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FEAR

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Wastewater Sanitation and Reclamation: Solutions for Sustainable Living

Background - A disadvantaged community, according to the Safe Drinking Water Act, is a region or community within a water system where the median household income is less than 80 percent of the statewide average. As of 2015, the median household income in California was \$61,489. Therefore, to be considered disadvantaged, a community's household income may not exceed \$49,191. According to the Department of Water Resources, the community is deemed a severely disadvantage community (DAC) if the median household income is less than 60 percent of the statewide median. In California, this equates to \$36,893. Figure 1 shows the DAC mapping tool created by the Department of Water Resources, where yellow indicates the disadvantaged communities and brown indicates the severely disadvantage communities. Coachella Valley area is indicated to be in the severely disadvantaged area.

Client - The project is dedicated to help Don Jose Mobile Home Park (MHP) improve their quality of life. Don Jose MHP (marked in Figure 1) is located in Thermal California in Coachella Valley. Mobile home park is a common form of residential type for disadvantage communities. Families and friends gather up their resources to buy a large plot of land and build as many houses as they can. Per Riverside county standards, each MHP can build up to 10 houses with an estimation of five resident per house, and this sums up to 50 residents per MHP. Don Jose MHP locates next two high way 86 and 111, which provides an easy access for construction and equipment transportation. The project team collaborated closely with Coachella Valley Water District and Pueblo Unido CDC, which is a non-government organization (NGO) that worked closely with MHP communities such as Don Jose MHP. Pueblo Unido CDC installed the existing septic tank systems for Don Jose MHP with government funding, and they have facilitated the team to prepare this proposal to improve their quality of living.



Figure 1. Disadvantage Communities Mapping Tool



Figure 2. Orthoimage generated from Drone Survey

Challenges - According to the American Society of Civil Engineers Report Card, America's national average grade for infrastructure is a D+. If these conditions for the average American household, severely disadvantage communities may experience worst. In Don Jose MHP, the septic tanks are overflowing, failing and not up to Riverside County code. They are not connected to any municipal drinking water or sewer quality. Objective of the project is to improve the groundwater quality by proposing a wastewater treatment system. This will improve their drinking water quality because they have drinking water wells on site. And lastly, we want to provide a new source of income for the community.

Solution - DEWATS - Decentralized Wastewater Treatment System (DEWATS) takes in raw waste water and come out Title 22 Disinfected Tertiary. Bremen Overseas Research and Development Association (BORDA), a German organization, has implemented DEWATS all over the world in countries including South Africa, Mexico and India. DEWATS has never been implemented in United States before, and the team intend to be the first one who implement it. This system was selected because it is sustainable and has low operation and management cost, which is ideal for Don Jose MHP.

Water Reuse Standards - Title 22 is California's water quality standards. California has some of the most stringent water quality standards in the United States. To meet Title 22 disinfected tertiary requirements, the DEWATS system require to include aerobic filtration paired with disinfected 5-log removal, or 99.999% inactivation of plaque-forming units.

Field Data Collection – The team visited Don Jose MHP twice to collect sufficient data for design use. Drinking water and septic tank water sample were collected to obtain an influent water quality to design the DEWATS. Geotechnical survey was conducted to obtain the most accurate soil properties for seismic design. Figure 2 orthoimage generated from drone survey for identifying the locations of utility such as telephone and electric lines. Questionnaire was conducted to gather residents’ desire, which were used to determine solutions for their best interest.

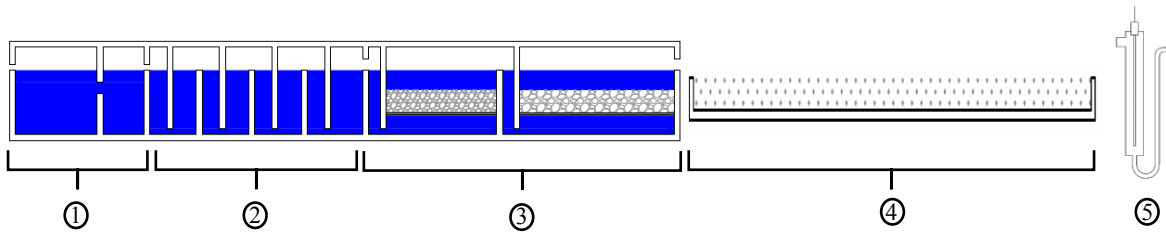


Figure 3. Overview of the DEWATS System

Process Overview – Don Jose MHP currently has seven household with about 5 people each. The DEWATS anticipates an 2100 gpd distributed over 18 hours with a maximum flow of 5250 gpd. The overall dimension of the system is approximately 120 feet long, with a total square footage of approximately 2,000 square feet. The overall hydraulic retention time (HRT) of the system is minimum of 54 hours. Figure 3 and Table 1 indicate the specification of each processes. Anaerobic Baffled Reactor and Anaerobic Filters are two train systems for redundancy purposes.

Table 1. DEWATS Processes specification

	Influent	1 - Settler	2 - Anaerobic Baffled Reactor	3 - Anaerobic Filters	4 - Planted Gravel Filter	5 - UV (Solar Panels)
Width	-	10 ft	5ft (10.5 ft)	5ft (10.5 ft)	25 ft	3.3 ft
Length	-	10.5 ft		24.25 ft	50 ft	1.5 ft
Depth	-	6 ft	7 ft	7 ft	1.7 ft	-
% BOD Removal	-	32%	49%	12%	4%	0%
BOD Concentration	200 mg/L	132 mg/L	38 mg/L	14 mg/L	6 mg/L	6 mg/L

Settler - The settler is the first treatment process which the collected wastewater will pass through in the DEWATS. The settler is rectangular and is comprised of two separate chambers which are separated by a baffle. Settable solids are separated from suspended solids to prepare the effluent for the anaerobic baffled reactors in the next stage of treatment. Sludge accumulation after two years will be approximately 1.11 ft deep, which is about 15 percent of the tank depth.

