www.nibib.nih.gov/science-education/science-topics/ultrasound>. (NSCA), N. S. a. C. A. (2016). Exercise technique manual for resistance training (3rd ed.). Human Kinetics.

Pinto, R. S., Gomes, N., Radaelli, R., Botton, C. E., Brown, L. E., & Bottaro, M. (2012). Effect of range of motion on muscle strength and thickness. *Journal of Strength and Conditioning Research*, 26(8), 2140–2145. <https://doi.org/10.1519/JSC.0b013e31823a3b15>

Rothwell, D. T., Fong, D. T., Stapley, S. A., & Williams, D. J. (2019). A clinically applicable tool for rapidly estimating muscle volume using ultrasound images. *European journal of applied physiology*, 119(11), 2685-2699.

Varović, D., Žganjer, K., Vuk, S., & Schoenfeld, B. J. (2021). Drop-Set training elicits differential increases in non-uniform hypertrophy of the quadriceps in leg extension exercise. *Sports*, 9(9), 119. <https://doi.org/10.3390/sports9090119>.

Schoenfeld, B. J., & Contreras, B. (2014). The muscle pump: potential mechanisms and applications for enhancing hypertrophic adaptations. *Strength & Conditioning Journal*, 36(3), 21-25. doi: 10.1097/SSC.0000000000000021.

Schoenfeld, B. J., & Grgic, J. (2020). Effects of range of motion on muscle development during resistance training interventions: A

systematic review. *SAGE Open Medicine*, 8(PMC6977096), 205031212090155. <https://doi.org/10.1177/2050312120901559>

Wagner, L. L., Evans, S. A., Weir, J. P., Housh, T. J., & Johnson, G. O. (1992). The effect of grip width on bench press performance. *Journal of applied biomechanics*, 8(1), 1-10.



Mindsets and Their Relationships to Pandemic Behavior

By: Meghan Moore

Abstract

The present study explored the degree to which people's implicit beliefs are consistent across different domains. Participants ($n = 220$) completed a series of different implicit belief measures including a piloted scale for pandemic health. As expected, implicit measures were positively correlated with one another across domains. Thus, knowledge that someone adopts a growth mindset in one domain is useful in predicting their belief systems across domains.

Unfortunately, the pandemic health measure failed to predict specific health behavior rendering it less useful than expected.

Introduction

The proposed study uses an implicit theory perspective to explore the relationships between mindsets of varying domains. An implicit theory is an underlying belief that an individual holds about the nature of human qualities, abilities, and attributes (Dweck & Leggett, 1988; Elliot &

Dweck, 1988). Differences in implicit beliefs have been shown to create differences in goals, achievement, motivation, and response to failure (Dweck, Chiu, & Hong, 1995; Dweck, 1999). Malleable or incremental beliefs lead to favorable responses to challenges and failures while fixed or entity beliefs lead to avoidant coping and negative perceptions of personal ability (Dweck, 1999; Burnette, 2010). Dweck first defined differences in implicit beliefs as mindsets. Since Dweck's original research on implicit beliefs of intelligence, more studies have expanded implicit beliefs to increasing domains including morality (Chiu & Dweck, 1992), person perception (Chiu & Dweck, 1992), relationships (Knee et al., 2003), emotions (Tamir et al., 2007), weight management (Burnette, 2010), and more.

MENTOR

Steven Seidel, Ph.D.

DEPARTMENT OF PSYCHOLOGY

Although mindsets have been researched thoroughly in the literature, there has been less exploration about the relationships between mindsets across various domains. It is unclear whether mindsets can be viewed as transferrable across domains or if they function independently depending on the specific domain. For this reason, the first goal of the proposed study is to explore the relationships among different mindsets across domains. In other words, if an individual holds a growth mindset for intelligence, will they transfer this mindset to more domains such as relationships, emotions, weight management, and health. With the Covid-19 Pandemic being a current public health issue, the second goal of the study is to investigate whether holding a growth mindset within the health domain can predict an individual's likelihood to engage in pandemic health behaviors. To measure implicit theories of health of the Covid-19 Pandemic, the present study introduced a pilot scale modeled after Dweck's original implicit theories of intelligence scale (1999).

Implicit Beliefs of Intelligence

Dweck and colleagues first used Implicit Belief Theories to describe noticeable patterns in the way elementary school children respond to challenges and failures they encountered while learning math (1988).

According to their studies, some students responded favorably to failure and saw it as an opportunity for growth while other students accepted their failure as a reflection of their innate inability. To create definitions of these frames of mind, Carol Dweck coined the term "growth mindset" to refer to malleable beliefs which are the idea that an individual has the capacity to improve upon abilities and learn new skills in aspects like intelligence. A "fixed mindset" refers to fixed beliefs which is a more dichotomous way of thinking where an individual believes that they are either capable or they are simply incapable of a certain ability of skill (1999). The primary difference is that individuals using a fixed mindset view failures and challenges as uncontrollable and inevitable. Conversely, individuals using a growth mindset view challenges more optimistically and use better coping strategies to achieve goals.

Implicit Beliefs of Emotions, Dieting, & Relationships

Implicit theories of intelligence paved the way for additional researchers to apply an implicit theory perspective to additional domains like relationships. Implicit theories of relationships was developed by focusing on how individuals respond to challenging relationship events and failures (Knee et al., 2001). Those who hold romantic destiny beliefs (fixed mindset)

tend to be especially focused on fixed aspects of their partner, are more sensitive to signs indicating the relationship is not meant to be and are more likely to disengage when problems arise. On the other hand, those with romantic growth beliefs (growth mindset) see benefit to conflict by increasing effort to combat challenges and become closer with their partner. Tamir et al. also investigated how people differ in the implicit theories that they hold, but in the context of emotions (2007). It was found that mindsets apply to the domain of emotions as well. Individuals holding entity beliefs (fixed mindsets) displayed lower emotion self-efficacy, lower social adjustment, and higher depressive symptoms compared to those holding incremental beliefs (growth mindsets). Similarly, Burnette (2010) explored implicit theories in the domain of weight management to understand how mindsets play a role in weight loss failures and successes. When given hypothetical dieting setbacks, individuals holding entity beliefs tended to exhibit avoidant coping. As in line with the literature, the incremental theorists had positive expectations of their weight loss success even when presented with hypothetical setbacks.

Implicit Theories of Health/ Covid

Expanding on this, growth mindsets have also been applied to health and are shown to

be positively associated with health behaviors such as eating healthily, engaging in physical activity, and overall health-promoting behaviors in daily life (Schreiber et al., 2020). In light of the current Covid-19 Pandemic, we elected to explore how implicit theories of health relate to engagement in pandemic health behaviors. The current recommended preventative health measures from The Center for Disease Control and Prevention (CDC) are getting vaccinated, staying up to date on vaccinations, wearing a mask, social distancing, hand washing, sanitizing/disinfecting, and monitoring daily health (2022). The present study explored the relationships between the different implicit belief measures discussed above and included a piloted measure of implicit beliefs of pandemic behavior to determine whether people holding growth mindsets in one domain are more likely to hold similar mindsets for other domains (evidence for a more general “growth” trait). The project also will shed light on whether mindsets can predict health behavior of people during the Covid-19 pandemic.

vMethods

Participants

The sample for the study comprised of half male and half female participants (n=220) living in the U.S. with an age range of 22 to 64 years old (M = 34.29, SD =

11.16). Demographics that stood out were that participants were mostly White (78.6%) and Democratic (81.8%). All participants were recruited through Prolific which is an online participant recruitment software that verifies and monitors participants. They were compensated \$1.59 for their participation in the study.

Procedure

An online survey link was created through Qualtrics and was inputted into Prolific for participants to access. The participants were asked to complete self-reports of implicit theories measures of intelligence, weight management, relationships, emotions, and pandemic health (pilot scale) followed by questions regarding pandemic health behaviors. Two questions stating, “If you are reading this select 5 to avoid being disqualified from the survey,” were inserted to prevent participants from completing the survey without reading the questions.

Survey Measures

Implicit Belief Scales

Dweck’s original Implicit Beliefs of Intelligence Scale was included in the survey to measure mindsets in the intelligence and ability domain. The scale consists of eight items in total with four measuring growth beliefs and four measuring fixed beliefs. It uses a five-point Likert scale ranging from Strongly

Disagree (1), Disagree, Neither Disagree nor Agree, Agree, and Strongly Agree (5). Participants responded to growth and fixed items such as “With enough time and effort, I think I could significantly improve my intelligence level” and “I can learn new things, but I don’t have the ability to change my basic intelligence.” We created a piloted measure of Implicit Beliefs of Pandemic Health to model Dweck’s scale. It also uses a five-point Likert scale but has six items in total. One of the items used to measure growth beliefs was “No matter who you are, it is very possible to improve your odds of not developing disease or viral infection.” One of the fixed belief items used was, “Your odds of becoming sick during a pandemic is something you can’t change very much.” The Implicit Beliefs of Emotions Scale consisted of only two growth items and two fixed items. Examples of them are “If I want to, I can change the emotions that I have,” and “No matter how hard I try, I cannot really change the emotions that I have” This scale also uses a five-point Likert scale. The Implicit Beliefs of Relationships Scale was modified for this study by cutting the items in half in order to keep the survey under ten minutes. The scale originally had 22 items (11 growth) and (11 destiny). The modified scale for the current study reflects 12 items (6 growth) and (6 destiny). This scale uses a 7-point Likert

scale including the options of Somewhat Agree and Somewhat Disagree. Examples of growth and destiny items are “A successful relationship evolves through hard work and resolution of incompatibilities,” and “A relationship that does not get off to the perfect start will never work.”

Participants were also asked to answer items on the Implicit Theories of Weight Management Scale. This scale uses a six-point Likert scale and has a total of six items. Examples of items measuring incremental and entity beliefs are “You can change your basic body weight considerably,” and “To be honest, you can’t really change your body weight.”

Finally, pandemic health behaviors were assessed by asking three questions about an individual’s vaccination status, how often they wear masks in public, and how often they use hand sanitizer in public. To measure vaccination status, participants could choose from one of three options, “I did not receive any vaccinations,” “I am partially vaccinated,” and “I am fully vaccinated (including my recommended boosters).” Frequency of mask wearing was measured by asking participants to self-report how often they wear a mask in public. They could select from one of the five options, Never, Sometimes, About half the time, Most of the time, and Always. The last question regarding health behaviors asked was “How often

do you use hand sanitizer when entering/exiting a public space?” Participants could then select their frequency ranging from Never to Always.

Results

With the exception of the Pandemic Health Beliefs Scale ($\alpha = .617$), reliability analyses determined that all other scales were highly reliable (Intelligence, $\alpha = .964$; Weight management $\alpha = .917$; Relationships $\alpha = .794$; and Emotions $\alpha = .830$). Males ($M = 4.801$) were found to have higher scores on the Dieting scale than women (4.1773), $t(110) = 5.536$, $p < .001$, $d = .836$. This suggests that males hold more growth mindsets for dieting beliefs than women do. To examine relationships between the measures used in the study, bivariate correlations were computed (see Table 1). As can be seen in the table, the 5 mindset scales (first 5 variables in Table 1) used for the study were found to be consistently correlated with one another indicating that mindsets are somewhat consistent across domains. Interestingly, the emotions mindset scale was found to have greater correlations with the other mindset scales suggesting that it has greater predictive utility across domains. Unfortunately, however, the implicit belief scales showed little or no relationship with the pandemic behavior measures.

Table 1.

Means, Standard Deviations, and Pearson Correlations for Measures used in the Study

	<i>M(SD)</i>	1	2	3	4	5	6	7	8
Intelligence	.356 (.923)	-							
Weight	4.49 (.891)	.151*	-						
Relationships	4.78 (.697)	.205*	.172*	-					
Emotions	3.72 (.761)	.202*	.360*	.247*	-				
Health	3.67 (.583)	.108	.301*	.213*	.290*	-			
Vaccination	2.71 (.624)	-.090	-.028	.068	-.032	.133*	-		
Mask	3.82 (1.25)	.009	-.124	-.052	-.062	.081	.297*	-	
Sanitizer	3.03 (1.26)	.146*	.086	.038	.072	.013	-.017	.310*	-

* $p \leq .05$. ** $p \leq .01$.

Discussion

The first goal of the present study was to investigate whether mindsets would be consistent across domains including intelligence, weight management, relationships, emotions, and health. The above data provide support for our first hypothesis that mindsets (growth/fixed) would be consistent across domains rather than domain specific. Although the results suggest that mindsets are consistent across domains, the significance level of this finding is moderate. Since mindsets are only moderately related, this indicates that the implicit belief scales are still somewhat limited in their ability to predict consistency across domains. Further, the Emotions and Dieting scales had the highest predictive utility which suggests that those domains have the strongest relationships to an individual's tendency to hold either malleable or fixed implicit beliefs.

Interestingly, there was a sex

difference found for the Dieting scale. Males scored higher than females in malleability indicating that men are more likely to hold malleable implicit beliefs for dieting than women. Presnell et al. (2008) also found a sex difference where males demonstrated higher levels of weight loss self-efficacy when undergoing a weight loss intervention compared to females. Men having higher levels of weight loss self-efficacy as well as being more likely to hold malleable dieting beliefs suggests that men have greater perceived control over their weight loss and dieting efforts.

The second hypothesis of the study was to see if the piloted health belief measure would be able to predict pandemic health behaviors. However, the results were not supportive of this hypothesis. The piloted health belief scale was unable to significantly predict the likelihood to engage in Covid-19 related preventative health behaviors. This was unexpected

given that an implicit theories of health perspective would predict that individuals with growth mindsets would engage in more preventative health behaviors. The health scale had the lowest reliability of the five scales included in the study which could be a potential reason for its low predictive utility. Additionally, the pandemic health behaviors were self-reported and measured with only three questions regarding vaccination, mask wearing, and sanitizing. Having a limited array of questions and behaviors could be another reason for why the scale failed to perform as expected. To improve the scale's reliability in the future, more items could be added and reassess for reliability. Any established pandemic health behavior measures could also be used and may be better suited for future studies.

The extensive research of implicit theories has shown the positive outcomes of holding growth mindsets such as wellbeing, goal achievement, and psychological flourishing (Burnette et al., 2013).

Continued research of implicit theories and mindsets has led to the development of mindset interventions with goals of improving mental health. Further explorations into understanding the dynamics that shape mindsets will help to expand the development of future interventions.

References

- Burnette, J., (2010). Implicit theories of body weight: Entity beliefs can weigh you down. *Personality and Social Psychology Bulletin*, 36(3), 410-422.
- Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin*, 139(3), 655–701. <https://doi.org/10.1037/a0029531>
- Centers for Disease Control and Prevention. (2022). "Covid-19: How to Protect Yourself and Others." Retrieved from: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>
- Chiu, C.-y., Hong, Y.-y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. *Journal of Personality and Social Psychology*, 73(1), 19–30. <https://doi.org/10.1037/0022-3514.73.1.19>
- Conner, A. L., Boles, D. Z., Markus, H. R., Eberhardt, J. L., & Crum, A. J. (2019). Americans' health mindsets: Content, cultural patterning, and associations with physical and mental health. *Annals of Behavioral Medicine*, 53(4), 321.
- Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgements and reactions: A world from two perspectives. *Psychological Inquiry*, (6) 267-285.
- Dweck, C. S., & Leggett, E. L., (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, 25, 109- 116.
- Dweck, C. S. (1999). *Self- Theories: Their Role in Motivation, Personality, and Development*. Philadelphia: Psychology Press.
- Elliot, E. S., Dweck, C. S. (1988). Goals: an approach to motivation and achievement. *Journal of Personality and Social Psychology*, 54, 5-12.
- Knee, C. R., Nanayakkara, A., Vieotor, N. A., Neighbors, C., & Patrick, H. (2001). Implicit theories of relationships: Who cares if romantic partners are less than ideal? *Personality and Social Psychology Bulletin*, 27, 808-819.
- Knee, C. R., Patrick, H., Lonsbary, C. (2003). Implicit theories of relationships: Orientation toward evaluation and cultivation. *Personality and Social Psychology Review*, 7, 41-55.
- Presnell, K., Pells, J., Stout, A., & Musante, G. (2008). Sex differences in the relation of weight loss self-efficacy, binge eating, and depressive symptoms to weight loss success in a residential obesity treatment program. *Eating behaviors*, 9(2), 170–180. <https://doi.org/10.1016/j.eatbeh.2007.07.005>
- Schreiber, M., Job, V., & Dohle, S. (2020). Is your health malleable or fixed? The influence of implicit theories on health-related attitudes and behavior. *Psychology & Health*, 33(12), 1421-1439.
- Tamir, M., John, O. P., Srivastava, S., & Gross, J. J. (2007). Implicit theories of emotion: Affective and social outcomes across a major life transition. *Journal of Personality and Social Psychology*, 92, 731-744.

ARTICLES

22/

23



Wait For It: The Influence of Delayed Information about Physical Appearance on Dating Intentions

By: Rose Rodriguez

Abstract

In online dating, quick judgments are often made based on appearance as photos take centerstage on dating applications. Research has indicated that traditionally attractive individuals have benefitted from first impressions and are often perceived as having positive characteristics due to their appearance. This phenomenon is often referred to as the halo effect. The present study investigated the impact of delaying information about physical appearance

on attraction and dating intentions. Specifically, the present study employed a 2 (physical attractiveness) by 2 (order presentation: photo then description and photo or description then description and photo) by 2 (rating 1 vs. rating 2) mixed subject's design. We controlled for participants' gender, sexual orientation, and age. We hypothesized that delaying information about physical appearance would benefit only the physically attractive targets. For the study, 450 participants were recruited through Prolific and were

randomly assigned one of the four conditions. Participants were asked to review the profile and then indicate their attraction and dating intentions toward the described individual. Our results illustrate that delaying information is beneficial for attractive individuals while detrimental for unattractive individuals.

Introduction

Our evaluations of others often happen at an unconscious and implicit level (Ham & Van Den Bos, 2011). These unconscious judgments can be based on several attributes, but a common attribute is one's physical appearance. In fact, individuals who are considered physically attractive, tend to be attributed with more positive traits during interpersonal interactions (Palmer & Peterson, 2020).

MENTOR

Yuliana Zaikman, Ph.D.

DEPARTMENT OF PSYCHOLOGY

This phenomenon is known as the halo effect. It is often during first impressions that attractive individuals benefit from the halo effect and are treated more positively and held at a higher regard (Cowan & Little, 2013; Palmer & Peterson, 2020). The present research explored whether the halo effect occurred when information about physical appearance was delayed. More specifically, the study investigated if delaying information about physical appearance impacted individuals' attraction and evaluations of others. The halo effect can be a benefit to some and in turn a disadvantage for others. Since physical attractiveness can positively impact the perception and life chances of an individual, physical attractiveness can become a form of inequality that needs to be recognized (Palmer & Peterson, 2020; Westfall et al., 2018). Therefore, it is prudent to investigate the halo effect and its real-world application and impact (Westfall et al., 2018). This is especially valuable since the halo effect has been found to impact all ages, backgrounds, and various professional settings (Malouff et al., 2013; Palmer & Peterson, 2020).