Anaerobic Baffled Reactor (ABR) – The function of the ABR is to treat particulate matter (greater than 0.45 micron) by using an activated sludge blanket capture method and biological secondary treatment. The ABR contains an activated sludge blanket that, via up-down flow induced by vertical baffles, removes particulate matter from water. The system is modeled as a plug flow reactor, which results in more treatment occurring in the first ABR chamber and less treatment in the final ABR chamber. A series of hanging and standing baffles separate the chambers within the ABR, allowing for an increased travel path and contact time. The up-flow chambers contain sludge blankets which the water passes through from bottom to top. As the water is pushed through the activated sludge blanket, particulate matter is captured and the cleaner water travels over the standing baffle. The water then flows into the down-flow chamber, at which point it travels into the next ABR chamber beginning with another up-flow chamber. This process causes greater buildup of sludge within the first ABR chamber than the last ABR chamber. Combining multiple ABR chambers results in cleaner water entering each subsequent chamber which results in cleaner effluent. The ABR

Anaerobic Filter - After the anaerobic baffled reactor, the anaerobic filter is the next step of the DEWATS. This is an additional secondary treatment step. The process provides a media surface for microorganisms to attach to for continued biological treatment. The filter is designed to remove suspended particles via physical treatment by entrapment in the pores of the media as the water moves up through the filter, as well as to remove dissolved carbon via anaerobic digestions. To account for the potential clogging issue occurs in the anaerobic filters, 2.8-inch gravel (Coarse) and 1.4-inch gravel (fine) were selected to provide polishing of the effluent.

Planted Gravel Filter - Because the wastewater has only undergone anaerobic treatment to this point, oxygen must be reintroduced into the water via a planted gravel filter. Oxygen is primarily transferred to the water from the atmosphere by dispersing it across the top of the filter bed. The proposed filter is designed for vertical flow, with the water dispersed across the surface of the planted gravel filter. The influent is applied uniformly across the top of the filter bed via perforated pipes, and additional perforated pipes are laid along the bottom of the filter bed to collect the effluent. The filter bed profile consists of granular material increasing in size from the surface of the filter bed to its bottom, typically with a coarse sand at the surface and a coarse gravel surrounding the underdrain pipes. The proposed design followed design practices and recommendations that are used in existing constructed wetlands in California and other locations in the United States and around the world. The design of the constructed wetlands is primarily dependent on flowrate, pathogen removal, water temperature, and hydraulic conductivity of the filter bed media.

Disinfection - The design proposed for the community located in Thermal, California is intended to meet Title 22 requirements for disinfected tertiary. This means that the desired effluent will meet disinfected secondary-2.2 quality with the required addition of filtration followed by disinfection. Moreover, any water sample is not permitted to exceed a Most Probable Number (MPN) of 240 total coliform bacteria colonies per 100 milliliters at any time; for a more detailed explanation of Title 22 Requirements see section 2.1.1. Additionally, plaque forming units (PFU) will be inactivated to meet 5-log removal. Plaque forming units are a measure of the number of particles capable of forming plaque per unit volume. Based on the analysis and considering the effectiveness of treatment, the recommended reclaimed water uses, as well as the cost, it was determined that the system that can better meets the needs of the community is UV disinfection. The UV disinfection unit is a closed, pressurized vessel that meets 5-log removal. It is powered by two solar panels with a battery for backup power.

Conveyance System - A conveyance system will connect the UV system to the storage tanks. Figure 4 shows the conveyance system layout. The green line represents the conveyance system for sewage, while the purple line represents the reclaimed water conveyance system. SewerGems by Bentley was used in accordance to Riverside County criteria. The layout consists of gravity fed sewer pipes that will flow from North to the South. The effluent will then be treated by the DEWATS, and, after final disinfection, the reclaimed water will be pumped to the northern location and stored or dispersed for the community's needs.



LEGEND			
Sewer SDR-35 PVC Pipe		C-900 PVC Pipe	
Blow Off Valve/Dead End Cap		Storage Tank	
Air Vacuum/Air Release Valve		DEWATS	

Table 1. DEWATS Processes specification

Post Design – Structural analysis and material coating were designed to account for seismic activity and corrosive soil property of the location. Monitoring plan provides continuous sampling per Riverside County standards. The monitoring plan will consist of a display unit and various sensors and will be stationed at each treatment process. The sensors will test for BOD/COD, TSS, total organic carbon (TOC), nitrogen, ammonia, and phosphorus and can be programmed to automatically test for each chemical at their respective increments. Permits considered for the DEWATS includes: general permit, general building permit, general grading permit, research operations permit (Rule 441), environmental permit and Assembly Bill No. 52 (AB 52).

Education Plan – Educating the community and general public about DEWATS is essential to the success of implementation of the system. Educational plan including presentation, flyer in both English and Spanish, physical demonstration model was created to inform the public about the mechanics of the system and benefits from the implementation of the system.

Cost Estimate – For disadvantaged communities such as Don Jose MHP, cost control has an important role in the design. The DEWATS was designed to utilize material from local suppliers and native materials. The total construction cost was estimate to be about \$514,000 and an annual operation and maintenance cost to be \$3,900. The cost included excavation for Don Jose MHP, however implementation in new MHP development will significantly reduce the cost by 20% because excavation will be included in the development cost, which additional exaction will not be required

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Assessing the Efficacy of Laser Photomodulation in Laboratory Mice Wound Healing

Abstract

Low Level Laser Treatment (LLLT) is commercially used as a therapeutic in human and veterinary medicine to minimize inflammation and expedite wound healing. Experimentally, studies that sought to quantify the clinical significance of LLLT have had varying results. In vitro experiments involving LLLT lack the active immune response, making extrapolation difficult. Consequently, we are testing the effect of LLLT on the surgical wound healing of live adult mice (*Mus musculus*) in a controlled laboratory environment. A class II, maximum 100 megaWatt, 650 nanometer wavelength type BF laser was used. Age controlled female mice (n = 12) were anesthetized and receive an initial surgical wound of approximately 2 centimeters located on their lower abdomen, mimicking a spay/neuter wound. After this surgery, all mice had their wounds surgically closed (3-stitches) and received a single dose of analgesic. The treatment group (n = 8) received an initial laser treatment 10 J/cm² at the incision site after the surgical closure; A control group (n = 4) did not receive any laser treatment. The following morning each animal was evaluated and their incision site was photographed for scoring. LLLT decreases the likelihood of wound dehiscence (opening) in mice, as the mice that did not receive treatment displayed more wound dehiscence than the mice that that did receive LLLT. Additional experimentation is needed to further evaluate the effects of LLLT on wound healing in mice.