In recent times there has been an increase in discourse and intrigue when it comes to presenting one's personality characteristics over appearance to limit things like the halo effect. Specifically, this has

been seen in reality television dating shows and online dating applications (Albury et al., 2017; DeRose et al., 2003). The current study attempts to highlight the real-world impact of the halo effect on dating intentions, specifically in a modern-day setting.

The Halo Effect

According to the halo effect (also referred to as 'what is beautiful is good'), people are attributed to have more favorable personality and other trait characteristics when they are considered physically attractive (Zebrowitz & Franklin, 2014). Qualities such as facial symmetry, the depiction of averageness, and a distinct depiction of sexual identity (displaying masculinity or femininity) are often associated with attractiveness (Han et al., 2018). Physically attractive people can be perceived as having a myriad of positive traits such as intellect, humor, successfulness, and sociableness (Cowan & Little, 2013; Palmer & Peterson, 2020). The halo effect occurs when individuals spontaneously and implicitly judge others based on their first impressions of their appearance (Ham & Van Den Bos, 2011; Han et al., 2018; Palmer & Peterson, 2020).

The way in which the halo effect operates produces an inequity in the assessment of individuals (Malouff et al., 2013). This inequity can even impact important aspects

of life such as the grading of academic work and rating of employee's performance (Malouff et al., 2013). The unfairness of these unconscious assessments does not just impact a certain stage of life but instead persists throughout all ages, as people from all ages tend to be impacted by the halo effect (Ham & Van Den Bos, 2011; Palmer & Peterson, 2020). Clearly, the halo effect is benefiting attractive people, and in turn, disadvantages those who are not regarded as attractive. This social inequity is why reducing the impacts of the halo effect is so important. While the bias formed through the halo effect is seemingly unconscious and therefore cannot be controlled, understanding such biases can lead to ways in which one can alleviate them (Ham & Van Den Bos, 2011; Malouff et al., 2013). The halo effect has been found to be impacted by personality characteristics and descriptors (Lammers et al., 2016; Zhang et al., 2014). Studies have found that when paired with positive descriptions, subjects rated faces more positively as opposed to neutral or negative descriptors (Malouff et al., 2013). Another way the halo effect can be mitigated is through anonymity. When a grader does not know the identity of whom they are grading, a great number of biases can be avoided (Malouff et al., 2013). The importance of implementing solutions such as anonymity is further highlighted

when exploring first impressions and their impact.

First Impressions

The opinions formed during first impressions are implicit and often based on something subjective and unrelated like appearance (Palmer & Peterson, 2020). When new information is presented, impressions can change, however, it has been found that while explicit thoughts and attitudes can be changed somewhat easily, implicit thoughts and attitudes can be resistant to change (Mann & Ferguson, 2015; Wyer, 2010). While there is a possibility to change implicit evaluations, it requires more than just the addition of information (Mann & Ferguson, 2015). Instead, active consideration and at minimum moderate cognitive resources are necessary to change implicit evaluations (Mann & Ferguson, 2015). Subsequently, since impressions based on physical appearance fall into the implicit category, they could be more resistant to change (Ham & Van Den Bos, 2011; Han et al., 2018; Palmer & Peterson, 2020). One way in which first impressions and implicit evaluations are resistant to change is via the belief perseverance effect. The belief perseverance effect suggests that people resist changing their beliefs even when receiving contradictory evidence (Guenther & Alicke, 2008). The belief perseverance

effect can cause individuals to use inaccurate information to drive their evaluations simply because that is what they were exposed to first (Guenther & Alicke, 2008). Due to this, first impressions impacted by the halo effect can be hard to shake even when one is presented with new information that contradicts the first impression. This can affect modern-day interpersonal relationships with the rise of social media and dating applications since photos are often the focal point of such applications (Albury et al., 2017).

Online Dating

The manufacturing and popularity of mobile dating applications have dramatically increased in recent times and have garnered millions of users (Albury et al., 2017; Degen & Kleeber-Niepage, 2021). In such applications, photos serve a key role in the decision-making process and the success of individuals seeking partners (Degen & Kleeber-Niepage, 2021). Especially, since what once was an in-person interaction has been reduced to a select few photos. For those seeking partners, it is easy to fall victim to snap judgments or biases as physical appearance takes center stage in such applications (Albury et al., 2017). Individuals with profiles on dating applications have been shown to base their presentation on the possibility of these biases (such as the bias caused by

things like the halo effect; Toma & Hancock, 2010). This is seen through research demonstrating that individuals who perceive themselves as less attractive are much more likely to lie about their physical description and even edit their photos (Toma & Hancock, 2010). Such dramatic editing of one's profile and online identity has been found to take a toll on one's self-perception and harm self-esteem (Shimokobe & Miranda, 2018). As dating shifts towards this new platform, it is paramount to understand how biases such as the halo effect impact dating intentions and attraction to see if these drastic measures (such as lying about one's physical appearance and editing photos) is warranted or unnecessary for finding a romantic partner. (Albury et al., 2017)

Overview and Hypotheses

The current research employs the element of temporary anonymity to the dating world by delaying information on physical appearance. The goal was to examine if and how the halo effect impacts an individual's attraction and dating intentions when they are first presented with one's personality descriptions before being introduced to information about physical appearance. The study utilized a 2 (physical attractiveness) x 2 (first profile) x 2 (rating time). The first profile refers to whether the participants were exposed first to a photo only or a personality

description only profile. Rating time refers to when participants evaluated the dating profile after the only photo or only personality description profile or after seeing the second profile which presented the photo and the personality description. Participants' sexual preferences for gender and age range were controlled for and photos were presented accordingly. Participants were asked to evaluate the general characteristics, attractiveness and dating intentions of the target individual.

Since physical attractiveness can lead to unconscious and implicit biases such as the halo effect to occur (Ham & Van Den Bos, 2011; Palmer & Peterson, 2020), we predicted that biases based on physical appearance like the halo effect will persist even when information on physical appearance is delayed. Specifically, we hypothesized that physically attractive people would be evaluated more favorably and desired as dating partners during their second rating. While not physically attractive people would experience a decrease in favorable ratings and be less desirable as dating partners during their second rating.

Methods

Participants

Four hundred ninety and three participants were recruited through Prolific and were monetarily compensated for their time and participation.

After removing participants that failed to correctly answer attention check questions, the final sample included 466 participants (49.4% females). The median age of participants was 28.00 ($M = 31.07$, $SD = 10.92$). The majority of the sample was White (68.2%), Heterosexual (71.1%) and Liberal (62.1%). All the participants were either single (96.6%) or dating but not committed to one person.

Measures and Materials

Interpersonal Attraction Scale.

To evaluate attraction and overall impression, participants were asked to complete an Interpersonal Attraction Scale (McCroskey & McCain, 1974). The scale consisted of three subscales: social attraction, physical attraction, and task attraction (McCroskey & McCain, 1974). For example, the social attraction subscale asked participants to rate someone on whether they would make a good friend. The physical attraction subscale asked participants whether they would consider the individual to be sexy. The task attraction subscale asked participants to rate the individual's ability to get a job done. Each subscale of the interpersonal attraction scale was graded on a five-point Likert scale with 1 - Very Unlikely and 5 - Very Likely. See Appendix A for the full scale.

Dating Intentions

Participants also completed

supplemental questions to evaluate dating intentions. Within the supplemental questions there were three subcategories: likelihood to message/respond to message, likelihood to ask for/give phone number and likelihood to ask/go on a date. All the supplemental questions were evaluated on a five-point Liker scale with 1 - being Very Unlikely and 5 - being Very Likely. See Appendix B for the full scale.

Photos.

The photo set included eight different individuals, two attractive females, two unattractive females, two attractive males, and two unattractive males. These individuals were determined to be attractive or unattractive from a previous study wherein a pilot study was conducted (Zaikman & Marks, 2016). The present study digitally modified the eight individuals to fit an array of age groups: 20-30, 30-40, 40-50, and 50-60. A pilot study was conducted in order to ensure the modified photos fit into the age group they were meant to represent. Participants were shown a random image of an individual and asked to assign said individual to one of the four age groups. This was repeated until the participants had seen and assigned an age group to each photo. See Appendix C for all the photos.

Procedure

After obtaining informed

consent, participants were told they would view a hypothetical dating profile and were asked to disclose an age range and gender preference for a romantic partner. This determined which profile the participant would see. Participants then were randomly assigned to one of two conditions (personality description or photo profile). For those in the photo condition only a photo was seen. This photo depicted an attractive or unattractive person. For those in the personality description first condition, the same description was shown to every participant with only the age range and the gender changing to meet the preferences each participant noted at the start of the study. After seeing the first profile, participants completed the Interpersonal Attraction Scale (McCroskey & McCain, 1974) and answered the Dating Intentions questions. Following this, participants were shown to a combined profile that included a personality description and a photo. If participants previously viewed the personality description condition, they were shown a combined profile featuring a randomly assigned photo of an attractive or unattractive person. If participants were previously in the photo condition, they were shown a profile of the same person they were exposed to previously with the personality description added. Participants then completed the same interpersonal attraction scale

and supplemental questions. Afterward, participants were asked to fill out some demographic questions, were debriefed, and thanked for their participation in the study.

Results

One-way ANOVA for profile age range revealed no differences in the dependent variables across the profile's age range. Thus, we were able to collapse across the age range variable, as planned. To examine our main results, a MANOVA was performed. There was a main effect for Rating Time, such that regardless of the condition, participants' ratings increased for social attraction, $F(1,402) = 7.67$, $p = 0.006$, and task attraction, $F(1,402) = 30.68$, $p < 0.001$, while decreased for dating intentions, $F(1,402) = 14.374$, $p < 0.001$. There was a main effect for First Profile such that participants viewing only personality profile first had greater social, $F(1,402) = 23.35$, $p < 0.001$, physical, $F(1,402) = 15.59$, $p < 0.001$, and task, $F(1,402) = 8.20$, $p < 0.001$ attraction and higher likelihood to message, $F(1,402) = 29.70$, $p < 0.001$, phone, $F(1,402) = 25.12$, $p < 0.001$ and date, $F(1,402) = 23.69$, $p < 0.001$ compared to those viewing only photo profile first.

There was a two-way interaction for First Profile by Rating Time, such that participants who saw only personality profile first had a decline in rating, while those

who saw only photo profile first has an increase in rating of social attraction, $F(1,402) = 113.26$, $p < 0.00$, physical attraction, $F(1,402) = 41.62$, $p < 0.00$, task attraction, $F(1,402) = 46.18$, $p < 0.00$, intention to message, $F(1,402) = 73.33$, $p < 0.00$, to phone, $F(1,402) = 47.14$, $p < 0.00$, and to date, $F(1,402) = 82.21$, $p < 0.00$. Finally, there was a three-way interaction, such that the above-described pattern was observed primarily for unattractive profiles. For attractive profiles, viewing the photo only condition first led to an increase in ratings for physical attraction, $F(1,402) = 32.471$, $p < .001$, $d = 0.15$, intention to message, $F(1,402) = 5.593$, $p < .001$, $d = 0.09$, intention to phone, $F(1,402) = 13.307$, $p < .001$, $d = 0.15$, and intention to date, $F(1,402) = 11.536$, $p < .001$, $d = 0.12$.

Discussion

The objective of this study was to determine if delaying information about physical appearance can have an impact on how individuals are evaluated. Our hypothesis was that physically attractive people would be evaluated more favorably and desired as dating partners during their second rating time (when appearance is revealed), while the opposite would occur for those perceived as unattractive. This was observed to be true as the results indicate that for profiles of unattractive individuals seeing

only the personality description first led to a decrease in ratings. For the profiles of attractive individuals this was not the observed pattern.

Despite the decline in ratings of unattractive profiles when only personality description was presented first, there seemed to be a slight benefit for these profiles compared to if the only photo profile was presented first. Specifically, while there is a significant decrease in ratings from viewing only personality description to viewing both personality description and photo, participants in the personality description (saw only personality description first) rated unattractive individuals slightly higher during the second rating time than those in the photo condition (saw only photo first). Although the results indicate only a slight benefit from introducing personality characteristics prior to information about physical appearance for unattractive individuals, we did find that personality characteristics tended to improve ratings for everyone. For the photo-only first condition individuals were evaluated more favorably once the personality description was added to the photo. Therefore, the personality description had some benefits. There was a main effect for only personality/photo profile, such that participants viewing only personality profile had greater social, physical and task attraction and higher likelihood to message, phone

and date, compared to those viewing only photo profile first. Surprisingly, there was also a main effect for rating time which showed that regardless of the condition participants had an increase in social and task attraction and decrease in dating intentions during the second rating time. This pattern indicates that the more information participants learned about the profiles the more non-romantic attraction increased. This was unexpected and could occur for a few reasons, perhaps as participants learned more about the profile's participant attitudes became more wholesome rather than romantic. There could also be a limitation regarding how attractive the personality description and photos are perceived, which is further discussed in the limitation section.

Limitations and Future Directions

As any study, ours was not without limitations. One limitation present during the study was how the information about physical appearance was delayed. In our study, the information was delayed for a minute or two while participants were filling out the Interpersonal Attraction Scale and supplemental dating questions. Perhaps if participants had not gotten to see the individuals' appearance rather immediately or had been given the chance to interact with said individual results could

vary. The profile used in the study is like what one would see as a first impression on an online dating application and plays more into the superficial and fast side of online dating. While it is acknowledged that online dating experiences often can be and are perceived as disconnected emotionally in favor of sexual satisfaction, some see online dating as a great way to facilitate interpersonal connection and grow social skills (Çevik, 2019). The study only focused on first impressions, but perhaps if participants were to interact and actively communicate with the profiles, our pattern of results would differ. A difference could occur during social interaction because some individuals feel more open and confident in conversation when conversing online (Çevik, 2019). Some even believe that online dating offers better compatibility for those with difficulty making interpersonal connections in real life (Çevik, 2019). Since online users can hide their insecurities and be more open to communication in comparison to face-to-face interaction (Çevik, 2019). Therefore, it may be worth researching how delaying information on physical appearance throughout social interaction impacts attraction and dating intentions. Another possible limitation is the differences in how individual's view attractiveness. Although the photos used were tested through a pilot study for both attractiveness and age

range, what one finds attractive can be quite subjective. Therefore, it is possible that participants found individuals deemed attractive by the study to be unattractive and vice versa. The same could be said for the personality description, some participants may view the description as attractive and others unattractive.

Conclusion

In summary delaying information on physical appearance results in a decrease in ratings for unattractive individuals. Despite this decrease, unattractive individuals are rated slightly higher when information on physical appearance is delayed in comparison to when physical appearance is revealed first. For attractive individuals the opposite was true, they were rated higher when physical appearance was revealed and information on personality was delayed. Although results illustrate that introducing a personality description before one's appearance had only a slight significant impact, including a personality description did have a benefit. The presence of a personality description was seen to improve ratings in social and task attraction in both attractive and unattractive groups. Overall, one can deduce that delaying information on physical appearance has a slight benefit for unattractive individuals since the end evaluations were

higher. Further research should explore this benefit, its impact and extent.

Appendix A

Interpersonal Attraction Scale

ROTATED FACTOR MATRIX FOR INTERPERSONAL ATTRACTION SCALES			
	Social Attraction	Physical Attraction	Task Attraction
<i>Social Attraction</i>			
1. I think he (she) could be a friend of mine	.76*	-.20	-.29
2. I would like to have a friendly chat with him (her)	.70*	-.31	-.17
3. It would be difficult to meet and talk with him (her)	-.64*	-.07	-.01
4. We could never establish a personal friendship with each other	-.60*	.17	.27
5. He (she) just wouldn't fit into my circle of friends	-.60*	.12	.08
6. He (she) would be pleasant to be with	.65	-.44	-.15
7. I feel I know him (her) personally	.51	-.16	-.06
8. He (she) is personally offensive to me	-.50	.26	.24
9. I don't care if I ever get to meet him (her)	-.49	.23	.33
10. I sometimes wish I were more like him (her)	.27	-.42	-.20
<i>Physical Attraction</i>			
11. I think he (she) is quite handsome (pretty)	.16	-.85*	-.06
12. He (she) is very sexy looking	.14	-.83*	.01
13. I find him (her) very attractive physically	.07	-.78*	-.06
14. I don't like the way he (she) looks	-.29	.73*	.22
15. He (she) is somewhat ugly	-.19	.65*	.14
16. He (she) wears neat clothes	.25	-.64*	-.22
17. The clothes he (she) wears are not becoming	-.23	.63*	.25
18. He (she) is not very good looking	-.11	.61*	.22
19. She (he) is well groomed	.33	-.53	-.26
20. He (she) is repulsive to me	-.59	.32	.31
<i>Task Attraction</i>			
21. I couldn't get anything accomplished with him (her)	-.20	.08	.66*
22. He (she) is a typical goof-off when assigned a job to do	.13	.28	.66*
23. I have confidence in his (her) ability to get the job done	.31	-.15	-.64*
24. If I wanted to get things done I could probably depend on him (her)	.29	-.23	-.63*
25. He (she) would be a poor problem solver	-.16	.15	.62*
26. I think studying with him (her) would be impossible	-.07	-.07	.58
27. You could count on him (her) getting a job done	.19	-.15	-.57
28. I have the feeling he (she) is a very slow worker	-.11	.17	.50
29. If we put our heads together I think we could come up with some good ideas	.42	-.18	-.49
30. He (she) would be fun to work with	.56	-.18	-.15
Eigenvalue after rotation	5.00	5.54	4.06

*Items with acceptable factor loadings

Appendix B

Supplemental Dating Questions

Messaging

How likely are you to respond to a direct message from this person?

How likely is it that you reach out to this person and direct message them?

Phone

If this person asked for your phone number, how likely that you would give it to them?

How likely are you to ask this person for their phone number?

Dating

If this person asked you out to coffee, how likely are you to go?

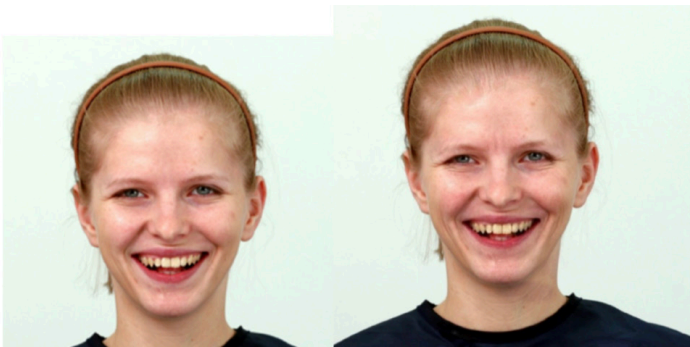
If this person asked you out to dinner, how likely are you to go?