Introduction

Past experiments have demonstrated the positive and negative effects of laser treatment in rodent populations. The laser treatments were more efficient when used in 72-hour increments. These increased cell viability and decreased cytotoxicity and DNA damage. When used in 24-hour increments, the results were detrimental to cell viability and DNA was damaged (Kurach et al. 2015). Other experiments have shown that laser procedures result in boosting anti-inflammatory responses (Baretto et al. 2013). Laser treatments have been reported to be most effective when red and infrared lasers are used in conjunction upon the wound, and least effective when used in closer proximity to the actual wound (Rodrigo et al. 2009). While many experiments that observe laser treatment on rodent populations have been conducted, none have focused on judging the level of inflammation through the use of removable stitches. Focusing on this experimental aspect is what makes this experiment unique and one that is not duplicating previous experiments, as previous research focused on variables including hair growth (Avci, P, Gupta GK, Clark J, Wikonkal N, Hamblin MR 2014) and any plausible side effects that accompany laser treatment.

In human studies laser treatment is also reported as widely beneficial at decreasing inflammation, and recovery time following dental procedures (Kathuria, Dhillon, & Kalra, 2015; Oliveira Sierra et al., 2013; Yassaei, Fekrazad, & Shahraki, 2013). The use of laser treatment following routine dental procedures (cleaning and simple extractions) in rodents has not been reported, but this is something that could be examined in the future.

Reported side effects of laser treatment are minimal. However, risk factors for laser phototherapy include delayed wound healing, increased swelling, discharge from the treatment area, edema, thermal burns, and cancer cell proliferation. Each of these contributes to the five cardinal signs of inflammation: swelling, pain, redness, heat, and loss of function. These side effects would be strictly monitored for the well-being of the patient. Inflammation is in fact the subject of this study and will be heavily scrutinized in all the patients, should there be any increase in inflammation beyond normal post-surgical recovery.

When administering sutures to close a mouse's wound after surgical incision, it is important to make sure that the sutures are not too long because the mouse may chew on the sutures and rip them out (Perret-Gentil 2012). However, while the length of the sutures may have an impact on whether the mice remove them, the irritation of the wound naturally causes mice to scratch and bite at the wound. When a wound is more irritated, there is a correlation with inflammation as a natural bodily response to the wound's inability to heal without additional assistance from the immune system. It can be implied that when a mouse removed its own stitches or chews on them, the wound could be irritated and likely to be inflamed. This can be used in the experiment we executed as a use of measuring the irritation and inflammation of a given wound. Typically, irritation and inflammation are hard to measure. Irritation is something subjective to the individual and it is difficult to gauge the irritation of an animal's wound since they cannot communicate their thoughts. Inflammation is easier to measure because the wound appears red, elevated, bulbous, and often will have white residues of pus or accumulations of white blood cells in the area. Inflammation often is a precursor of infection, but given the short duration of this experiment infection will not be measured. While infection may occur in an individual, it is impossible to tell one day after an incision was made on the mouse; that is why we are measuring inflammation and irritation. The tendency of a mouse to remove its own stitches is our predicted behavior in response to irritation and inflammation.

This experiment will provide necessary information before further research can be done onto that will utilize the laser. It is important to measure the immediate effects of the laser that will be used before progressing to larger organisms or more complex experiments. No previous study has performed this specific experiment with this particular laser and measured irritation and inflammation. That said, this experiment is a crucial stepping stone before proceeding to apply the laser to other experiments. Some of these hypothetical future experiments are crudely outlined in the discussion section.

Methods

Twelve female Swiss-Webster mice were randomly split into two groups of four individuals and eight individuals respectively. The groups of mice were given a two-centimeter-long incision. The incision will attempt to mimic a spay/laparotomy, and was performed along the caudal ventral midline between the fourth and fifth mammary chain. The incision itself will not penetrate the abdominal wall; it will only penetrate the skin and the subcutaneous tissue. All rodents received stitches (sutures) after their surgery.

The first group (of four individuals) had their incision sutured and no following procedures. This group was our control, and was used to compare the effects of the other group that received laser treatments to the control's level of wound dehiscence. The other group of eight individuals received an initial treatment of LLLT (100 sec) directly after surgery and stitches. This initial treatment was the first and the last LLLT treatment that they received. The suture pattern was a simple interrupted suture pattern, and the suture material was a synthetic non-absorbable blue nylon monofilament suture (4-0). The larger of the two groups was the experimental group. To provide an efficient control group, our control group was subject to the same process as the laser treatment rodents, except the laser was off during handling. This means that the control group was subject to the same amount of excess stress as the experimental group.

There is a risk of eye injury with any laser usage, and this is particularly the case with lasers in the invisible range of light and high-output lasers (class IV) (Kathuria et al., 2015). This study includes a class II laser and visible light ranges only. We required that anyone handling the laser and the rodent during LLLT wore protective eyewear, and the mouse's eyes were shielded during treatment with a towel. The individual operating the laser was wearing specialized tinted Pr safety glasses that come with the Spectravet Laser when it was purchased. **All LLLT treatment was conducted by Dr. Cord Brundage or Benjamin Clock.**

Before all incisions were performed, the mice undergoing the incision were provided with a dose of anesthesia (isoflurane). Mice were placed in an induction chamber in order to subdue them by providing them with a lower dose of the anesthetic before they were fitted with a nose cone on the surgical table. This nose cone supplied a steady flow of the anesthetic (isoflurane) to the mouse. Gaseous isoflurane was induced at 2-4% of the air provided to the animal. The anesthetic has a maintenance rate of 1-3%. The Minimum Alveolar Concentration associated with isoflurane is 1.35-1.41%. MAC is the concentration of anesthetic needed in the lungs to effectively stop motor responses and pain stimulus in the patient. The rodent was on a heating pad during the surgery to maintain homeostasis of body temperature. Artificial tears were used to make sure the rodent's eyes were lubricated through the surgical procedure. The surgical area previously mentioned in the first paragraph was shaved of any hair and scrubbed thoroughly with alcohol (specifically 3 scrubs with chlorhexidene followed by 3 70% isopropyl alcohol scrubs) to make sure it was clean and sterile. After the surgical procedure, Meloxicam (5 mg/kg subcutaneously) was provided to the mice to help reduce any pain they might be in after surgery. After the surgery, the rodents were kept in individual cages to prevent them from chewing each other's wounds closed with the sutures.