How likely are you to ask this person out on a date?

Appendix C

Digitally Modified Photos





References

- Albury, K., Burgess, J., Light, B., Race, K., & Wilken, R. (2017). Data cultures of mobile dating and hook-up apps: Emerging issues for critical social science research. *Big Data & Society*, 4(2), 2053951717720950.
- Çevik, S. B. (2019). Reassessing Turkey's soft power: The rules of attraction. *Alternatives*, 44(1), 50-71. DOI: 10.1080/01614576.1997.11074165
- Cowan, M. L., & Little, A. C. (2013). The effects of relationship context and modality on ratings of funniness. *Personality and Individual Differences*, 54(4), 496–500. <https://doi-org.manowar.tamucc.edu/10.1016/j.paid.2012.10.020>
- Degen, J. L., & Kleeberg-Niepage, A. (2021). Profiling the Self in Mobile Online Dating Apps: a Serial Picture Analysis. *Human Arenas*, 1-25.
- DeRose, J., Fürsich, E., & Haskins, E. V. (2003). Pop (up) goes the Blind Date: Supertextual constraints on “reality” television. *Journal of Communication Inquiry*, 27(2), 171-189. <https://doi.org/10.1177/0196859902250865>
- Guenther, C. L., & Alicke, M. D. (2008). Self-enhancement and belief perseverance. *Journal of Experimental Social Psychology*, 44(3), 706-712. <https://doi.org/10.1016/j.jesp.2007.04.010>
- Ham, J., & van den Bos, K. (2011). On unconscious and conscious thought and the accuracy of implicit and explicit judgments. *Social Cognition*, 29(6), 648-667. doi:<http://dx.doi.org/10.1521/soco.2011.29.6.648>
- Han, S., Li, Y., Liu, S., Xu, Q., Tan, Q., & Zhang, L. (2018). Beauty is in the eye of the beholder: The halo effect and generalization effect in the facial attractiveness evaluation. *Acta Psychologica Sinica*, 50(4), 363-376.
- Malouff, J. M., Emmerton, A. J., & Schutte, N. S. (2013). The risk of a halo bias as a reason to keep students anonymous during grading. *Teaching of Psychology*, 40(3), 233-237.
- Mann, T. C., & Ferguson, M. J. (2015). Can we undo our first impressions? The role of reinterpretation in reversing implicit evaluations. *Journal of Personality and Social Psychology*, 108(6), 823-849.
- McCroskey, J. C., & McCain, T. A. (1974). The measurement of interpersonal attraction.
- Palmer, C. L., & Peterson, R. D. (2021). Physical Attractiveness, Halo Effects, and Social Joining. *Social Science Quarterly*, 102(1), 552-566.
- Shimokobe, T., & Miranda, M. A. (2018). I Have Clout. *Swipe Right: Dating Apps and Implications on Self-Esteem and Body Image*. California Polytechnic State University, San Luis Obispo, 1-35.
- Talamas, S. N., Mavor, K. I., & Perrett, D. I. (2016). The influence of intelligence on the endorsement of the intelligence–attractiveness halo. *Personality and Individual Differences*, 95, 162–167. <https://doi-org.manowar.tamucc.edu/10.1016/j.paid.2016.02.053>
- Toma, C. L., & Hancock, J. T. (2010). Looks and lies: The role of physical attractiveness in online dating self-presentation and deception. *Communication Research*, 37(3), 335–351. <https://doi-org.manowar.tamucc.edu/10.1177/0093650209356437>
- Westfall, R. S., Millar, M. G., & Lovitt, A. (2019). The Influence of physical attractiveness on belief in a just world. *Psychological reports*, 122(2), 536-549.
- Wyer, N. A. (2010). You never get a second chance to make a first (implicit) impression: The role of elaboration in the formation and revision of implicit impressions. *Social Cognition*, 28(1), 1-19. doi:<http://dx.doi.org/10.1521/soco.2010.28.1.1>

Zaikman, Y., & Marks, M. J. (2016). The influence of physical appearance and personality on the exhibition of the sexual double standard. *Sexuality & Culture*, 20(2), 255-276. doi:<http://dx.doi.org/10.1007/s12119-015-9319-9>

Zebrowitz, L.A., & Franklin, G.R.Jr. (2014). The attractiveness halo effect and the babyface stereotype in older and younger adults: Similarities, own-age accentuation, and older adult positivity effects. *Experimental Aging Research*, 40 (3), 375–393.

Zhang, Y., Kong, F., Zhong, Y., & Kou, H. (2014). Personality manipulations: Do they modulate facial attractiveness ratings? *Personality and Individual Differences*, 70, 80–84.



Nutrient Inputs Associated With Groundwater Near Coral Reefs Along A Stretch Of The Caribbean Coast

By: Kathleen Mathews

ABSTRACT

The geologic/hydrogeological features of karst formations enable them to store/transmit large amounts of groundwater and contaminants from recharge to potential discharge zones (e.g., coastal seas). Due to karst aquifers being closely linked to coastal settings, groundwater discharge (as either underwater springs or coastal springs), aka submarine groundwater discharge (SGD), is critical for coastal ecosystems/services. This research explores the connection

between groundwater inputs to the nearshore Caribbean Sea and the health of coral reefs using stable (oxygen- $\delta^{18}\text{O}$ and hydrogen- δD) and radiogenic (radon- ^{222}Rn and radium- ^{224}Ra , ^{223}Ra , and ^{226}Ra) isotope measurements. Continuous measurements of ^{222}Rn along multiple transects between the shoreline and near the reefs identified several locations that are likely affected by groundwater inputs. The highest ^{222}Rn activities and ^{226}Ra were measured in the cenotes and near some of the springs. Cenotes, considered

to be the groundwater sources, didn't always have higher activities than the underwater springs. This may indicate that groundwater inputs via submarine springs may be associated with deeper flow paths, thus higher ^{222}Rn and ^{226}Ra activities. Based on the nonlinear relationships between $\delta^{18}\text{O}/\delta\text{D}$ and radium activity ratios, the deeper groundwater inputs are not near the most degraded coral reefs. The highest nitrate concentrations were found near reefs and in areas where the deep groundwater input indicators had the lowest presence. Ammonium was mostly associated with higher activities of ^{226}Ra and more depleted $\delta^{18}\text{O}/\delta\text{D}$ and mostly at distance from the reefs. Further analyses are conducted to constrain other types of nutrients and their association with the coral reefs or nearshore inputs.

MENTOR

Dorina Murgulet, Ph.D.

Daz Kousic, Ph.D. & Cody Lopez

DEPARTMENT OF PHYSICAL AND ENVIRONMENTAL SCIENCES

INTRODUCTION

The Yucatan Peninsula terrain consists of highly permeable limestone, also known as a karst environment. Rainwater rapidly infiltrates through the ground into the aquifers resulting in the absence of surface drainage and/or rivers (Carruthers et al., 2005). Karst aquifers provide drinking water, water needed for development, and are the only available source of water in some areas (Parise et al., 2018). However, because the karst aquifers recharge so quickly (through surface fractures, cenotes, and cave systems) the potential for groundwater contamination is high (see Fig. 1A, B). These karst aquifers exist both inland and in coastal areas. In coastal areas, groundwater and seawater interact via submarine groundwater discharge (SGD), driven by numerous factors (i.e., inland hydraulic gradient changes, seawater recirculation, etc.) (see Fig. 1C). The SGD enters offshore coastal waters as underwater springs through direct openings located on the seafloor or through diffused discharge through seabed sediments (Valle-Levinson et al., 2011). Because groundwater could be enriched in nutrients, when SGD enters coastal waters, it may introduce nutrients and anthropogenic contaminants, potentially impacting coastal marine environments. While some of these inputs could be beneficial, especially in nutrient-replete environments, studies

have also shown that depending on their timing, forms, and locations, some negative effects are occurring (i.e., triggers of harmful algae blooms). Thus, it is important to examine the extent and types of SGD and the associated nutrient inputs and composition.

Among the many marine environments that SGD is potentially positively or negatively impacting, are coral reef ecosystems. According to Rogger et al., SGD into coral reefs have only been quantified few times so information is limited (2021). However, numerous coral reefs are present along the Caribbean coast of Quintana Roo, Mexico with some of these reefs thriving (e.g., Limones) while others (e.g., Bonanza) are completely degraded (see Fig. 1D). Silbiger et al. (2020) indicate that the SGD input to corals reefs could be either beneficial or cause eutrophication depending on the environmental conditions. SGD entering the sea near coral reef environments is a significant contributor to the overall nutrient budget (Douglas et al., 2014). However, excess nutrient inputs to groundwater, even if they have occurred decades prior, can continue to enter the reef ecosystems for decades into the future (Douglas et al., 2014). A previous study by Hernández-Terrones et al. (2011) found the sewage systems in Puerto Morelos, Yucatan, to be inadequate for a karst environment given

the high levels of pollution in groundwater, mangroves, and beaches from these systems. Another study suggests that the southeastern Yucatan Peninsula may have higher SGD nutrient loading than observed in the north due to development (Kimberly et al., 2014). The extent of groundwater contribution found to occur in the area as advective flow via submarine springs or diffuse flow near the shoreline, could be an important indicator of the reef's current and future health. This study evaluated the groundwater inputs near a stretch of reefs along the Caribbean coast in October of 2018 using radon and radium isotopes combined with stable isotopes and nutrients.

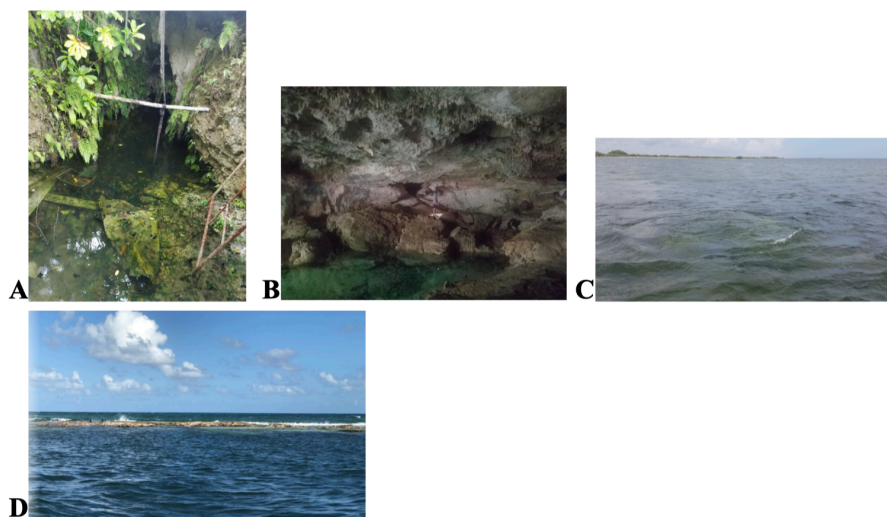


Figure 1: Cenotes (A); large, flooded cave in the study area (B); an ojo de agua (OdeA) (C); and the Bonanza dead reef (D).

METHODS

Radio isotopes

Radium isotopes (^{226}Ra , ^{223}Ra , and ^{224}Ra) were measured in seawater and groundwater samples. Samples were collected from inland springs called cenotes, lagoon inlet, along the shoreline, and from offshore springs in the coastal sea (see Fig. 2). The ^{226}Ra isotopes (long-lived) were measured using a RAD7 (DurrIDGE Inc.; portable monitor spectrometers) with the methods by Kim et al. (2001). The ^{223}Ra and ^{224}Ra isotopes were measured on the Radium Delayed Coincidence Counter (RaDeCC) (Moore and Arnold, 1996). All coastal/submarine spring water and other surface water/seawater radium samples were collected in 20L plastic carboys with total volumes ranging from ~20L (springs) to ~120L (seawater). For cenotes, given the expected enriched signature of radium, sample volumes ranged from 2 to 4 L. Uncertainties of Ra activity measurements were

estimated following Garcia-Solcon et al. (2008) and were determined to be <10%. Activity ratios were determined as the result of dividing the short-lived ^{224}Ra by the longer-lived ^{223}Ra activities and used to characterize the water sources. Radon (^{222}Rn) in groundwater from cenotes and coastal springs was measured with a RAD-7 detector fitted with a soda bottle accessory or a 250 mL bottle apparatus, depending on the sample volume. Radon was also measured continuously offshore from a boat using the RADAQUA system, where water is continuously pumped using a peristaltic pump, to the water-air exchanger and then measured by 3 RAD7's connected in-line (Dulaiova et al., 2005). The system takes approximately 30 minutes to equilibrate, after which time the RAD7's, which each have an integration time of 15 minutes, were started with their times offset by 5 minutes each so that each RAD7 would complete

a 15-minute measurement 5 minutes apart from each other. The boat travels in a fairly straight line and maintains a constant speed so that the samples are equidistant from each other (see Lopez et al., 2020).

Stable Isotopes

Stable isotopes of $\delta^{18}\text{O}$ and δD from water were measured to trace and constrain groundwater sources. Samples were filtered through $0.7\ \mu\text{m}$ GF/F in the field and analyzed using a Picarro L2120-I cavity ringdown spectrometer at the Texas A&M University, Stable Isotope Geoscience Facility. The isotope ratios were referenced to the international Vienna Standard Mean Oceanic Water (VSMOW) using internal reference standards (JGULF: 1.22‰ $\delta^{18}\text{O}$ and 5.8‰ δD and KONA: -6.86‰ $\delta^{18}\text{O}$ and -50.8‰ δD) and are reported using the delta (δ) notation in per mil (‰). Average internal precision was $\pm 0.12\text{‰}$ for $\delta^{18}\text{O}$ and $\pm 0.36\text{‰}$ for δD , and external precision (i.e., an internal standard with multiple aliquots measured throughout an analytical session) was $\pm 0.26\text{‰}$ for $\delta^{18}\text{O}$ and $\pm 1.1\text{‰}$ for δD .

Nutrients

Samples for nutrient analysis were collected in the field in acid washed bottles, kept in dark and cold temperatures until filtered in the lab with Whatman nuclepore track-etched hydrophilic polycarbonate membranes (nominal pore size $0.2\ \mu\text{m}$) and frozen until

analysis. Inorganic nutrients were determined from the filtrate using a Seal QuAAtro autoanalyzer. The method detection limit (MDL) was determined for each analyte and matrix by the EPA method detailed in 40 CFR Part 136, Appendix B (EPA, 2011), which is defined as the student's *t* for 99% confidence level, times the standard deviation (σ) of seven replicate measurements of the same low-level sample or spiked sample. The applicable concentration ranges of this method are defined by the concentration range of the calibration solution adjusted to the expected sample concentrations. Samples with concentrations exceeding the linear range (i.e., porewaters) were diluted and reanalyzed. The MDL (in μM) for the inorganic nutrients are: 0.11 for NO_3^- , 0.012 for NO_2^- , 0.057 for NH_4^+ , 0.025 for HPO_4^{2-} , and 0.14 for HSiO_3^- .

RESULTS AND DISCUSSION

The data collected was analyzed to show the relationship between spring/groundwater and seawater mixing by $\delta^{18}\text{O}$ and 226Ra. As seen in Fig. 3, the site XcaHa (cenote or groundwater endmember) resulted in the highest amount of 226Ra (5,000 dpmL⁻¹) and the most depleted in $\delta^{18}\text{O}$ (-8.5 ‰). The average 226Ra activity and $\delta^{18}\text{O}$ for all cenotes was 500 dpmL⁻¹ and -3.8 ‰, respectively. Coastal springs (e.g., NTSpring, Gorgos,

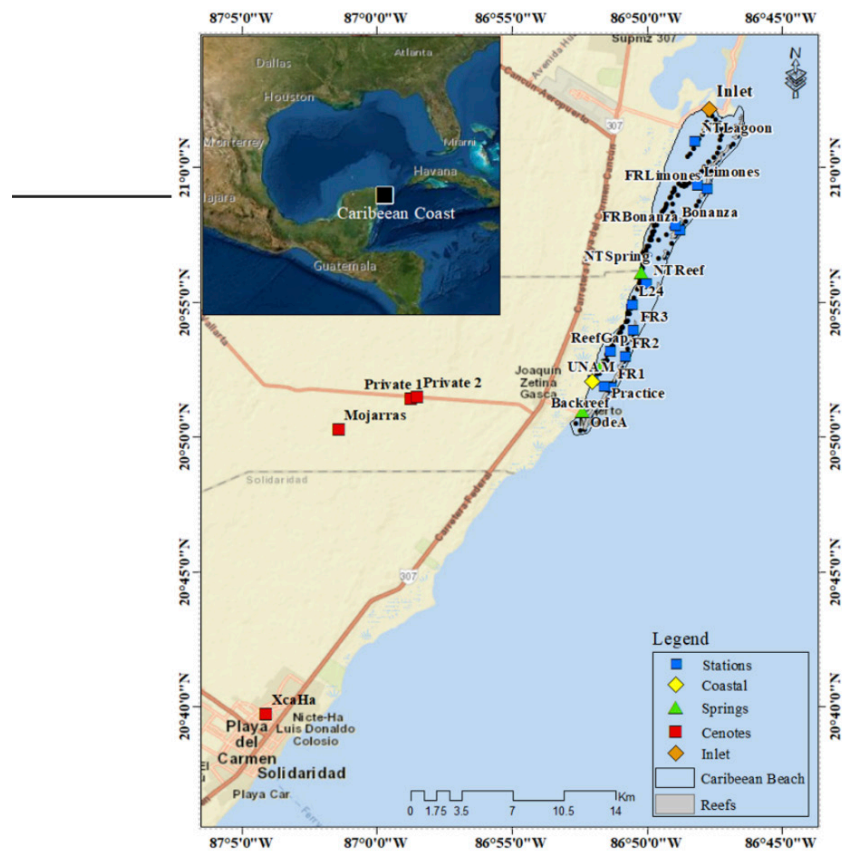


Figure 2. Aerial view of the study area- Caribbean coast, Mexico, and surface water and groundwater sampling locations.

etc.) clustered together as far as signatures, ranging from 2,000 to 500 dpmL⁻¹ for 226Ra and -1 to 1.5 ‰ for $\delta^{18}\text{O}$. Surface water samples collected away from identified springs (e.g., NTLagoon, Limones, NTReef, etc.) also clustered together based on the 226Ra activities ranging from 50 to 300 dpmL⁻¹ and $\delta^{18}\text{O}$ values between 0 and 2 ‰. The inlet to the lagoon and coastal samples are also within the surface water cluster with respective 226Ra and $\delta^{18}\text{O}$ levels of 250 dpmL⁻¹ and 0.85 ‰, respectively, and 200 dpmL⁻¹ and 1 ‰, respectively.

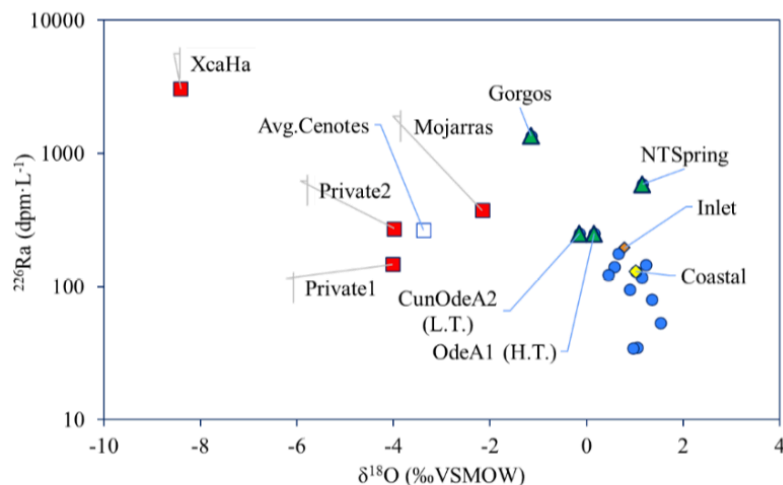


Figure 3: A comparison of $\delta^{18}\text{O}$ and ^{226}Ra shows the mixing between spring/groundwater and seawater.

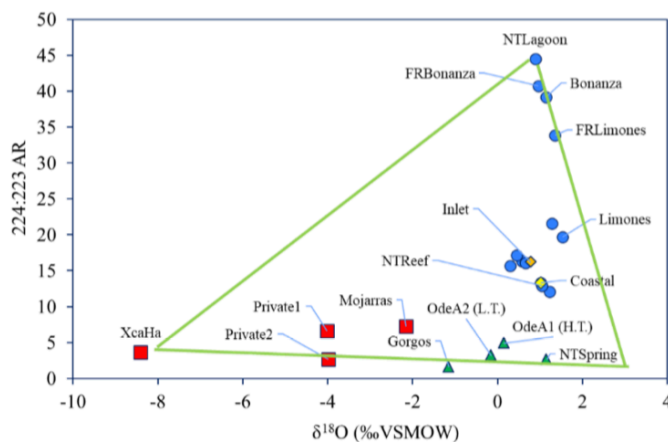


Figure 4: A comparison of $\delta^{18}\text{O}$ and 224:223 activity ratios (AR) as a mixing model, indicates a separation between recirculation versus terrestrial groundwater input to the sea.

As shown in Fig. 4, the cenotes clustered around lower levels of 224:223 AR and a range of $\delta^{18}\text{O}$ from -4 to -2‰ . The springs and cenotes displayed the most depleted AR values, while the $\delta^{18}\text{O}$ signatures spanned a wide range with the former on the more enriched end (-1 to 1‰). All other samples (e.g., seawater) had varying levels of 224:223 AR (10 to 45) while a relatively narrow range of $\delta^{18}\text{O}$ (0 to 2‰). Among these, the inlet and coastal sites had lower 224:223 AR (10 to 15 range) and closely overlapped with locations on the southern half of the study area, where smaller, but healthy, reefs are present.

Surface water (e.g. seawater endmember) had characteristically less NH_4^+ and lower ^{226}Ra compared to the other sites (as seen in figure 5). However, these sites showed high levels of $\delta^{18}\text{O}$ and 224:223 activity ratios (AR) (Fig. 4). The inlet and coastal samples had similar NH_4^+ (5 and 9 μM , respectively) and ^{226}Ra (250 and 150 dpmL^{-1}). The cenotes and springs had overlapping NH_4^+ concentrations for the most part (6 to 80 μM) but large discrepancies in ^{226}Ra (160 to 2,000 dpmL^{-1}). The XcaHa groundwater had the highest presence of NH_4^+ and ^{226}Ra (230 μM NH_4^+ and 3,500 dpmL^{-1} , respectively). In comparison to the activity ratios (AR), the XcaHa site was also an outlier showing the most depleted $\delta^{18}\text{O}$ to lowest AR levels.

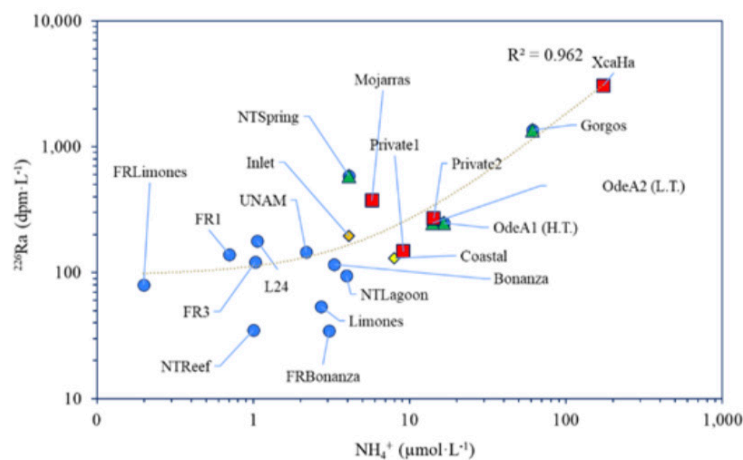


Figure 5: Comparison of ammonia (NH_4^+) and ^{226}Ra depicts a linear relationship between NH_4^+ and ^{226}Ra indicating that NH_4^+ is coming from terrestrial groundwater sources.

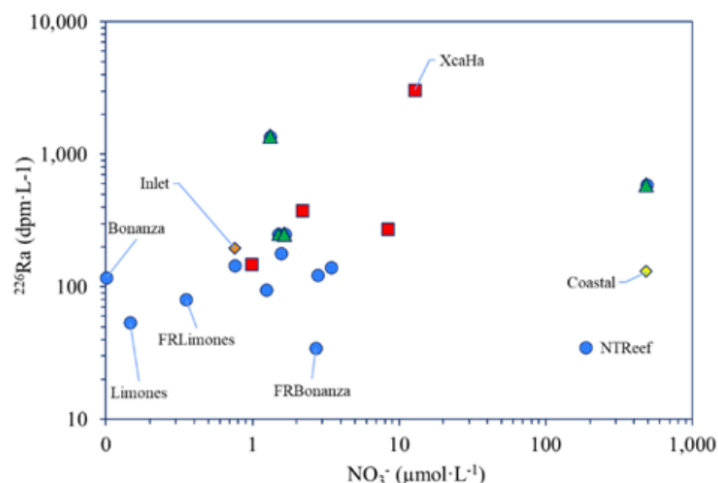


Figure 6: Comparison of NO_3^- and ^{226}Ra reveals seawater has low levels of NO_3^- especially in areas with low groundwater inputs (e.g., low ^{226}Ra and 224:223 AR)

An analysis of NO_3^- versus ^{226}Ra showed that most seawater has low levels of NO_3^- where groundwater inputs are lower or are of recirculated origin (Fig. 6). The exceptions are the seaward side of the Bonanza reef (FRBonanza), the coastal and one area next to reef midway in the study area (NTR Reef). Seawater concentrations of NO_3^- ranged from 0 to 200 μM and from 50 to 500 dpmL1 for ^{226}Ra levels with NTR Reef and coastal samples being the highest in NO_3^- (200 and 800 μM , respectively) while all other are at the lower end. The inlet and coastal sites averaged at about the same ^{226}Ra levels, however NO_3^- at the lagoon inlet (0.9 μM) was almost three orders of magnitude lower than the coastal sample, an indication that NO_3^- does not enter the lagoon via surface runoff and that sources among groundwater inputs are variable in concentrations. This is further supported by spring concentrations, which ranged from 2 to 800 μM for NO_3^- and 400 to 2,500 dpmL1 for ^{226}Ra . The sampled cenotes had much lower NO_3^- (1 to 10 μM) and ^{226}Ra (200 to 600 dpmL1), with the XcaHa being the highest in both (20 μM NO_3^- and 5,000 dpmL1 in ^{226}Ra).

The XcaHa cenote, recorded to be the highest in ^{226}Ra , had low HPO_4^{2-} (0.35 μM) and very similar to other cenotes (average of 0.42 μM) and seawater (average of 0.4 μM) with the exception of FRLimones, see Fig. 7. The springs were also low in HPO_4^{2-} (average 0.4 μM), with the exception of the Gorgos spring (1.2 μM), also the highest in ^{226}Ra among springs (2,000 dpmL1). Surface water samples ranged from 0.3 to 0.5 μM of HPO_4^{2-} . The comparison of HPO_4^{2-} and ^{226}Ra displayed no evident relationship with groundwater inputs. A few locations like the inlet and the seaward side of Limones reef (Inlet and FRLimones; Fig.7) and one spring (Gorgos) had higher HPO_4^{2-} and display an inverse relationship between HPO_4^{2-} and ^{226}Ra . The FRLimones station had the highest HPO_4^{2-} (1.8 μM) although ^{226}Ra similar to the average seawater samples. The coastal site had low levels of HPO_4^{2-} (0.6 μM) while the inlet was among the highest in concentration (1.7 μM). Since ^{226}Ra activities were among the more depleted at this location, it is believed that higher levels of HPO_4^{2-} supported by groundwater inputs. This is further supported by the lack of correlation between HPO_4^{2-} and ^{226}Ra for all other locations.

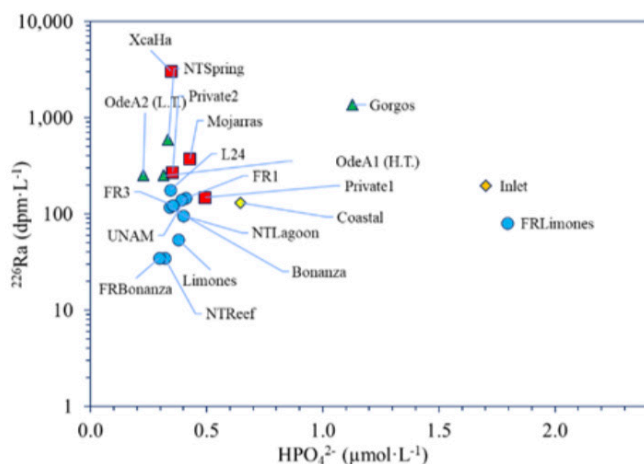


Figure 7: Comparison of HPO_4^{2-} and ^{226}Ra shows no relationship with groundwater inputs except for a few locations away from the only surface runoff inlet.

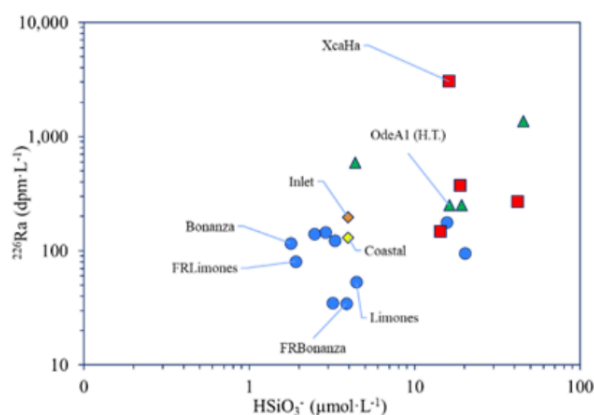


Figure 8: Concentrations of HSiO_3^- versus ^{226}Ra show a positive relationship with higher concentrations of HSiO_3^- in spring and cenotes waters with higher ^{226}Ra .

Seawater concentrations of HSiO_3^- ranged from 3 to 7 μM (with two sites having higher HSiO_3^- levels but average ^{226}Ra). The inlet and coastal locations had similar HSiO_3^- concentrations (6 μM) while the springs and cenotes ranged from 7.5 to 60 μM . The Xcaha cenotes, although it had the highest ^{226}Ra , was not the most concentrated in HSiO_3^- . The highest concentration was measured at one of the springs Gorgos and one other cenotes. Similar to NO_3^- and NH_4^+ , HSiO_3^- and ^{226}Ra levels showed a positive relationship, with higher HSiO_3^- concentrations at the springs and cenotes waters (Fig. 8). This shows that groundwater contributions to the reefs are occurring near the most significant springs and may be a significant contributor of HSiO_3^- . Based on the nutrient- ^{226}Ra relationship it is evident that NH_4^+ and HSiO_3^- μM are likely the major nutrient forms associated with groundwater inputs. In reference to NH_4^+ , the lower values measured at L24, FR1, FR2, and FR3 are located on the seaside of the reefs where groundwater inputs are expected to be diluted compared to the other locations closer to shore and in shallower waters. This supply of groundwater nitrogen is important because nitrogen is often the limiting nutrient in coastal waters.

Levels of ^{222}Rn along the coast (Fig. 9) are lower at the laguna inlet site and increase south along the coast until reaching NTSpring area (with small increases of ^{222}Rn at station sites before NTSpring station). This low level of ^{222}Rn includes the Limones and Bonanza reefs, south of the inlet. The highest level of ^{222}Rn was found at L24 station. The springs showed medium ^{222}Rn levels, with higher levels near the coast ^{222}Rn . The highest level of ^{222}Rn were in general measured near shore where the groundwater springs were found, and the lowest closer to the laguna inlet and the larger reef structures (Bonanza and Limones).

When combined with the radium isotopes (e.g., $\text{Ra } 224:223 \text{ AR}$), this study indicates that in the northern regions where the Limones and Bonanza reefs reside SGD may be of recirculated origin. One exception is the area in front of the Limones reef which is of lower Ra. On the other hand, the southern portion including the underwater springs is dominated by higher ^{226}Ra and lower $\text{Ra } 224:223 \text{ AR}$. This is also evidenced by the lower radon water inventories (Fig. 4, 9).

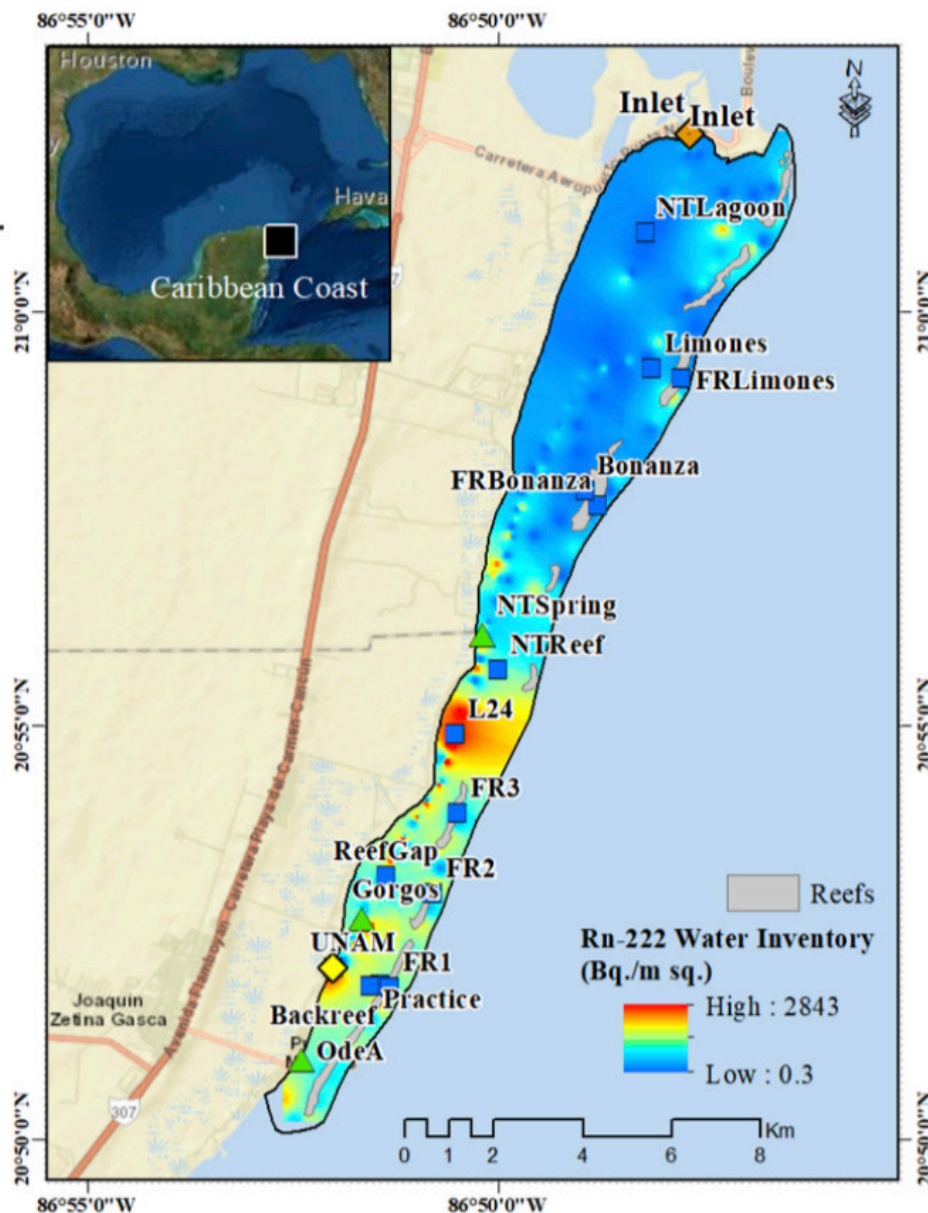


Figure 9: Aerial interpolation map of ^{222}Rn along the coast, showing low radon levels near the inlet area and both Limones and Bonanza reefs. Higher levels of ^{222}Rn were measured near shore where the groundwater springs were found.

CONCLUSION

This study evaluated the potential connection between groundwater inputs via SGD to the nearshore Caribbean Sea and the health of coral reefs. This snapshot of radiogenic and stable isotopes, together with nutrient analyses indicates that there may be two different sources of groundwater inputs to the nearshore Caribbean

Sea along the Quintana Roo coast. Each of these inputs seems to bring a distinct form of nutrient supply: (1) where terrestrial groundwater inputs dominate, as revealed by higher ^{222}Rn and lower $^{224}:^{223}\text{ARs}$, the nitrogen supply is greater and reefs are observed to be healthy; (2) where lower terrestrial groundwater inputs exist (towards the

lagoon inlet and close to the largest reefs (Limones and Bonanza), groundwater recirculation supplies lower amounts of nutrients. Thus, while excess nutrient supplies have been a cause of concern in many coastal areas, this study limited to one season (e.g., late summer) indicates that groundwater inputs may provide necessary nutrients

to coastal reefs. However, multi-season evaluations are necessary to constrain changes in SGD magnitudes and forms of nutrients delivered to the coast, as well as assessing potential transformations along groundwater flow paths.