The results were interpreted the next day using the implication that a wound with more inflammation and irritation would have less stitches remaining than a wound that was not inflamed or irritated. The number of sutures remaining (three were given after surgery) that day was recorded for each mouse and used as data for this experiment, along with any other important information/observations. The mice were finally subjected to euthanization using a carbon dioxide chamber.

Results

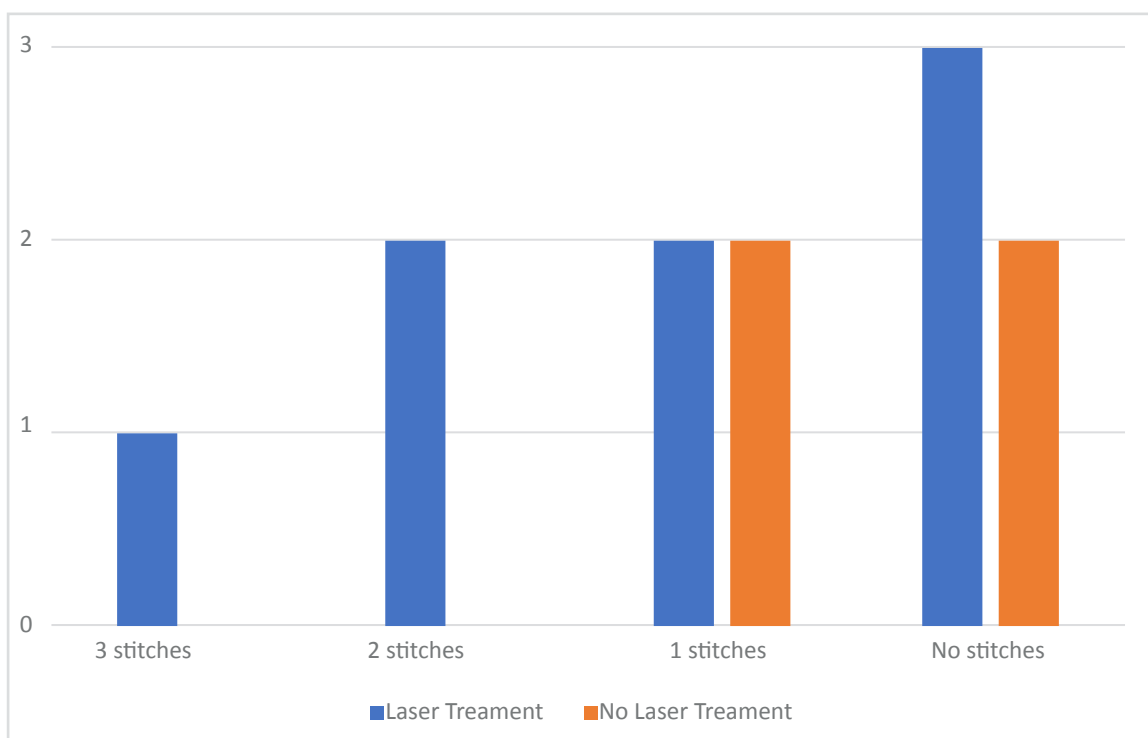


Figure 1 (above): Stitches remaining in mice with and without laser treatment.

Figure 1 depicts the observations recorded of the mice's remaining stitches from the three provided initially after surgery. There may be a trend between laser treatment and suture retention (non-dehiscence). All four untreated animals (control group) removed 2 or more of their stitches. Five out of eight (62.50%) treated mice retained one or more (out of three) stitches. All three mice with 66% or more incision closure received laser treatment. When examining the control, all the mice had 0-33% of their stitches remaining, with the average number of 0.5 remaining stitches. On the contrary, the range for the treatment group was 0-100%, but the number of remaining stitches for the treatment group was 1.125 stitches.

The significance of these findings is unknown. The sample size limits our ability to make a concrete conclusion, and the normal rate of wound dehiscence is unknown. Based on the abbreviated study duration, it is interesting that any correlation can be found. The mechanism and efficacy of wound laser treatment remains an area for future investigations.

Discussion

When examining our results from this experiment, it is important to keep in mind that the significance of the findings is unknown and that a trend between laser treatment and suture retention (non-dehiscence). The reasoning and science behind the explanation of this trend is also unknown since the bodies of the mice were not operated upon, and no tests were run on the blood or wound area. We can compare our results to those from other experiments utilizing laser therapy, although our experiment is unique so other experiments might have other variables of interest or subjects. One experiment (Kurach, et al. 2015) proved that lasers were more efficient when used in 72 hour increments (72 hours between treatments). The examined blood results of the dogs showed increased cell viability and decreased cytotoxicity and DNA damage in subjects that received the 72-hour increment procedure compared to 24 or 48 hours increments. Had we performed a blood test, we might have been able to compare the results of overnight laser therapy to this study. Another experiment (Baretto, et al. 2013) proved that lasers can boost anti-inflammatory responses, which pertains more specifically to our experiment. The trend extrapolated from our results informs us that laser treatment tends to reduce the level of irritation and inflammation, which is further solidified in this study. We decided to neglect the variable of hair loss, but some experiments (Avci et al. 2014) decided to make this their main focus. Had the setup of our experimental layout been longer, hair growth could have been a variable of interest.

The significance of these findings is unknown. This is due to a few different factors that all effect how reliable and trustworthy the results can be. In any experiment, it is ideal to limit the amount of variability between sample specimens. In terms of our experiment, having all female mice of the same breed and similar builds helped reduce that level of variability between the specimens. However, in any experiment it is also vital to have a sample size large enough to overcome any random results that could be due to sampling error. Our experiment had only twelve mice, a sample size that is certainly too small for the experiment we were executing. In order to obtain results that would be significant, we would need to obtain at least thirty mice and observe their results. Another limitation of our experiment is the laser itself: we used one type of laser with a specific wavelength, class, and duration of time to reach a particular amount of energy per square inch. Had we used several different types of lasers with varying classes, wavelength, and time spent focused on the wound, we might have yielded some interesting results that might have lead us to select a desired laser that had the most positive results of the lasers used. This is another idea for future experimentation in addition to the paragraph of other potential future directions below.

This experiment opens many different doors for future experimentation. In addition to the previous research that sought to determine the most efficient laser, our experiment could be replicated numerous times in order to overcome the potential of sampling error to obtain results that were significant and gives us information about the irritation of laser treatment in wound healing of laboratory mice. The laser could then be utilized in further research that could determine the best wound location and method of closing the wound. This would be important to determine the effect of laser therapy on the healing process of the mice in terms of recovery time and observable inflammation.