ACKNOWLEDGEMENTS

The Center for Water Supply Studies at Texas A&M University-Corpus Christi supported this project through support for investigators Dr. Dorina Murgulet, Cody Lopez, and Dr. Das Kousik who were integral in designing the research plan and data analyses and interpretation. I would also like to thank graduate students Zoe Ruben and Joseph Stearns who were an important part of the field sampling and processing of radioisotope samples. The Mexico Center for Research and Advanced Studies of the National Polytechnic Institute (CINVESTAV) team of students and the McNair Scholar Program are also to thank for their assistance in this study. This study was partially supported by the project CINVESTAV project: “Ciencia Básica SEP-CONACYT: Interacciones entre procesos físicos en lagunas arrecifales con aportes submarinos de acuífero”, award number CB-2014-01-0000242038.

REFERENCES

- Carruthers, T. J. B., van Tussenbroek, B. I., & Dennison, W. C. (2005). Influence of Submarine Springs and wastewater on nutrient dynamics of Caribbean seagrass meadows. *Estuarine, Coastal and Shelf Science*, 64(2-3), 191–199. <https://doi.org/10.1016/j.ecss.2005.01.015>
- Douglas R. Tait, Dirk V. Erler, Isaac R. Santos, Tyler J. Cyronak, Uwe Morgenstern, Bradley D. Eyre. (2014). The influence of groundwater inputs and age on nutrient dynamics in a coral reef lagoon, *Marine Chemistry*, Volume 166, 2014, Pages 36-47, ISSN 0304-4203, <https://doi.org/10.1016/j.marchem.2014.08.004>.
- Dulaiova, H., Peterson, R., Burnett, W., Lane-Smith, D., 2005. A multi-detector continuous monitor for assessment of ^{222}Rn in the coastal ocean. *J. Radioanal. Nucl. Chem.* 263, 361–363.
- Hernández-Terrones, L., Rebolledo-Vieyra, M., Merino-Ibarra, M. et al. Groundwater Pollution in a Karstic Region (NE Yucatan): Baseline Nutrient Content and Flux to Coastal Ecosystems. *Water Air Soil Pollut* 218, 517–528 (2011). <https://doi.org/10.1007/s11270-010-0664-x>
- Kim, G., Burnett, W. C., Dulaiova, H., Swarzenski, P. W., & Moore, W. S. (2001). Measurement of ^{224}Ra and ^{226}Ra Activities in Natural Waters Using a Radon-in-Air Monitor. *Environmental Science & Technology*, 35(23), 4680-4683. doi:10.1021/es010804u
- Kimberly A. Null, Karen L. Knee, Elizabeth D. Crook, Nicholas R. de Sieyes, Mario Rebolledo-Vieyra, Laura Hernández-Terrones, Adina Paytan. (2014). Composition and fluxes of submarine groundwater along the Caribbean coast of the Yucatan Peninsula, *Continental Shelf Research*, Volume 77, 2014, Pages 38-50, ISSN 0278-4343, <https://doi.org/10.1016/j.csr.2014.01.011>.
- Lopez, C. V., Murgulet, D., & Santos, I. R. (2020). Radioactive and stable isotope measurements

reveal saline submarine groundwater discharge in a semiarid estuary. *Journal of Hydrology*, 590, 125395.

Null, K. A., Knee, K. L., Crook, E. D., de Sieyes, N. R., Rebolledo-Vieyra, M., Hernández-Terrones, L., & Paytan, A. (2014). Composition and fluxes of submarine groundwater along the Caribbean coast of the Yucatan Peninsula. *Continental Shelf Research*, 77, 38–50. doi:10.1016/j.csr.2014.01.011

Moore, W. S., & Arnold, R. (1996). Measurement of ²²³Ra and ²²⁴Ra in coastal waters using a delayed coincidence counter. *Journal of Geophysical Research: Oceans*, 101(C1), 1321–1329.

Parise M, Gabrovsek F, Kaufmann G, Ravbar N. 2018. Recent advances in karst research: from theory to fieldwork and applications. *Geological Society, London, Special Publications* 466, SP466. 426.

Peterson, R. N., Burnett, W. C., Taniguchi, M., Chen, J., Santos, I. R., & Ishitobi, T. (2008). Radon and radium isotope assessment of submarine groundwater discharge in the Yellow River delta, China. *Journal of Geophysical Research*, 113(C9). doi:10.1029/2008jc004776

Rogger E. Correa, M. Bayani Cardenas, Raymond S. Rodolfo, Mark R. Lopus, Kay L. Davis, Anna B. Giles, Jose C. Fullon, Mithra-Christin Hajati, Nils Moosdorf, Christian J. Sanders, and Isaac R. Santos. (2021). *ACS ES&T Water* 2021 1 (8), 1756-1764 DOI: 10.1021/acsestwater.1c00104

Silbiger, N. J., Donahue, M. J., & Lubarsky, K. (2020). Submarine groundwater discharge alters coral reef ecosystem metabolism. *Proceedings of the Royal Society B: Biological Sciences*, 287(1941), 20202743. <https://doi.org/10.1098/rspb.2020.2743>

Valle-Levinson A, Marino-Tapia I, Enriquez C,

Waterhouse AF. 2011. Tidal variability of salinity and velocity fields related to intense point-source submarine groundwater discharges into the coastal ocean. *Limnology and Oceanography* 56(4), 1213–1224.



Implicit Beliefs about Work as Predictors of Social Comparison and Work Satisfaction

By: Nasya Melendez

Abstract

In the workplace, some people believe that they can do well at just about anything if they put forth the effort needed to master job tasks. Others may believe that there are some jobs they can be good at and other jobs that just simply will never be good at. Such implicit beliefs (or mindsets) about work may affect how people approach work and influence the amount of work satisfaction they experience. As such, knowledge of a person's mindsets could serve as a significant predictor of worker

satisfaction. In the present study, we attempted to measure participants' patterns of implicit beliefs about work and explore the relationships such patterns have with social comparison and work satisfaction. Participants ($N = 200$) completed an online survey containing measures of implicit beliefs about work (Burnett & Polland et al., 2013), satisfaction (Ironson et al., 1989), and items designed to measure participant's use of upward and downward comparisons. It was predicted that participants holding more malleable beliefs about work

would be more likely to report using more upward social comparison and show higher levels of work satisfaction. On the other hand, participants holding more fixed belief patterns about work would be more likely to report using more downward comparison and show lower levels of satisfaction. Malleable beliefs (or growth beliefs) were found to be positively related to job satisfaction and overall social comparison. Fixed beliefs, however, were not found to be related to social comparison or satisfaction. Interestingly, job satisfaction was found to be related to lower use of upward comparison when experiencing success or failure.

Keywords: implicit beliefs, work satisfaction, social comparison, motivation

MENTOR

Steven Seidel, Ph.D.

DEPARTMENT OF PSYCHOLOGY

Implicit Beliefs about Work as Predictors of Social Comparison and Work Satisfaction

Implicit belief theory has its origin in the work of Carol Dweck (Dweck & Leggett, 1988; Elliot & Dweck, 1988) who explored the impact of children's beliefs about math on their reactions to failure feedback. Implicit belief theory suggests that people who hold malleable beliefs respond more favorably to failure feedback than those holding more fixed beliefs. Those holding malleable beliefs view failure feedback as a sign that they are not trying hard enough and respond by increasing effort. Those holding fixed beliefs view failure feedback as an indicator of their fixed abilities and are more likely to resign from effort. In the workplace, employees likely hold similar sets of implicit beliefs about work. Some may take the view that they can do anything as long as they work hard enough (malleable/growth beliefs). Others, on the other hand, may hold beliefs that are fixed and believe that they can be good at some things and not good at others and there is no amount of effort that will change this. Thus, it seems reasonable that those holding more malleable beliefs about work should be more satisfied since they appear to adopt more adaptive strategies in the face of failure. The present

study explored the relationship between implicit beliefs about work, social comparison, and work satisfaction. More specifically, we hope to shed light on whether fixed implicit belief patterns are related to a tendency to downward social comparisons and whether the combination of fixed beliefs and downward comparison may be symptomatic of lower job satisfaction. In contrast, we also wondered whether people who adopt more malleable beliefs about work engage in more upward comparison and experience a higher level of work satisfaction.

Implicit Beliefs in the Workplace

Dweck referred to people's implicit sets of beliefs as "mindsets." Besides Dweck's early work exploring implicit beliefs about intelligence (see Dweck & Leggett, 1988, for example), implicit belief theory has been expanded to other domains such as relationships (Knee, Patrick, & Lonsbary (2003), emotion (Tamir et al., 2007), and work satisfaction (Polland, & Burnette, 2013). Results of such studies have generally concluded that malleable mindsets are more advantageous compared to fixed mindsets. For instance, malleable/growth mindsets have been found to be associated with better mental and physical health, whereas fixed/destiny mindsets have been found to be associated with poorer mental

and physical health in the United States and Korea (Lee, Lou, Johnson, & Park, 2019). Burnette and Polland (2013) argued that people hold varying beliefs about the meaning of work that can be classified into destiny (fixed) beliefs (the belief that you are destined for a specific career and not others) and growth (malleable) beliefs (the belief you can excel at any career as long as you try hard enough). Consistent with their expectations, Burnette and Polland found that growth beliefs predicted greater job and life satisfaction. We attempted to expand on this idea by exploring people's implicit beliefs about work and their relationships with work satisfaction and the tendency to make either upward or downward social comparisons. We reasoned that those that doubt their ability to improve their skills as an employee (destiny beliefs about work) may be more likely to make comparisons with employees that are less skilled than themselves (downward comparison). Likewise, we reasoned that participants who have the confidence in their ability to improve their skills as an employee (growth beliefs) may be more likely to make comparisons with employees that are more skilled than themselves.

Social Comparison Theory

Festinger (1954) is credited with developing social comparison theory which holds that

people have an innate drive to discover accurate evaluations of themselves. In order to obtain accurate information about themselves, the theory holds the people engage in comparing themselves to others. The theory was later expanded to focus on explaining why people sometimes compare downward or upward. People generally are more likely to compare downward when they do not feel competent and want to feel better about themselves (Gruder, 1971; Wills, 1981). On the other hand, comparing upward (comparing oneself to someone who is better off) can make people feel worse (Tesser, Millar, & Moore, 1988). Collins (1995) suggests, however, that comparing upward can be used by people in an attempt to engage in self-improvement. Regardless of whether people engage in upward or downward comparison, the theory of Social Comparison suggests that people are driven to evaluate their own performance and compare it to that of their peers and others to help obtain information about oneself (Festinger 1954). When looking at the theory of Social Comparison and the connection it has between worker satisfaction and social comparison in a workplace or organizational environment, whether a person's performance is seen as "worse than average" or "better than average" depends on the context of the comparison (Moore, 2007). Despite how good a person's

performance is, they may feel disappointed in themselves if they compare upward. In the same way, if an individual performs poorly, they can come to feel better about their performance if they compare downward. Greenberg, Ashton-James, and Ashkanasy (2007) and Mussweiler and Strack (2000) suggest that there is an increased chance of "deflection" whenever an individual feels poorly about their performance. Deflection refers to an act in which one compares downward following a poor performance to disassociate themselves with poor performance. Deflection would likely result in people taking less responsibility for their performance and resist making attempts to improve (see Greenberg, Ashton-James, and Ashkanasy, 2007). This behavior is not uncommon and is more commonly found within groups of individuals who possess a higher self-esteem due to their increased personal investment in their work performance.

Implicit Beliefs and Social Comparison

So how might social comparison be related to implicit beliefs about work? People who hold fixed beliefs are less likely to engage in attempts to improve upon their ability (Dweck and Legget, 1988). We suggest that one explanation for this is that holding fixed beliefs about work is that such people may be more likely to compare downward which would reduce the need

to engage in self-improvement since "deflection" is a process designed to make one satisfied with current performance, regardless of whether the performance itself is above or below average. People holding malleable beliefs (or growth beliefs), on the other hand, are more motivated to engage in behavior that improves their abilities (Dweck and Legget, 1988). It seems reasonable that such people would be more likely to compare upward which may highlight differences between their performance and some ideal and lead to behavior aimed at improving one's abilities. This idea is consistent with self-awareness theory (Duval and Wicklund, 1972; Carver and Scheier, 1981). The impact of implicit beliefs on work satisfaction is a bit more difficult to comprehend. While research by Burnette and Polland (2013) suggests that those holding more growth minded beliefs will experience higher satisfaction, it is very possible for those holding fixed beliefs to experience satisfaction by comparing downward. Given that Burnette and Polland (2013) did not find that satisfaction was significantly related to people's level of fixed beliefs, we will not predict that such a relationship will exist. Consistent with their work, however, we will predict that satisfaction will be higher for those holding malleable/growth beliefs about their work. The purpose of the present study was to explore whether

mindsets serve as a predictor of job satisfaction and social comparison style. It was predicted that people holding fixed belief systems are more likely to engage in downward social comparison. In addition, it was expected that downward social comparison and fixed belief systems would be associated with lower work satisfaction. Malleable beliefs systems, on the other hand, were predicted to be positively related to higher work satisfaction. Further, it was expected that people who adopt more malleable mindsets would be less likely to rely on social comparison when making self-assessments. As such, this project sheds light on whether implicit belief patterns are related to the types of social comparison people make, which may, in turn, moderate the amount of work satisfaction a person may experience.

Methods

Participants

Half male (N=100) and half female (N=100) participants were recruited using Prolific. The age range was from 20 to 75 ($M = 35.83$, $SD = 9.957$). Participants were mostly White (68.5%), with a wide range of ethnicities making up the remainder of the sample (Asian or Pacific Islander (9.0%), Multiracial or Biracial (7.5%), Hispanic or Latino (7.0%), Black or African American (7.0%), and Native American or Alaskan Native

(1.0%)).

Measures

Implicit Theory of Work Scale (Burnette & Polland, 2013)

The implicit theory of work scale consists of 6 items that are designed to assess destiny beliefs and 6 items that are designed to measure growth beliefs. The measure uses a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). It is important to note that the measure is a self-report measure of implicit theory and not itself an implicit measure. The measure was developed using Knee's (1998) implicit theory of relationships measure. As a result, the measure assesses two orthogonal constructs (destiny/fixed beliefs and growth/malleable beliefs). Previous research has found that both destiny ($\alpha = .87$) and growth ($\alpha = .87$) scales to have good internal consistency reliability (Burnette & Polland, 2013).

The Job in General Scale (Ironson, et al., 1989)

The Job in General Scale was designed to measure job satisfaction consisting of 18 adjectives (pleasant, bad, ideal, etc.) that are rated on a 1 (strongly disagree) to 7 (strongly agree) scale. It is a global measure of satisfaction that has been shown to have high internal consistency reliability ($\alpha = .91$) and good convergent and discriminant validity. The Iowa–Netherlands Comparison Orientation Measure (INCOM) (Gibbons

and Buunk, 1999)

The Iowa–Netherlands Comparison Orientation

Measure consists of 11 items designed to measure comparisons of ability and comparisons of opinions. Each item presents a statement followed by a 1 (strongly disagree) to 5 (strongly agree) scale. The instrument has been tested in both the United States and the Netherlands and has been shown to have good reliability and validity.

Upward and Downward Comparison

In order to measure upward and downward comparisons, 4 items were added to the survey in which participants would indicate their level of agreement using a 1 (strongly disagree) to 5 (strongly agree) scale. These items were worded to assess what participants were most likely to make upward comparisons (or downward comparisons) when they felt that they had succeeded (or failed).

Procedures

Participants were paid \$1.25 to complete an online survey through a crowd sourcing platform used for collecting data (Prolific.co). The online survey contained measures discussed previous with a few demographic items including ethnicity and age.

Results

The scales used for the study were all found to have good reliability (Growth Beliefs about work, $\alpha = .785$; Destiny

Beliefs about work, $\alpha = .869$; Satisfaction, $\alpha = .977$; Social Comparison, $\alpha = .829$). To examine how work mindsets related to satisfaction and comparison, the bivariate correlations between the major variables were examined. As can be seen in Table 1, malleable beliefs were negatively correlated with fixed beliefs, $r(n = 200) = -.159, p < .05$. Growth beliefs, as expected were positively related to job satisfaction ($r(n = 200) = .306, p < .01$) and overall social comparison $r(n = 200) = .146, p < .05$. Fixed beliefs, however failed to correlate with any criteria measured in the study. Implicit beliefs did not appear, however, to correlate with any of the directional comparison items used. Interestingly though, lower job satisfaction was found to be related to using upward comparison when one failed ($r(n = 200) = -.194, p < .05$) or succeeded ($r(n = 200) = -.173, p < .05$). Participants use of upward or downward comparison did not appear to be affected by whether they experienced success or failure indicated by positive correlations between the 2 upward comparison measures for success and failure ($r(n = 200) = .619, p < .001$) and the downward comparison measures for success and failure ($r(n = 200) = .606, p < .001$).

Table 1. Pearson Correlations between Target Variables

	Mean & (SD)	1	2	3	4	5	6	7	8
1. Malleable Beliefs	5.25 (.81)	-							
2. Fixed Beliefs	3.08 (1.15)	-.159*	-						
3. Job Satisfaction	4.95 (1.39)	.306**	-0.133	-					
4. Social Comparison	3.650 (.77)	.146**	-0.094	-1.22	-				
5. Upward Comparison (Success)	2.79 (1.22)	-0.063	-0.057	-.173*	.492**	-			
6. Upward Comparison (Failure)	3.05 (1.31)	-0.025	-0.036	-.194*	-.580**	.619**	-		
7. Downward Comparison (Success)	2.37 (1.18)	0.015	0.094	-0.062	.236**	.532**	.311**	-	
8. Downward Comparison (Failure)	2.61 (1.17)	0.078	0.042	-0.121	.346**	.434**	.351**	.606**	-

*Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level

Discussion

It was predicted that people that hold more fixed beliefs about work would be more likely to engage in downward comparison and experience greater dissatisfaction, regardless of whether they imagined experiencing success or failure. The results of the present study failed to support this hypothesis. Indeed, participants indicating more fixed beliefs about work did not appear to be related to the satisfaction they experienced or tendency to engage in downward comparison. It may be the case that people holding more fixed beliefs about work have multiple ways of preserving the feelings of competence besides engaging in downward comparison. Of course, since our study required participants to imagine scenarios where they experienced failure

or success, results may have been different should we have been able to manipulate success and failure on some tasks. Future studies should consider manipulating true failure and success to confirm the results we obtained. It was predicted that downward social comparison would be associated with lower work satisfaction. The results of the present study failed to support this hypothesis. Downward social comparison was not found to be correlated with job satisfaction or any type of implicit belief. This suggests that the use of downward social comparison may not a reliable predictor of job satisfaction. It may be the case that although people make downward comparisons to perhaps feel better about themselves, their self-preservation does not spill

over into their assessment of their ability or evaluation of their work. Perhaps adding a measure of self-esteem would have been helpful in the present study to confirm that downward comparison was associated with increased esteem levels. Given the self-esteem is known as a very good measure of relationship satisfaction (Leary, 2012), it seems unlikely that work satisfaction would not have been affected by participants engagement in downward comparison. It was predicted that participants' level of malleable beliefs would be positively related to job satisfaction and greater upward social comparison. The results of the present study are partially supportive of this prediction. Levels of malleable beliefs were found to be strongly correlated with work satisfaction. Although malleable beliefs were not found to be correlated with upward comparison, they were found to be related to greater social comparison in general. This may indicate that people who hold malleable beliefs devote more cognitive energy to self-evaluation. Perhaps comparing both upwardly and downwardly in a question for accuracy in self-evaluation. Limitations to this research include using imagined scenarios in the context of survey research. While survey response is generally an effective first step in investigating a phenomenon,

the true test of the effect of a concept is being able to manipulate it. In the context of the topic studied here, future studies might concentrate on attempting to manipulate "growth" beliefs of employees and measuring the effect of such a manipulation on participants satisfaction and performance. Such information would likely be more useful and demonstrate the valuable impact that increasing understanding of implicit theories of work may have on people's lives and work success. Workers spend much of their time engaged in continual assessment of their employment, often changing vocations in an attempt find more meaningful work. Applications of implicit belief theory to the world of work may have implications for work satisfaction, turnover, productivity, and more. The results of the present study add to the understanding of how people's mindsets may impact their levels of career success. It is hoped that this line of research will grow in time and be able to positively impact people's happiness in their work and lives in general.

References

- Burnette, J. L., & Polland, J. M. (2013). Implicit theories of work and job fit: Implications for job and life satisfaction. *Basic and Applied Social Psychology*, 35(4), 360–372. <https://doi.org/10.1080/01973533.2013.803964>
- Carver, C. S. & Scheier (1981). The self-attention-induced feedback loop and social facilitation. *Journal of Experimental Social Psychology*, 17 (6): 545-568.
- Collins, R. L. (1995). For better or worse: The impact of upward social comparison on self-evaluations". *Psychological Bulletin*. 119 (1): 51–69. doi:10.1037/0033-2909.119.1.51
- Duval, S. & Wicklund, R. (1972). *A Theory of Objective Self-awareness*. Oxford Press.
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, 95(2), 256–273. <https://doi.org/10.1037/0033-295X.95.2.256>
- Elliott, E. S., & Dweck, C. S. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology*, 54(1), 5–12. <https://doi.org/10.1037/0022-3514.54.1.5>
- Festinger L. A theory of social comparison processes. *Human Relations*. 1954;7(2):117-140. doi:10.1177/001872675400700202
- Gibbons, F. X., & Buunk, B. P. (1999). Individual differences in social comparison: Development of a scale of social comparison orientation. *Journal of Personality and Social Psychology*, 76(1), 129–142
- Greenberg, J., Ashton-James, C. E., & Ashkanasy, N. M. (2007). Social comparison processes in organizations. *Organizational Behavior and Human Decision Processes*, 102(1), 22– 41. <https://doi.org/10.1016/j.obhdp.2006.09.006>
- Gruder C. L. (1971). Determinants of social comparison choices. *Journal of Experimental Social Psychology*. 7 (5): 473–489. doi:10.1016/0022-1031(71)90010-2
- Ironson, G. H., Smith, P. C., Brannick, M. T., Gibson, W. M., & Paul, K. B. (1989). Construction of a job in general scale: A comparison of global, composite, and specific measures. *Journal of Applied Psychology*, 74(2), 193-200. <https://doi.org/10.1037/0021-9010.74.2.193>
- Knee, C. R. (1998). Implicit theories of relationships: Assessment and prediction of romantic relationship initiation, coping, and longevity. *Journal of Personality and Social Psychology*, 74(2), 360–370. <https://doi.org/10.1037/0022-3514.74.2.360>
- Knee, C. R., Patrick, H., & Lonsbary, C. (2003). Implicit theories of relationships: Orientations toward evaluation and cultivation. *Personality and Social Psychology Review*, 7(1), 41-55. https://doi.org/10.1207/S15327957PSPR0701_3
- Leary, M. R. (2012). Sociometer Theory. In P. Van Lange, A. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (Vol. 2, pp. 151-159). Thousand Oaks, CA: Sage.
- Lee, H., Lou, N. M., Johnson, M. D., & Park, S. W. (2019). A socioecological perspective to understanding mental and physical health: The mediating role of relationship mindsets and goals. *Journal of Social and Personal Relationships*, 36(10), 3117–3138. <https://doi.org/10.1177/0265407518814371>
- Moore, D. A. (2007). Not so above average after all: When people believe they are worse than average and its implications for theories of bias in social comparison. *Organizational Behavior and Human Decision Processes*, 102(1), 42-58. <https://doi.org/10.1016/j.obhdp.2006.09.005>
- Mussweiler, T., & Strack, F. (2000). The relative self: Informational and judgmental consequences of comparative self-evaluation. *Journal of*

Personality and Social Psychology, 79(1), 23- 38.
<https://doi.org/10.1037/0022-3514.79.1.23>

Mussweiler, T., Gabriel, S., & Bodenhausen, G. V. (2000). Shifting social identities as a strategy for deflecting threatening social comparisons. *Journal of Personality and Social Psychology*, 79(3), 398-409.

Tamir, M., John, O. P., Srivastava, S., & Gross, J. J. (2007). Implicit theories of emotion: affective and social outcomes across a major life transition. *Journal of personality and social psychology*, 92(4), 731–744. <https://doi.org/10.1037/0022-3514.92.4.731>

Tesser, A.; Millar, M.; Moore, J. (1988). Some affective consequences of social comparison and reflection processes: the pain and pleasure of being close. *Journal of Personality and Social Psychology*. 54 (1): 49–61. doi:10.1037/0022-3514.54.1.49. PMID 3346807

Wills T. A. (1981). Downward comparison principles in social psychology. *Psychological Bulletin*. 90 (2): 245–271. doi:10.1037/0033-2909.90.2.245



The Price of Negligence: How YouTube's Algorithms Affect Users' Awareness of Current Events & Social Justice Issues

By: Brian Owens

Introduction

Having seen multiple socio-informational trends appear and disappear since 2000, there have been incredible changes in data transmission and media. Particularly, the frequency of data distribution and reception on social media has skyrocketed. According to Dr. Esteban Ortiz-Ospina, an economist at the University of Oxford, the total number of Facebook users has risen from 100 million in 2008, to 2.26 billion in 2018 (Ortiz-Ospina, 2019). Facebook usage has increased twentyfold in the

past 10 years. The same can be said for other platforms, such as YouTube. Due to this change, citizens across the world have the power to voice their opinions and express themselves. Although this expansion of free speech connects people and nations, the covert impact of social media algorithms grows every day. But what are algorithms? And what are they responsible for? Algorithms are “the building blocks for programming, and they allow things like computers, smartphones, and websites to function and make decisions”

(GCF Global, 2022).

Algorithms are responsible for Google search results, YouTube suggestions, and Tik-Tok For-You pages. They manage the data most people consume daily, which is why algorithmic awareness and equity are gradually becoming a greater issue.

Safiya Umoja Noble, a scholar of critical internet inquiry and the author of *Algorithms of Oppression*, supports this claim. According to Safiya, “on the Internet and in our everyday uses of technology, discrimination is...embedded in computer code and, increasingly, in artificial intelligence technologies that we are reliant on” (Noble, 2018). Now, more than ever, it is important to question algorithmic bias. There has been brilliant research done in relation to data, algorithms, and ethics.

MENTOR

Sarah Salter, Ph.D.

DEPARTMENT OF ENGLISH

Few have directly explored the objective state of social media algorithms in relation to awareness of current events and social justice issues. Thus, I sought to fill this niche for the benefit of algorithmic study. I expected to discover that social media algorithms encourage blind spots surrounding pressing contemporary phenomena and conflict. In doing so, I hoped to inspire change in commercial and social media algorithms while also promoting a societal shift to inquisition and curiosity. As such, this study indicates how users may better interact with social media algorithms, to prevent the effects of algorithmic bias on their awareness of current events and social justice issues. Since it is not feasible to obtain the internal black-box algorithms used to generate social media content, I felt it was best to conduct an external study of a designated social media platform. I felt YouTube was the best for the study, as it emphasizes users' watch history and content interactions. This then led me to the question, "How do YouTube's algorithms contribute to users' knowledge of current events and social justice issues?" Thus, this study aims to evaluate the effects that social media algorithms have on the general awareness of current events and social justice issues. More specifically, it will answer the question, "How YouTube's Algorithms Affect Users' Awareness of Current Events

& Social Justice Issues?" Hopefully, the results will inspire inquiry and curiosity among social media users.

Review of Literature

In the 21st Century, few things compare to the enormity of the Internet. Today's Internet is far different from its origin. The Internet initially began as a private communication system resistant to nuclear attack during the Cold War era (National Science and Media Museum, 2020). Only with time and development was it able to expand into the vast data communication system it is today. The world now relies on the Internet for: art, music, health, travel, education, film, and so much more. With this new dependency on digital information, it's easy to imagine how algorithmic bias can be dangerous to the integrity of data. The following literature examines algorithmic bias and its related subjects.

"Mind the Gaps: Controversies About Algorithms, Learning and Trendy Knowledge", a study by Gerald Argenton, a professor of philosophy, evaluates the influence of digital algorithms on knowledge. By explaining algorithmic objectivity and societal trust in algorithms, he indicates the newfound battle between trendy data and relevant data. Due to society's emphasis on trendy data, Gerald argues that algorithms should favor relevancy over popularity. This article perfectly analyzes

the ethical impact of algorithmic bias and could provide a basis for ethical reference (Argenton, 2017).

A similar article, "The Algorithmic Imaginary: Exploring the Ordinary Effects of Facebook Algorithms", opts to investigate the social power of algorithms. In the article, Taina Bucher, a media researcher and associate professor at the University of Oslo, begins by highlighting a study of general algorithmic awareness. The study found that 62.5% of the 40 participants were not aware of Facebook's algorithmic curation, suggesting that some users are misled to believe they are receiving objective data (Bucher, 2016). Bucher continues by evaluating situations in which algorithms have deceived and violated the privacy of users. The article provides a full study of social media algorithms' power over the public. A following study from a direct, user, perspective may serve to amplify their thesis.

Three years following, Bucher contributed to related research by Anne-Britt Gran, the director of the "Centre for Creative Industries at BI Norwegian Business School", alongside Peter Booth, a postdoctoral fellow at the same school. The article, To Be or Not to be Algorithm Aware: A Question of a New Digital Divide, begins by acknowledging the significance of algorithms and leads with the key statement: "Whether through search

engines, social media, or music streaming services, algorithms have become imperative to the internet's infrastructure" (Gran, Booth, & Bucher, 2020). This is followed by an analysis of Norway's probable digital division due to low algorithm awareness. Essentially, this article investigates Norway's user attitudes toward social media algorithms and implies similar conclusions may be drawn in other cyber-intensive nations. Thus, a study concerning the integrity of social media algorithms in the American sphere would prove useful.

Dissimilar to the aforementioned studies, "Manipulation by Algorithms: Exploring the Triangle of Unfair Commercial Practice, Data Protection, and Privacy Law", evaluates the commercial use of algorithms. Phillipp Hacker, a Yale law graduate and Chair for Law and Ethics of the Digital Society, introduces his thesis with the jarring claim that machine learning technology is now developed enough to read the mind by analyzing emotional reactions to digital content and media (Hacker, 2021). He then follows with an analysis of the justice and legality of corporate utilization of machine learning on digital consumers. After concluding that exploiting the human psyche is immoral, Hacker presents various solutions by advocating for withdrawal rights, fairness tools, and privacy norms.

Two years before Hacker's publication in 2021, Dr. Outi Lundahl, a marketing professor and scholar of algorithms, furthered Bucher's study of social power while introducing new concepts to algorithmic study (Henley Business School, n.d.). Lundahl begins, "Algorithmic Meta-Capital: Bourdieusian Analysis of Social Power Through Algorithms in Media Consumption", by acknowledging the amplification of hidden or black box algorithms in the digital world. She then introduces the idea that the popularity of digital media in the modern era has severely amplified the gravity of algorithms. After coupling this idea with the inevitability of algorithmic bias, the social and commercial power behind black box algorithms seems immense. In all, Lundahl combines preexisting concepts with modern context to conclude that algorithms are now a form of meta-capital, "which implies centralized power" (Lundahl, 2019). Using this concept in a research analysis could have a powerful result. Despite the stance of the aforementioned publications, algorithms are not evil, they are rather tools. Feyza Altunbay Ozbey and Bilal Alatas, software engineering professors at Firat University, accentuate a positive application for algorithms in their study, "Fake News Detection Within Online Social Media Using Supervised Artificial Intelligence

Algorithms". They begin by noting the recent upheaval of online news publications due to growing Internet accessibility and suggest that this accessibility has led to more data inaccuracy. However, the remainder of the study proposes an algorithmic approach to identifying inaccurate data on social media, which theoretically mitigates fake news on social media platforms. This study acknowledges a moment of algorithmic success and would beautifully contrast the primary narrative (Ozbay & Alatas, 2020).

Corresponding to the same idea, Kai Shu, a computer science professor at the Illinois Institute of Technology, directly vouches for algorithms used to detect fake news, hoaxes, and conspiracy theories. In "Combating Disinformation on Social Media: A Computational Perspective", Shu separates her study from Ozbey and Alabat's by recognizing the utility and pitfall of algorithms as part of the issue, despite being a possible solution. However, she primarily advocates for machine learning algorithms as a means of reducing fake news and conspiracies on social media. The proposed algorithm would single out visual and linguistic cues commonly found in fake news. One pitfall of this approach may be the lack of correlation to the accuracy of data. However, the study is a worthy defense against the use of algorithms in social media

(Shu, 2022).

Unconventional perspectives aside, Stefania Milan, a scholar of digital infrastructure at the University of Amsterdam and Harvard University, opted to investigate the effect of social media algorithms on collective identity. Her study, “When Algorithms Shape Collective Action: Social Media and the Dynamics of Cloud Protest”, begins with a vivid description of the Toronto Tent camp eviction on November 23rd, 2011. The description entails several bystanders who chose to share an incident of civil injustice on social media instead of taking action. This event proves the peculiar impact that social media can have on a population’s civil identity and purpose. Furthermore, she adds that social media algorithms may skew a narrative, then continues to prove how social media activism lacks political potency. Using this information, one may gather that social media suggests a false sense of identity. (Milan, 2022).

Central to the argument of the studies, *Algorithms of Oppression: How Search Engines Reinforce Racism*, by Safiya Noble, dives deep into the effects of digital algorithms on societal perception. Her book begins with a startling tale in which she Google searches the term “black girls” and receives incredibly vulgar suggestions. This alone indicates that algorithms have the potential to reinforce cultural negativity and

would make most question the reliability of search data. When you pair this idea with her later mentions of an increasingly digital society, the implications are horrific. In all, this book makes excellent contributions to algorithmic study, and the many concepts shared provide a worthy foundation for further research (Noble, 2018).

Although somewhat impartial to algorithmic study, “Justifications Shape Ethical Blind Spots”, by Andrea Pittarello and other professors of psychology and economics, is entirely relevant to the understanding of ethical intent. The bulk of the study revolves around the manner in which ambiguity shapes ethical blind spots. After conducting a series of quantitative experiments, the researchers have concluded that humans prioritize self-interest over ethical- righteousness. Using this research, it is possible to support the idea that commercial actors may incentivize profit over ethical righteousness. The same concept could apply to algorithms that profit from user attention (Pittarello, Leib, Gordon-Hecker & Shalvi 2015). In the same year, Oak Ritchie, a media and information science professional at the University of North Carolina at Chapel Hill, released a study analyzing the many ways algorithms affect users’ data reception. “Platform Algorithms and Their Effect on Civic and Political Arenas” begins with an introduction to the World Wide Web, then

delves into the premise of algorithms. Once the audience is familiar with the basis of the World Wide Web, he mentions more advanced concepts like filtering, the process in which algorithms select or deselect information to display to its users. With the additional explanations of algorithmic data selection throughout the paper, this study diligently analyzes the techniques algorithms use to manipulate user belief (Richtie, 2015).

Finally, *Using Social Media to Enhance Emergency Situation Awareness: Extended Abstract*, by Jie Yin and various other researchers at the Commonwealth Scientific and Industrial Research Organisation, examines the impact of algorithms on civil situational awareness in emergency situations. The study begins by identifying the informational overload within social media platforms such as Twitter, then offers data clustering as a primary solution. However, the key characteristic of the study isn’t the proposed resolution. More importantly, this concept proves that there are still grounds for the study, analysis, and optimization of social media algorithms (Yin, Karimi, & Lampert, 2015).