This experiment would test the incision on the lower abdomen with sutures, the same incision with staples, the same incision with surgical glue, the same incision with sutures and a nose cone for the mouse, and the incision moved to the upper back (between the scapula's) with sutures. The most significantly successful result from the previous experiment to use as the location of the incision for the follow up experiment. This next experiment would examine the healing process of the mice in terms of recovery time and observable inflammation compared to a group of mice that received no laser treatment (control group). The laser treatment would be split into two groups, one that would receive treatment directly after surgery only, and another group that would receive the treatment directly after surgery and every 72 hours following that initial treatment. This would help to examine the potential therapeutic benefits of laser therapy on the wound healing process. We would be examining how long the mice took to fully recover from their wounds, and a blind veterinarian would be used to grade daily pictures of the wounds using a scale of inflammation and infection. Another follow up experiment would be performed after this experiment to somehow examine the internal effects of the laser on the mouse' body. This experiment has yet to be thought out in more depth.

In the distant future, should these experiments utilizing the laser's effects prove to have therapeutic and health benefits on the mice, the laser could be used on dental procedures in canines after routine teeth cleaning.

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On the Intersection of Drugs and Poverty: Reshaping the Philosophical Debate for Drug Decriminalization

Abstract

American legal efforts to combat the use and trade of illicit drugs have contributed to an unprecedented spike in rates of incarceration that have disproportionately impacted minority groups. This has caused huge backlash against the efforts of current criminalization of illicit drugs. In response, many are tempted by the arguments in defense of drug decriminalization. Prominent philosophers have contributed to the discussion by concluding that the decriminalization of drugs is the most justified response to the drug dilemma. However, research on the correlation between addiction and poverty suggest social positioning plays a fundamental role in how an individual experiences drug use. The impoverished are the most vulnerable and susceptible group to the havoc resulting from the use and trade of illicit drugs. In this essay, I will argue that the methodology in the current philosophical defense for drug decriminalization is flawed because it fails to attend to the experiences at the intersection of drugs and poverty. This will be argued through two main points. The first, will explain how the methodology disregards the experiences of the poor which then results in misleading claims of harm. The second point will argue that the methodology is flawed because it attempts to universalize a freedom of drug use that is inconsistent with the experiences of the poor. Having established my argument, I will move onto consider a counterargument that raises concern for the practicality of my proposal. To which I respond that concerns for practicality are misguided, as I am arguing for a change in methodology.

1.1 Introduction

I have been traveling the country, visiting drug-ridden neighborhoods, seeing treatment and prevention programs in action, talking to teachers, policemen, parents, young people. These, it seems, are the real drug experts because they've witnessed the problem first hand. But, unlike some prominent residents of Princeton, Madison, Cambridge, or Palo Alto, they refuse to surrender¹ (Bennett, 1990)

In 1989, William Bennett gave a speech at Harvard University, where he expressed his frustration against the academic community that criticized the criminalization of drug use and trade. He condemned scholars, journalists and philosophers who argued in defense of decriminalization and described their positions to be oblivious to the harsh reality of illicit drug use and trade.

¹ Bennett, W., Drug Policy and the Intellectuals. *The International Journal of Drug Policy* 1990 1(6), 16–18.

² Wikipedia contributors. (2018, March 11). War on drugs. In Wikipedia, The Free Encyclopedia. Retrieved 07:35, March 16, 2018, from https://en.wikipedia.org/w/index.php?title=War_on_drugs&oldid=829938160

³ Bennett, W., Drug Policy and the Intellectuals. *The International Journal of Drug Policy* 1990 1(6), 16–18.

In addition, he emphasized the need for continuing with legal efforts to assess the country's drug problem. Criminalization of drugs is one approach to how a country may overcome complications of drug use and trade. In America, this approach has been in motion since 1971² and is widely known as, the War on Drugs. The underlying justification for the governmental efforts is that without criminalization, drug use will rise and when drug use rises so does drug related crime, addiction and disease³ (Bennett,1990, 16-18). Unfortunately, the drug problem has proven not to be that simple. While the overall prison population grew 700% between 1970-2005, drug related offenses account for nearly half of those currently behind bars⁴ (Kerby, 2012). Even more concerning, although people of color use/sell drugs at the same rate as white people, they are six times more likely to be incarcerated for drug related crimes⁵ (Alexander, 2010). In 2002, the NAACP reported that Blacks made up for 80% of those incarcerated under crack cocaine related offenses⁶ (NAACP,2015). The data demonstrates the War on Drugs has resulted in unjustified racial disparities and counterproductive efforts to combat problems of drug use and trade.

The clear racial disparities are often an articulated point in defense of decriminalization. However, with the aim to reach the most justified response to how we regulate drug use, the defense for decriminalization of drugs is also problematic due to its failure to recognize implications that arise at the intersection of drugs and poverty. Although, it's reasonable to speculate Bennett was politically motivated in his speech, as he was the drug czar under the Bush administration⁷, nevertheless, he points to a critical gap in the methodology used in the philosophical debate for drug decriminalization. Namely, that philosophers have assumed drugs cause a static harm across all socioeconomic points and that the experience of freedom to use drugs is consistent across the board.

The problem for the methodology used in the debate for decriminalization, is that it does not consider how drugs have a different dynamic with individuals depending on their socioeconomic positioning. In this essay, I will argue that the methodology in the current philosophical debate for drug decriminalization is flawed because (A1) it disregards the experiences of the poor which results in misleading claims of harm and it (A2) attempts to universalize a freedom of drug use that is inconsistent with the experiences of the poor.

⁴ Kerby, S. (2012). The Top 10 Most Startling Facts About People of Color and Criminal Justice in the United States - Center for American Progress. Center for American Progress. Retrieved 16 March 2018, from <https://www.americanprogress.org/issues/race/news/2012/03/13/11351/the-top-10-most-startling-facts-about-people-of-color-and-criminal-justice-in-the-united-states/>

⁵ Alexander, Michelle. *The New Jim Crow : Mass Incarceration in the Age of Colorblindness*. New York : [Jackson, Tenn.] :New Press ; Distributed by Perseus Distribution, 2010. Print.

⁶ NAACP | Criminal Justice Fact Sheet. (2015). NAACP. Retrieved 16 March 2018, from <http://www.naacp.org/criminal-justice-fact-sheet/>

⁷ Bennett, W., Drug Policy and the Intellectuals. *The International Journal of Drug Policy*1990 1(6), 16–18.

In section 1.2, I will focus on argument (A1) and argue that the methodology for decriminalization has excluded the experiences of the poor. As a result, we've mistakenly concluded that drugs don't cause a significant amount of harm to justify legislation against its use. In section 1.3, I will move onto argument (A2), where I will assert that the methodology is erroneous because it universalizes a freedom of drug use that is inconsistent with the intersection of drugs and poverty. Having established my argument, I will then consider a counterargument in section 1.4. Where I raise concerns for the practicality of my proposed methodology. To which I will respond in section 1.5, by explaining questions of practicality are misguided in this discussion. Finally, in section 1.6 I will consider other areas of philosophy that can aid in further developing this discussion.

1.2 Misleading Claims of Harm

The first point in defense of decriminalization claims that drug use should be decriminalized because it does not cause a degree of harm that warrants its prohibition. In Douglas Husak's essay, *Four Points about Drug Decriminalization*, he explains the sale or production of illicit drugs is not the focus of his theory. Rather, the question of whether current legislation is justified in punishing drug use. Husak admits the sale and production of illicit drug use is a lingering issue when theorizing a justified approach to drugs but believes we are better off first focusing on the use itself independently from how it is supplied⁸ (Husak,2003). Although, current legislation typically pursues punishment through some form of incarceration, Husak argues any form of repercussion that is framed with the aim to punish drug use is unjustified. This may be problematic for the call to meet drug use with rehabilitation or minor fines because so far as those are principled in punishment they are unjustified. Although, intuitively rehabilitation and treatment efforts seem to be an appealing means for dealing with the drug problem, Husak remains firm to his claim that there is no reason to punish drug use itself, in any way. The main argument for why drug use should not be punished is because it does not cause harm on every occasion and so we cannot punish the mere (very unlikely) possibility of harm. Furthermore, when harm does arise from drug use it is not as detrimental as legislation has described it to be.

We have excellent reason to punish people who commit theft or rape. These offenses harm others by violating their rights. But this rational cannot explain why drug users should be punished. I do not think there is any sense of harm or any theory or rights that can be invoked to show that I harm someone or violate his rights when I inject heroin or smoke crack⁹ (Husak ,2003).

⁸ Husak, Douglas (2003). Four points about drug decriminalization. *Criminal Justice Ethics* 22 (1):21-29.

⁹ Husak, Douglas (2003). Four points about drug decriminalization. *Criminal Justice Ethics* 22 (1):21-29.

He further asserts this claim by suggesting the harm of illicit drug use is not as concerning as current legislation implies. He believes if drug use was as harmful as it has been depicted, criminalization is justified but that is not the case. Therefore, criminalization is unjustified.

I can certainly imagine a drug that people should be punished for using. Such drugs are easy to describe; they are vividly portrayed in great works of fiction. Consider the substance that transformed Dr. Jekyll into Mr. Hyde. If a drug literally turned users into homicidal monsters, we would have excellent reasons to prohibit its consumption. Fortunately, no such drug exists. In fact, I have never seen a persuasive argument for punishing persons who use any drug that I am aware is widely used for recreational purposes¹⁰ (Husak, 2003).

The claim by Husak is misleading, as it tramples on the experiences of the poor who are disproportionately impacted by the harms of illicit drug use. In his argument, Husak concludes that because illicit drug use does not cause a significant deal of harm we should decriminalize. However, at the intersection of poverty, illicit drug use is far more prone to result in prolonged addiction. This is primarily because the lack of economic opportunity and the lack of resources to connect with their respective social world in a healthy way. The result is significant harm to both to the user and the community.

To further understand how drastically the drug experience varies among different socioeconomic dimensions we can turn to the Rat Park Experiment¹¹ (Alexander, 1978), conducted by psychologist Bruce K. Alexander and colleagues from Simon Fraser University. The research was published in the early 80's and was aimed at better understanding the nature of addiction. The experiment consisted of two cages, the controlled model had a single rat in the cage. In it there was nothing more than two dispensers. One filled with water while the other was water laced with heroin or cocaine. Before, the experimental group was introduced this experiment had been conducted to see which water the rat preferred. And, as addiction is commonly understood, the rat would ultimately go with the drug laced water in every instance. With these results, Dr. Alexander wanted to see how (if, at all) socioeconomic factors interplayed with addiction. And so, in the experimental model (called "Rat Park Cage") there were the same two dispensers, with the same cage and a single rat. But it also had an attached cage that included a playground filled with toys for the rat as well as access to interact and mate with other rats. And what they found was that when the rat had access to these activities and interactions, they had the opposite response to the dispensers. They actually preferred the pure water over the drug laced water at every instance.

¹⁰ Husak, Douglas (2003). Four points about drug decriminalization. *Criminal Justice Ethics* 22 (1):21-29.

¹¹ Alexander, B.K., Coombs, R.B., and Hadaway, P.F. (1978). "The effect of housing and gender on morphine self-administration in rats," *Psychopharmacology*, Vol 58, 175–179.

But here's the fascinating thing: In Rat Park, they don't like the drug water. They almost never use it. None of them ever use it compulsively. None of them ever overdose. You go from almost 100 percent overdose when they're isolated to zero percent overdose when they have happy and connected lives..... what if addiction isn't about your chemical hooks? What if addiction is about your cage? What if addiction is an adaptation to your environment?¹² (Hari, 2015)

What we can gain from this research is that addiction is not as black-and-white as we've come to understand it. We've attempted to assign a binary explanation to drug use, addicted or not addicted. What the Rat-Park Experiment demonstrates is that methodology must be able to attend to additional powerful forces at work. Namely, socioeconomic factors. We must reshape the way we think about addiction if we want to go on to assess the harms of drug use. Current methodology in the philosophical debate for decriminalization has oversimplified the dynamics of drug use. But if environment significantly alters the experience of drug use, we must reshape the methodology to recognize this correlation.

Additionally, if we consider the parallel between the experiment to how addiction manifest in our society, the poor seem much more vulnerable to addiction because of their surroundings. The lack of economic opportunity in many of these poverty-stricken neighborhoods, the depleting educational structures, deprivation of fundamental utilities etc. all these factors further contribute to an intense battle against drug use that is uniquely experienced by the poor.