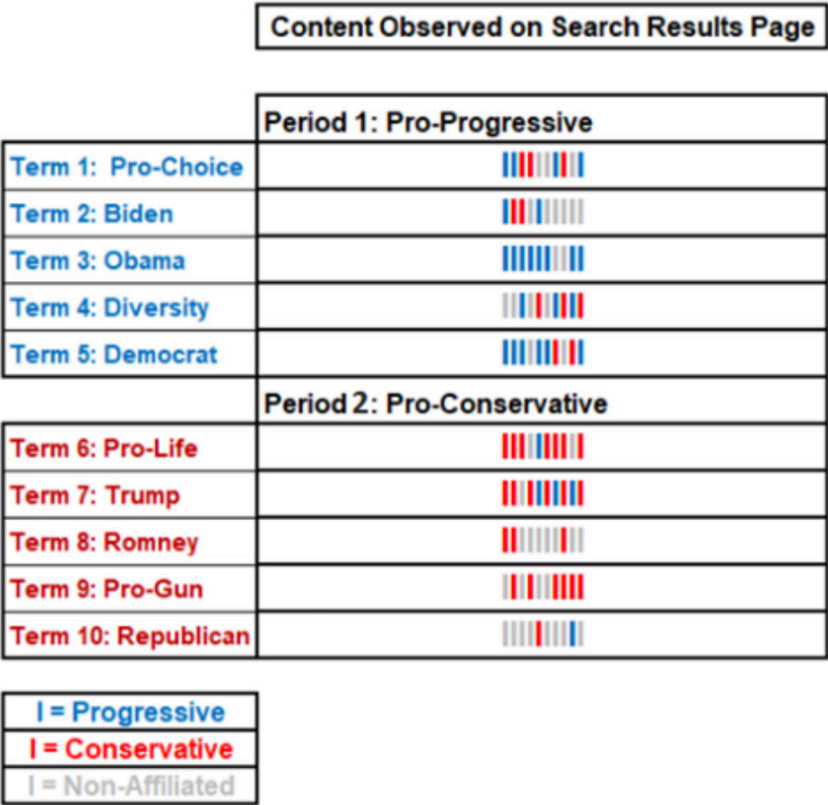
Methodology & Data Collection

Procedures











To conduct the study, I set out two periods where I would attempt to shift YouTube’s

homepage suggestions toward a designated political perspective and discover algorithmic bias. The designated perspective for the first period was progressivism, and the second was conservatism. I spent each period searching 5 terms. The five terms for the first period were: Pro-Choice, Biden, Obama, Diversity & Democrat. And the five terms for the second period were: Pro-Life, Trump, Romney, Pro-Gun & Republican. Within the first 10 results of each term searched, I liked the content that aligned with the designated perspective, disliked content that opposed the designated perspective, and ignored miscellaneous content. After doing so, I returned to the home page and interacted with the first 10 results on the home page. Within the first 10 suggestions on the home page, I liked the content that aligned with the designated perspective, disliked content that opposed the designated perspective, and ignored miscellaneous content. In doing so, I was able to quantify YouTube’s algorithmic suggestions after user interaction. I designed the first period to cater YouTube’s homepage suggestions toward a designated perspective and the second period to investigate whether this action could be reversed. The following chart demonstrates the first 10 posts/search-results for each term searched. This chart demonstrates the interactions used to generate and reverse the

algorithm. Period 1 contains pro-progressive terms to generate a pro-progressive algorithm. Period 2 contains pro-conservative terms to reverse the pro-progressive algorithm. Blue tallies indicate a progressive post observed, red tallies indicate a conservative post observed, and gray tallies indicate a non-affiliated post observed.



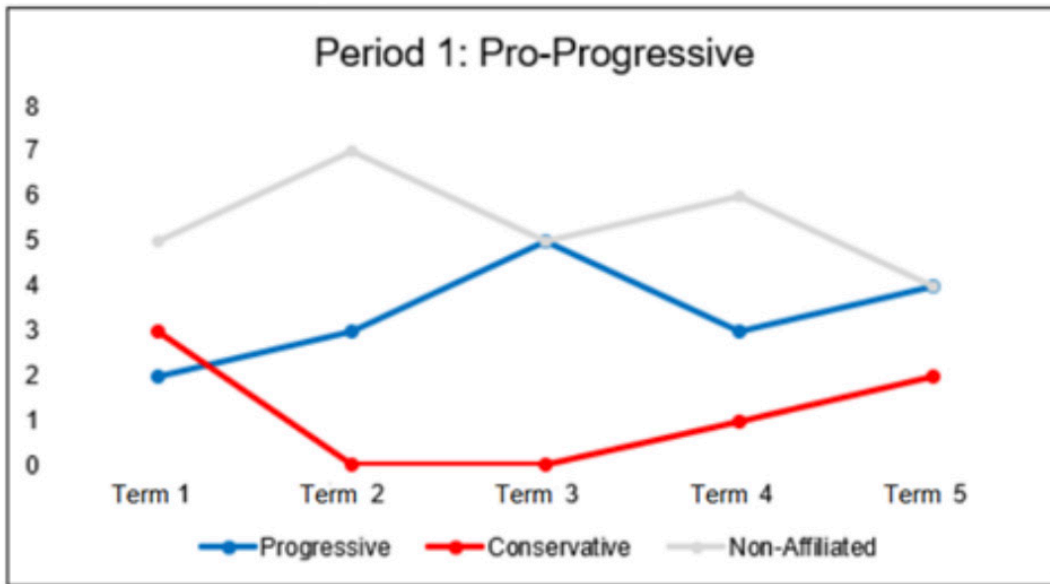
The following chart demonstrates the first 10 home page suggestions after each term was searched. Period 1 determines if the terms searched were able to generate a pro-progressive algorithm. Period 2 determines if the terms searched were able to reverse the pro-progressive algorithm. Blue tallies indicate a progressive post observed, red tallies indicate a conservative post observed, and gray tallies indicate a non-affiliated post observed.

Content Observed on Home Page	
Period 1: Pro-Progressive	
Term 1: Pro-Choice	
Term 2: Biden	
Term 3: Obama	
Term 4: Diversity	
Term 5: Democrat	
Period 2: Pro-Conservative	
Term 6: Pro-Life	
Term 7: Trump	
Term 8: Romney	
Term 9: Pro-Gun	
Term 10: Republican	

I = Progressive
I = Conservative
I = Non-Affiliated

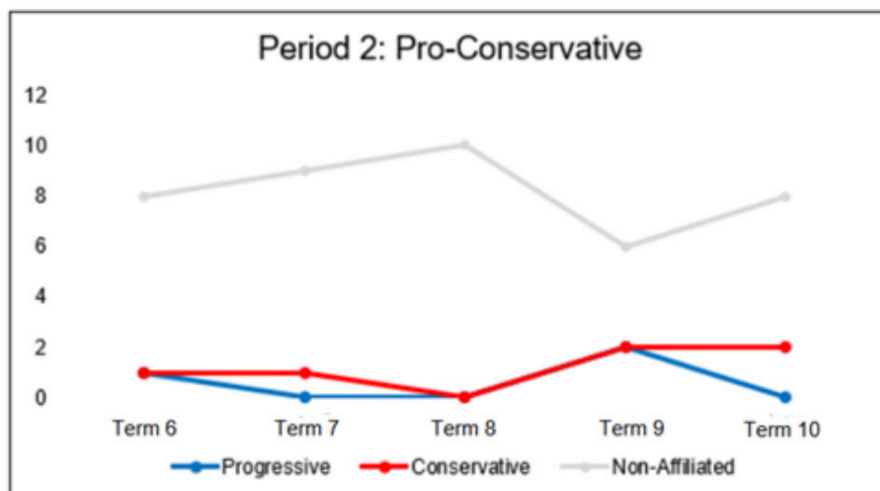
The following graph demonstrates the progression of home page suggestions in Period 1:

This data demonstrates whether the Period 2 successfully generated a pro-progressive algorithm:



The following graph demonstrates the progression of home page suggestions in Period 2.

This data demonstrates whether the Period 2 successfully reversed the pro-progressive algorithm:



Limitations

While my study does have a robust foundation, I do feel as though there are some areas of concern. I realize that a higher number of quantified instances per period may improve accuracy, the chosen terms may skew the results, and a longer collection period may improve findings. I acknowledge that these limitations may slightly reduce accuracy. However, I feel the current structure is optimal for the available resources.

Implications/Conclusion

Before beginning the data collection process, I assumed that YouTube would lock users into an echo chamber, an endless loop of one-sided content, very quickly. However, I learned that, while it is possible to become consumed by an echo chamber, it is hard to do so.

In the first half of Period 1, my searched terms and content interactions generated progressive homepage suggestions. Meaning, I was essentially in an echo chamber. However, this did not last long, as the last two terms I searched generated fewer progressive homepage suggestions and slightly more conservative suggestions. This may be due to the terms I selected, but it does not take away from the fact that the echo chamber slightly waned.

Additionally, most of the content was miscellaneous throughout the entire study. This could indicate that YouTube

does have some level of bias mitigation within its algorithm. Or it could suggest further study is needed.

As for the homepage suggestions in Period 2, YouTube seemed to completely stray away from its previously primarily progressive homepage suggestions as soon as I demonstrated interest in conservatism. This suggests that curiosity is an effective means of escaping YouTube's echo chambers. I gather that users should actively explore new perspectives to truly understand YouTube's current events and social justice issues.

References

- Argenton, G. (2017, September 19). Mind the Gaps: Controversies About Algorithms, Learning and Trendy Knowledge. Retrieved August 4, 2022, from <https://doi.org/10.1177%2F2042753017731358>.
- Bucher, T. (2016, February 25). The Algorithmic Imaginary: Exploring the Ordinary Affects of Facebook Algorithms. Retrieved July 26, 2022, from <https://doi.org/10.1080/1369118X.2016.1154086>.
- GCF Global. (n.d.). Algorithms. GCFGlobal.org. Retrieved July 21, 2022, from <https://edu.gcfglobal.org/en/computer-science/algorithms/1/>.*
- Gran, A.-B., Booth, P., & Bucher, T. (2020, March 9). To Be or Not to Be Algorithm Aware: A Question of a New Digital Divide? Retrieved July 26, 2022, from <https://doi.org/10.1080/1369118X.2020.1736124>.
- Henley Business School. (n.d.). Dr Outi Lundahl. Henley Business School. Retrieved July 28, 2022, from <https://www.henley.ac.uk/people/dr-outi-lundahl>.*
- Hacker, P. (2021, December 9). Manipulation by Algorithms. Exploring the Triangle of Unfair Commercial Practice, Data Protection, and Privacy Law. Retrieved July 27, 2022, from <https://doi.org/10.1111/eulj.12389>.
- Lundahl, O. (2019, November 3). Algorithmic Meta-Capital: Bourdieusian Analysis of Social Power Through Algorithms in Media Consumption. Retrieved July 28, 2022, from <https://doi.org/10.1080/1369118X.2020.1864006>.
- Milan, S. (2022, December 30). When Algorithms Shape Collective Action: Social Media and the Dynamics of Cloud Protestng. Retrieved August 2, 2022, from <https://doi.org/10.1177%2F2056305115622481>.
- National Science and Media Museum. Retrieved July 26, 2022, from <https://www.scienceandmediamuseum.org.uk/objects-and-stories/short-history-internet>.*
- Noble, S. U. (2018). Algorithms of Oppression : How Search Engines Reinforce Racism. New York University Press.
- Ortiz-Ospina, E. (2019, September 18). The Rise of Social Media. Our World in Data. Retrieved July 26, 2022, from <https://ourworldindata.org/rise-of-social-media>.*
- Ozbay, F. A., & Alatas, B. (2020, February 15). Fake News Detection Within Online Social Media Using Supervised Artificial Intelligence Algorithms. Retrieved July 28, 2022, from <https://doi.org/10.1016/j.physa.2019.123174>.
- Pittarello, A., Leib, M., Gordon-Hecker, T., & Shalvi, S. (2015, April 15). Justifications Shape Ethical Blind Spots. Retrieved August 3, 2022, from <https://journals.sagepub.com/doi/10.1177/0956797615571018>.
- Richtie, O. (2015, April). Platform Algorithms and Their Effect on Civic and Political Arenas. Retrieved August 4, 2022, from https://www.researchgate.net/publication/304380890_Platform_Algorithms_and_Their_Effect_on_Civic_and_Political_Arenas.
- Shu, K. (2022, March). Combating Disinformation on Social Media: A Computational Perspective. Retrieved August 3, 2022, from <https://www.sciencedirect.com/science/article/pii/S2772485922000229#b16>.
- Yin, J., Karimi, S., & Lampert, A. (2015, July). Using Social Media to Enhance Emergency Situation Awareness: Extended Abstract. Retrieved August 4, 2022, from https://www.researchgate.net/publication/280829031_Using_Social_Media_to_Enhance_Emergency_Situation_Awareness_Extended_Abstract.



Comparison of Texas Colonias Water Availability to Coastal Unincorporated Communities in the U.S.

By: Laura Button

Abstract

Nueces County, Texas contains colonias, which are unincorporated communities typically located in South Texas. These communities primarily consist of Hispanic, low-income residents who live in self-built homes lacking drinking water, sewage systems, paved roads, or basic city services. The colonias face challenges of poor water quality due to the use of shallow groundwater wells that are highly susceptible to contamination. To compare the colonias with other coastal

unincorporated communities outside of Texas, factors such as soil types, drought, floods, groundwater quality, and proximity to contamination sites will be considered. ArcGIS Pro software and layers from county, state, and other study area resources will be employed to visualize the differences and similarities among these unincorporated communities. Although other unincorporated communities in the United States may not be termed as colonias, they encounter similar issues, such as accessing groundwater near contaminated

land and experiencing frequent droughts and floods. The findings revealed variations in the level of resources, such as housing assistance and recorded contamination data, with Alameda County exhibiting greater support compared to the other counties. Additionally, disparities were observed in terms of research and data availability, community acknowledgment, and outreach, particularly in unincorporated communities near the border. Addressing these disparities is crucial for achieving environmental justice and promoting the well-being of these vulnerable communities.

MENTOR

Dorina Murgulet, Ph.D.

DEPARTMENT OF PHYSICAL AND
ENVIRONMENTAL SCIENCE

Introduction

Colonias are defined as unincorporated communities located near the US-Mexico border, with a large majority

concentrated primarily in the South Texas counties. Such as Nueces, Hidalgo, Starr, Cameron and Willacy, and many others along the Texas-Mexico border are home to the colonias (Rowles et al., 2020). This research focuses on Nueces County colonias, located near the Gulf of Mexico and Corpus Christi Bay, which are typically low-income Hispanic populations. These socioeconomically vulnerable residents reside in self-built homes on agricultural lands that do not have access to potable water, sewage and drainage systems, and basic city services (Jepson & Brown, 2014). Most colonias experience poor water quality, which is a result of their proximity to landfills, abandoned oil wells, and agricultural fields in addition to septic or pit latrine sources. Although other unincorporated communities may not be termed as colonias, there are many population groups like these across the United States. For instance, the unincorporated communities in Alameda and Imperial Counties in California and Orange County in Florida will be used in comparison to Nueces County colonias (Figure 1).

Background

A common characteristic of all the selected counties is the proximity to a superfund site. A Superfund site are some of the most contaminated areas in the United States, this can

be due hazardous waste that was dumped, left open or not properly taken care of on the site (Environmental Protection Agency, 2022). The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was created in 1980 by Congress, in response to the contamination created by chemical and petroleum industries (Environmental Protection Agency, 2022). The intent of this act was to clean up contaminated sites, manage the responsible party for the waste and take the necessary action for closed industry sites (Environmental Protection Agency, 2022).

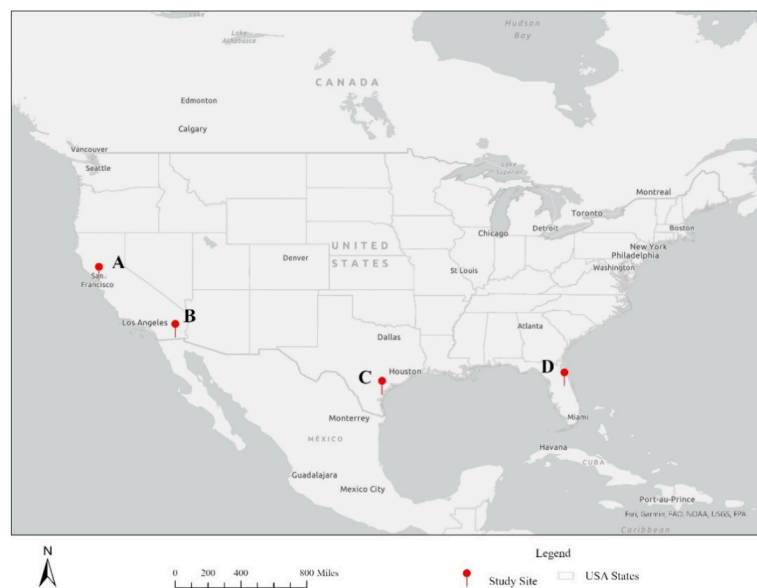


Figure 1. Geographic location of the study areas: A. Alameda County, CA, B. Imperial County, CA, C. Nueces County, TX, D. Orange County, FL.

Orange, Imperial and Alameda County experience flooding due to various reasons including sea level rise, the elevation the homes are built at and the soils the homes reside on (May et al., 2020). Nueces County experiences flooding from heavy rainfall and hurricanes, and for both Texas, Florida and California communities there is a lack of drainage due to factors such as being on clay soil, and an absence of proper infrastructure for drainage (Ohio State University, 2018). All four of the counties contain clay like soils due to the tendency of clays minerals to swell and shrink with changes in moisture, environments that consist of clay rich soils tend to flood more often because they are the least permeable soil type. Clay minerals in soils can swell enough that the soil becomes impermeable, so water will not infiltrate and instead run over the ground and flood homes and cities. The flooding for these unincorporated and disadvantaged communities creates safety hazards, including contamination of groundwater sources and damage to homes (May et al., 2020).

The four counties have many similarities ranging from soil type, flooding hazards, groundwater contamination, the utilization of shallow groundwater wells, and presence of superfund sites despite the distance between the counties being over 2,800 miles. These similarities demonstrate that

unincorporated communities facing environmental injustices are a nationwide issue for coastal communities. Rather than addressing these concerns solely at the local government level, assistance from the state or national government would advantageous for the residents living in communities that lack basic city services.

Methods

By utilizing the ArcGIS Pro software and layers sourced from the county, state or a research lab within the state of the study area, it became possible to compare water sources and contamination proximity to unincorporated and disadvantaged communities. Each county's map was created, utilizing the disadvantaged areas of Alameda County, while retrieving information on unincorporated or colonia communities in Orange, Nueces, and Imperial County. Local contamination sites and superfund sites within each county were also mapped. The Alameda County map illustrates the risk of groundwater contamination due sea level rise, the Orange County map is the hydrology of the county, the Imperial County map showcases the lakes and streams, and lastly, the Nueces County map contains the FEMA flood zones.

Study Area

The four study areas were chosen because each county is located in a large coastal state,

namely Texas, Florida, and California as seen in Figure 1. All of the selected counties consist of clay or sand soil types, experience groundwater contamination, and have unincorporated communities reliant on shallow groundwater wells. The Alameda County study area is situated within city limits and serves as a benchmark for comparison with the three other counties that encompass unincorporated communities. Additionally, each study site contains one to three superfund sites within the county, along with numerous groundwater, water, or general contamination sites. It is important to note that each county employs different methods to determine the classification and severity of contamination sites, resulting in variations in the number of sites across the study areas. While Orange and Alameda counties documented all contamination sites, Imperial and Nueces counties had limited public access to such information.

Results

The four maps generated from using ArcGIS Pro revealed multiple instances where water sources or flood areas were in close proximity to contamination sites, which also bordered unincorporated or disadvantaged communities. The maps also demonstrated variations in available data available between disadvantaged communities located within city limits and those outside of city limits.

Alameda County, situated within city limits, exhibited a greater amount of data available for the disadvantaged communities compared to the other three unincorporated communities in the study area as seen in Figure 2. Information regarding income and groundwater at highest risk of contamination was recorded and accessible for Alameda communities, along with housing assistance opportunities. Conversely, the other disadvantaged communities near the border lacked these resources.

In Texas there are over 1800 colonias, 38 of these colonias exist in Nueces County (Alvarado, 2016). The Texas Commission on Environmental Quality (TCEQ) is an environmental agency for the state of Texas and there are four TCEQ sites in Nueces County, near six of the colonias (Texas Commission on Environmental Quality, 2022). The TCEQ charges the responsible party with the cleanup of the contamination site or to pay a third party to be properly cleaned or suggest the contamination to the EPA registry (Texas Commission on Environmental Quality, 2022). There are other states, similar to coastal counties like Nueces County that have unincorporated communities and one or more superfund sites that have not been cleaned. Counties in Florida and California have the same contamination issues and face groundwater shortages like

Texas.

Nueces and Imperial County, both located near the US-Mexico border, face similar challenges concerning water quality, availability, contamination, and the socio-economic vulnerability of their Hispanic communities. Imperial County shares a border, while Nueces County lies less than 120 miles away from the border. The difference in available data is evident in the Imperial County map depicted in Figure 3. Nueces County, despite housing numerous industries and refineries, exhibits a discrepancy between recorded contamination and the level of industry and environmental harm present. Figure 4 illustrates multiple contamination sites, but there is a noticeable difference compared to Figures 2 and 5. Overall, the unincorporated communities near the border have fewer opportunities for housing, less research and data on hydrogeology and social well-being, and limited community acknowledgment and outreach.

In this study, Alameda and Orange counties exhibit the most similarities in terms of recording contamination and addressing issues related to groundwater contamination and disadvantaged unincorporated areas within their county boundaries. Orange County encompasses Orlando, Florida, while Alameda County is near San Francisco, California, and Nueces County contains Corpus

Christi, Texas. These cities all have populations exceeding 300,000 residents and continue to grow. The argument here is that the significant disparity in support provided by the county or state is not solely linked to proximity to a large city but rather rooted in the sociopolitical history of the county and state.”

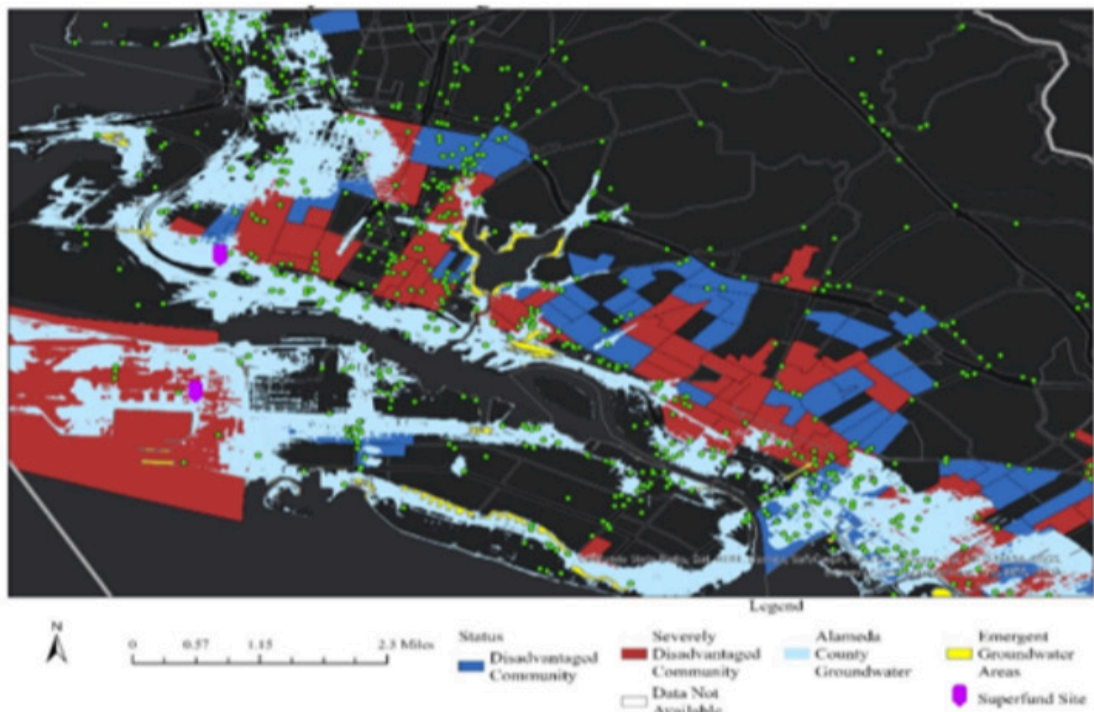


Figure 2. Alameda County Disadvantaged Communities and Contamination. Residents in the red areas earn 60,000 dollars less than the average income in Alameda County

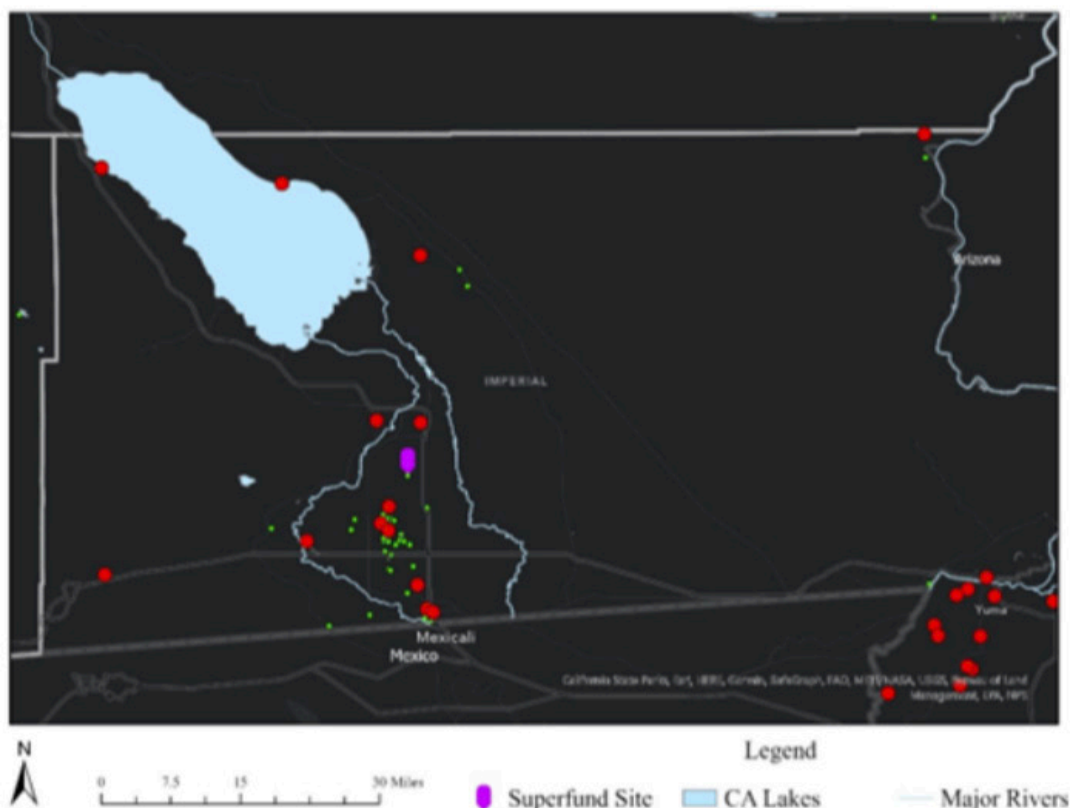


Figure 3. Imperial County Colonia and Contamination Map. Colonias are situated atop contamination sites, downstream from water sources, and susceptible to catching any contamination that flows into their groundwater sources.

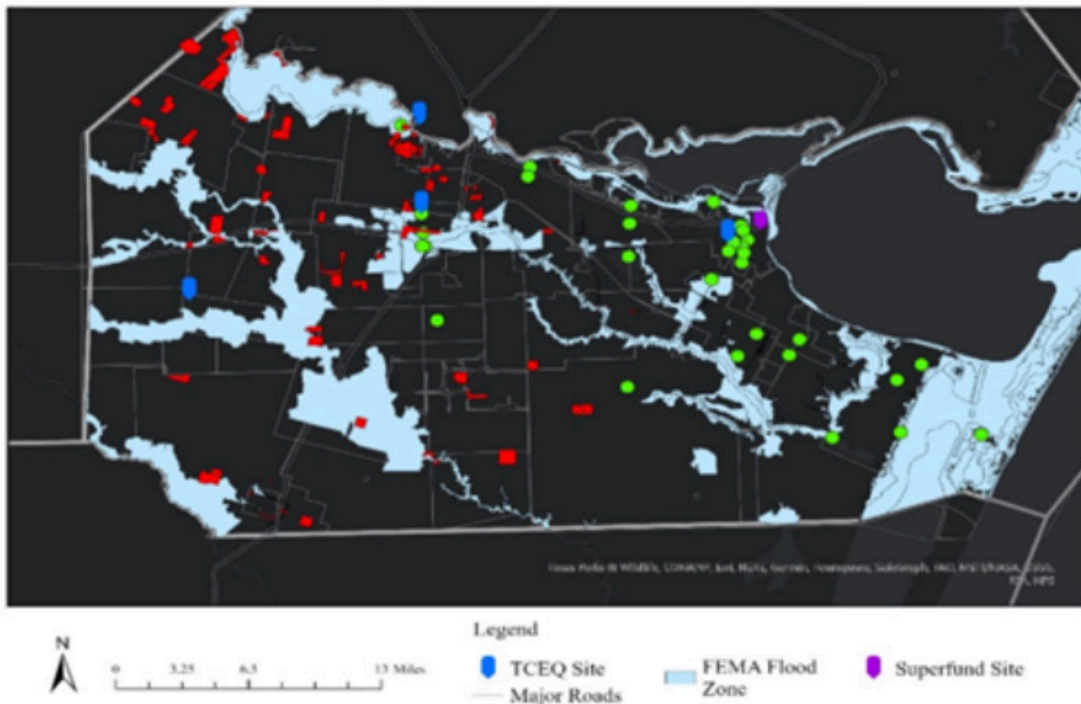


Figure 4. Nueces County Colonias and Contamination Map. There are many colonias located in a flood zone, and close or directly next to a TCEQ contamination site. This shows a higher risk of shallow groundwater contamination and increasing the likelihood for health issues for the residents.

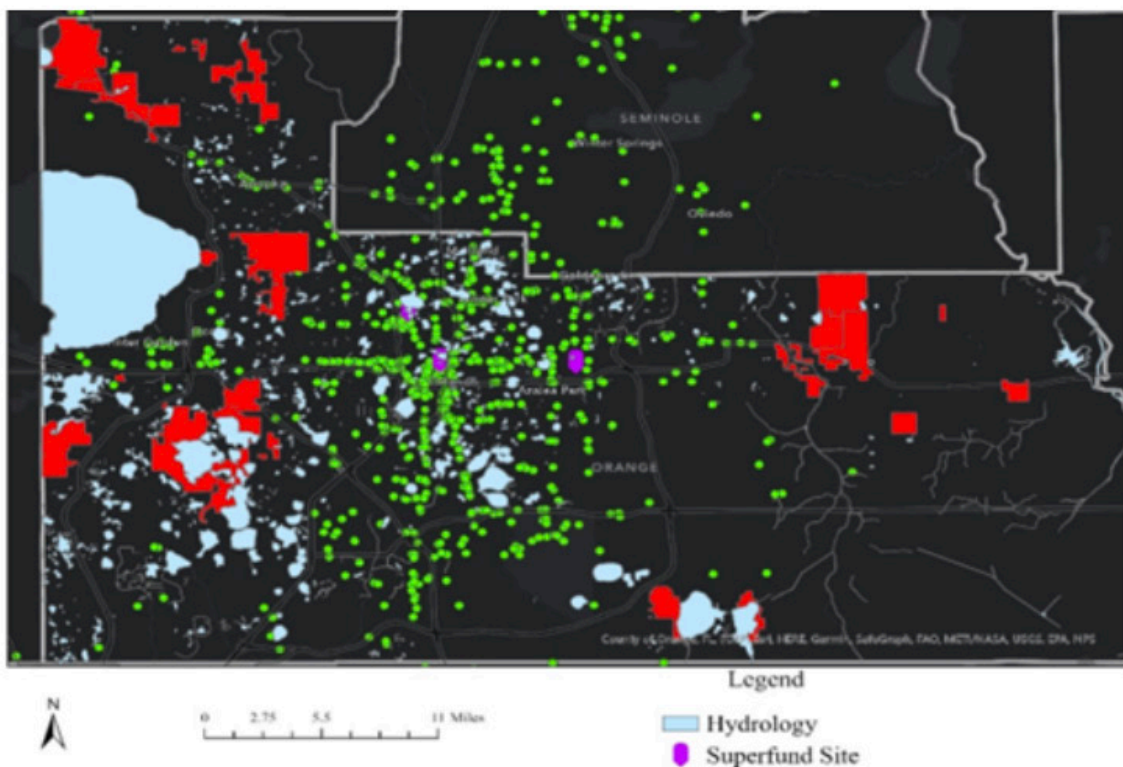


Figure 5. Orange County Unincorporated Settlements and Contamination Sites. Orange County acknowledges and actively works towards improving the unincorporated settlements within its jurisdiction.

Limitations and Future Directions

Each county employed a different method of recording or addressing contamination, as well as recognizing and supporting the unincorporated and disadvantaged communities within the county. For future directions, the project could specifically focus on the different colonias water quality to better assess the socio-economic impacts of groundwater pollution.

Conclusion

In summary, the maps generated using ArcGIS Pro revealed numerous instances where water sources or flooding areas were located near contamination sites, impacting unincorporated or disadvantaged communities. Data availability varied between communities within city limits and those outside of them, with Alameda County demonstrating more resources and support for disadvantaged communities. Nueces and Imperial County faced similar challenges related to water quality and contamination, with Hispanic communities being socioeconomically vulnerable. Disparities in available data and limited resources were observed in communities near the border. Alameda and Orange counties showcased similarities in addressing contamination and supporting disadvantaged areas. The findings underline the need for equitable attention to environmental issues in

these communities. It is crucial to recognize that a community is only as strong as its weakest area. Allowing underserved populations to bear the negative impacts of flooding, contamination, and lack of resources can have consequences for the entire community. The environmental injustices experienced by the colonias underscore the need for further research, education, and advocacy to improve their conditions. It is essential that residents of the county and the state acknowledge the existence of these communities and work towards rectifying the challenges they face.

Acknowledgements

I would like to thank the Center for Water Supply Studies and the McNair Scholars Program for supporting this project. A special thank you to Dr. Dorina Murgulet for her encouragement, support and guidance throughout the entire project.

References

Alvarado, B. (2016, May 19). Coalition discusses growing list of colonias in Nueces County. Caller-Times. <https://www.caller.com/story/news/local/2016/05/19/coalition-discusses-growing-list-of-colonias-in-nueces-county/91518516/>

Environmental Protection Agency. (2022, November 1). What is Superfund? Environmental Protection Agency. Retrieved January 22, 2023, from <https://www.epa.gov/superfund/what-superfund>

Jepson, W., & Brown, H. L. (2014). 'If no gasoline, no water': Privatizing drinking water quality in south texas colonias. *Environment and Planning. A*, 46(5), 1032-1048. <https://doi.org/10.1068/a46170>

May, C. L., Mohan, A. T., Hoang, O., Mak, M., & Badet, Y. (2020, September). City of Alameda. AlamedaCA.gov. Retrieved January 22, 2023, from <https://www.alamedaca.gov/files/assets/public/alameda-pio/slr2020.pdf>

Ohio State University. (2018, 03). Soil Infiltration. Agronomic Crops Network. Retrieved March 17, 2023, from <https://agcrops.osu.edu/newsletter/corn-newsletter/2018-03/soil-infiltration>

Rowles III, L. S., Hossain, A. I., Ramirez, I., Durst, N. J., Ward, P. M., Kirisits, M. J., Araiza, I., Lawler, D. F., & Saleh, N. B. (2020). Seasonal contamination of well-water in flood-prone colonias and other unincorporated U.S. communities. *The Science of the Total Environment*, 740, 140111-140111. <https://doi.org/10.1016/j.scitotenv.2020.140111>

Texas Commission on Environmental Quality. (2022, June 20). Superfund Sites in Nueces County Texas Commission on Environmental Quality. Texas Commission on Environmental Quality. Retrieved January 22, 2023, from <https://www.tceq.texas.gov/remediation/superfund/sites/county/nueces.html>

TEXAS A&M UNIVERSITY- CORPUS CHRISTI

A BRIEF HISTORY

Texas A&M University–Corpus Christi began in 1947 as the University of Corpus Christi (UCC) which was affiliated with the Baptist General Convention of Texas.

In 1970, Hurricane Celia caused more than \$1,000,000 dollars in damage to the campus. In 1971, the Baptist General Convention of Texas sold UCC to the state of Texas and the Texas Legislature authorizes the Texas A&I University System to establish a state-supported upper-level institution of higher education in Corpus Christi. In 1973, Texas A&I University at Corpus Christi opens its doors on 4 September 1973 to 969 students as an upper-level institution of higher education. In 1977, the Texas Legislature changes the name of the University to Corpus Christi State University.

In 1989, Corpus Christi State University joins the Texas A&M University System. In 1993, the Texas A&M University System Board of Regents renames the institution Texas A&M University–Corpus Christi and a year later it becomes a four-year comprehensive university and enrollment increases to 5,000 students. In 2004, the Board

of Regents approves the College of Nursing and Health Sciences which opened in 2005. In 2005, Dr. Flavius Killebrew becomes President/CEO and initiates Momentum 2015, a ten year plan to establish Texas A&M University–Corpus Christi as the flagship university of South Texas.

In 2016, Dr. Killebrew announced his retirement and former Provost and Vice President for Academic Affairs Kelly Quintanilla was appointed interim president. Today the University has over 12,000 students.

Today Texas A&M University–Corpus Christi is not only a proud member of the Texas A&M University System but it is also the premier public university in the region and is currently the only university in the United States to be situated on an island. Texas A&M University–Corpus Christi is currently a member of the Southland Conference under the NCAA division I.

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McNair Scholars Program
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Classroom West
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The McNair Research Journal is the official journal of the McNair Scholars Program (Ronald E. McNair Post-Baccalaureate Achievement Program) at Texas A&M University-Corpus Christi. Funding is through the U.S. Department of Education (Grant No. P217A170075).

MC NAIR

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