Unfortunately, the complications don't stop there. It's not just that those positioned in low socioeconomic communities are more prone to addiction, but addiction is also harder to overcome for the poor. The National Center for Biotechnology Information, conducted research aimed at better understanding what exactly goes on at the intersection of drug use and poverty (Heyman, 2013). Although, addiction has been commonly understood through a primarily biological stance, socioeconomic factors are just as capable of shaping the severity of addiction. When looking at individuals who fit into the DSM-5¹³ criteria for addiction (American Psychiatric Association, 2013) they found that a majority of classified addicted individuals tend undergo a phenomenon referred to as, Ageing out of Addiction¹⁴ (Heyman, 2013). Meaning around the age of thirty, individuals tend to successfully manage or quit their addictive behaviors, even without treatment¹⁵.

¹² Hari, Johann. "Everything You Think You Know About Addiction is Wrong". TED. June 2015. Lecture.

¹³ American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.

¹⁴ Heyman, G. M. (2013). Addiction and Choice: Theory and New Data. *Frontiers in Psychiatry*, 4, 31. <http://doi.org/10.3389/fpsy.2013.00031>

¹⁵ Heyman, G. M. (2013). Addiction and Choice: Theory and New Data. *Frontiers in Psychiatry*, 4, 31. <http://doi.org/10.3389/fpsy.2013.00031>

One can imagine it as if they naturally mature out of addiction. But there's a specific group that does not experience this natural shift in behavior. When comparing the two groups they found the difference was in the social connections present in the individuals lives. These social pressures tend to arise at a critical point of development of the frontal lobe, where your reason and your judgment forms (Heyman, 2013). At this point, most of us are experiencing our first job, starting college, joining these communities that provide us responsibility and purpose. These social pressures combat addictive behaviors.

Though advocates like to claim that addiction is an equal opportunity destroyer, in reality, it is far less likely to hit people who have stable, structured lives and decent employment than it is those whose lives are marked by uncertainty and lack of work¹⁶ (McKenna,2016) .

When individuals do not have economic opportunities or the means to connect with their social world in a healthy way, they don't have this force combating their addictive behavior. Ultimately, addiction is far more severe and aggressive in low socioeconomic communities.

Another example for how differently drug use manifest throughout low socioeconomic communities compared to the rest of the society, is the substance use patterns in the European Union during the 2008 economic crisis (Heyman, 2013). Data collected demonstrated an overall drop in substance use among the population, but this was entirely inconsistent with the pattern specific to individuals of low economic status¹⁷ (Heyman, 2013).In this specific subgroup they found that substance use had increased significantly.

The results show that effects of the recession need to be differentiated. A number of studies point to reductions in population's overall substance use. In contrast, an increase in harmful use and negative effects is found within specific subgroups within the society. Risk factors include job-loss and long-term unemployment, and pre-existing vulnerabilities¹⁸ (Heyman, 2013).

Misinterpreting the harm of illicit drug use is problematic because it leads to ineffective methodology to assess what exactly the drug problem entails. The methodology for decriminalization is not equipped to evaluate for the most justified solution for illicit drug use. Social positioning is fundamental to the nature of one's interaction with drugs. This point, I argue, has been completely neglected in the discussion of decriminalizing drugs.

¹⁶ McKenna, S. (2016). Most drug users stop without help, so long as they're not poor – Stacey McKenna | Aeon Essays. Aeon. Retrieved 16 March 2018, from <https://aeon.co/essays/most-drug-users-stop-without-help-so-long-as-they-re-not-poor>

¹⁷ Heyman, G. M. (2013). Addiction and Choice: Theory and New Data. *Frontiers in Psychiatry*, 4, 31. <http://doi.org/10.3389/fpsy.2013.00031>

¹⁸ Dom, G., Samochowiec, J., Evans-Lacko, S., Wahlbeck, K., Van Hal, G., & McDaid, D. (2016). The Impact of the 2008 Economic Crisis on Substance Use Patterns in the Countries of the European Union. *International Journal of Environmental Research and Public Health*, 13(1), 122. <http://doi.org/10.3390/ijerph13010122>

1.3 Freedom for All!... Except the Poor

The second point for decriminalization is from a libertarian perspective. This position argues that we are free agents and our autonomy should be respected even when it comes to drug use. Just as in the first argument, the harm of drug use is questioned. Illicit drug use is compared to other substances such as some pharmaceutical drugs, alcohol and tobacco, that we allow for despite their known harmful side effects. There is no major difference between these substances that justify why drugs are outlawed while the others are simply regulated. The major concern in this argument is the freedom of the individual. Although, there is a potential harm that comes with drug use, it is argued that it would incur within the users' own body. Therefore, we should have the freedom to assess those potential harms and decide whether we'd like to engage in drug use or not.

But drug use seems to be a paradigm case of a legitimate exercise of the right to control one's own body. Drug consumption takes place in and immediately around the user's own body; the salient effects occur inside the user's body¹⁹ (Huemer, 73)

The current debate for drug decriminalization assumes the freedom of drug use is a static experience across all socioeconomic dimensions. But when we consider how drastically drug use varies depending on one's surrounding, there is a need to distinguish between freedom to use drugs and the capacity to partake in drug use²⁰. To understand why this is necessary we can first look at how differently drug use has impacted low socioeconomic communities. For example, as explained in section 1.2, those who are in low income communities are more prone to addiction because they don't have social pressures to combat compulsive behavior. Drug overdose has also become increasingly more common among those with less than a high school diploma, reaching 50.3% for non-Hispanic white males in 2011, compared to 6.3% for non-Hispanic white males who received a bachelor's degree or higher²¹ (CDC, 2011). HIV rate is also significantly higher among individuals with an annual household income under 10,000, reaching up to 2.4% infected compared to .4% among those with an annual household income of 50,000 or more²² (Denning, 2017). With injection drug users noted as one of the highest impacted groups (Denning, 2017).

¹⁹ Huemer, M. (2008). The drug laws don't work. *The Philosophers' Magazine*, (41), 71-75.

²⁰ Thank you to Dr. Gasdaglis for suggesting this.

²¹ Center for Disease Control and Prevention (CDC), National Center for Health Statistics, "Compressed Mortality File 1999-2015," CDC WONDER Online Database, accessed at <http://wonder.cdc.gov/cmfi-icd10.html>, on Dec. 13, 2017; and Holly Hedegaard, Margaret Warner, and Arialdi Miniño, "Drug Overdose Deaths in the United States, 1999–2015," NCHS Data Brief, no 273 (Hyattsville, Md.: National Center for Health Statistics, 2017).

²² Denning, P., & DiNenno, E. (2017). Economically Disadvantaged | HIV by Group | HIV/AIDS | CDC. Cdc.gov. Retrieved 16 March 2018, from <https://www.cdc.gov/hiv/group/pover-ty.html>

These statistics demonstrate a great difference in how drug use impacts low socioeconomic communities compared to other groups. And so, in arguing for freedom to use drugs, there's an assumption that drug use unfolds similarly across the board. When we accept this assumption, we overlook harm resulting from drug use that is uniquely experienced by the poor. To fix this, we must do away with the universalization of a single experience of drug use. Assessing the intersection of drugs and poverty is achievable if we alter the methodology to differentiate between the freedom to use drugs and the capacity to manage this freedom.

To further demonstrate the downfall of universalizing freedom as a single experience, we can turn to the recent tobacco crisis. In many ways, tobacco allows us to preview what decriminalization would look like. There are regulations in place as far as smoke-free zones, age restrictions, safe sale enforcement²³ (tobacco21.org , 2018) etc. Nevertheless, adults have the freedom to use tobacco if they wish. And for the most part, they have chosen against tobacco as a recent wave of decline has demonstrated.

The nation seems to be kicking its smoking habit faster than ever before. The rate of smoking among adults in the U.S. fell to 15 percent last year thanks to the biggest one-year decline in more than 20 years ²⁴ (CBS News ,2016).

While most of the nation is celebrating this significant decline of tobacco use, the poor have continued to struggle with this substance. While only 15% of Americans still smoke, 73% of smokers come from low income communities (Wan, 2107).

Most of the country has quit smoking, saving millions of lives and leading to massive reductions in cancer. That is, unless those Americans are poor, uneducated or live in a rural area. Hidden among the steady declines in recent years is the stark reality that cigarettes are becoming a habit of the poor. The national smoking rate has fallen to historic lows, with just 15 percent of adults still smoking. But the socioeconomic gap has never been bigger²⁵ (Wan, 2017).

²³ State By State Tobacco Laws, Taxes, and Statistics. (2018). Tobacco 21. Retrieved 16 March 2018, from <https://tobacco21.org/state-by-state/>

²⁴ U.S. smoking rate does something it hasn't in years. (2016). Cbsnews.com. Retrieved 16 March 2018, from <https://www.cbsnews.com/news/us-smoking-rate-does-something-it-hasnt-in-years/>

²⁵ Wan, W. (2017). America's new tobacco crisis: The rich stopped smoking, the poor didn't. Washington Post. Retrieved 16 March 2018, from https://www.washingtonpost.com/national/americas-new-tobacco-crisis-the-rich-stopped-smoking-the-poor-didnt/2017/06/13/a63b42ba-4c8c-11e7-9669-250d0b15f83b_story.html?utm_term=.29b40a2dae90

This reality demonstrates an interesting dynamic. One that reflects the intersection of drugs and poverty. The literal freedom to smoke tobacco is consistent across the nation. But to make sense of the drastic outcome it has had for the poor, we must distinguish between the freedom itself and the capacity to manage the freedom. It seems to be that there is a significant difference between resources needed to mitigate the harms of drug use.

Unfortunately, the trouble doesn't stop there. With such massive declines in tobacco use, many have perceived this as a victory and efforts to combat tobacco have begun to decrease²⁶ (Wan, 2017). If we alter the methodology to attend to the capacity to act out such freedom we can better understand those caught in the intersection of drugs and poverty.

1.4 Counterargument: Concerns for Practicality

In response to the argument I've raised, those that support the traditional debate for drug decriminalization may have concerns for practicality of the methodology I've proposed. Because decriminalization takes form as legislation, there is good reason to question how functional this suggested methodology would be in creating laws and regulations. It seems unlikely to be able to center laws around the experiences of the poor as laws are meant to be universalized. Because I've highlighted a vulnerability to drugs felt uniquely by the poor, some may even wonder whether my argument would result in outlawing drug use for the poor but decriminalizing for the rich²⁷. This seems to be the conclusion from the findings I've discussed, and it seems far from practical.

To this point, I'd like to respond by referencing the example of Portugal's government approach to drugs. In 2001, Portugal decriminalized drugs along with legislation aimed at reducing harms of drug use²⁸ (Hari, 2015). This resulted in what could be described as a war against poverty. This is a subtle but significant point. When assessing the harms of drug use, Portugal government recognized that poverty was a driving force in the trouble arising from drug use. A point, I've argued, the current methodology in the philosophical debate for decriminalization is not set up to recognize.

²⁶ Wan, W. (2017). America's new tobacco crisis: The rich stopped smoking, the poor didn't. Washington Post. Retrieved 16 March 2018, from https://www.washingtonpost.com/national/americas-new-tobacco-crisis-the-rich-stopped-smoking-the-poor-didnt/2017/06/13/a63b42ba-4c8c-11e7-9669-250d0b15f83b_story.html?utm_term=.29b40a2dae90

²⁷ Thank you to Dr. Gasdaglis for raising this important point!

²⁸ Hari, J. (2015). Portugal Cut Addiction Rates in Half by Connecting Drug Users With Communities Instead of Jailing Them. YES! Magazine. Retrieved 16 March 2018, from <http://www.yesmagazine.org/peace-justice/portugal-cut-drug-addiction-rates-in-half-by-connecting-users-with-communities>

And so, along with decriminalization there was simultaneous enactment of legislation aimed at helping those who were most harmed by drugs. Welfare programs implemented did everything from incentivizing businesses to hire recovering addicts by paying half their wages to introducing a Guaranteed Minimum Income (GMI) to make sure no one was living under the poverty line ²⁹ (Hari ,2015).

They resolved to decriminalize all drugs and transfer all the money they used to spend on arresting and jailing drug addicts and spend it instead on reconnecting them—to their own feelings, and to the wider society. The most crucial step is to get them secure housing, and subsidized jobs so they have a purpose in life, and something to get out of bed for. I watched as they are helped, in warm and welcoming clinics, to learn how to reconnect with their feelings, after years of trauma and stunning them into silence with drugs ³⁰ (Hari, 2015).

The government of Portugal has seen great success in overcoming its drug related hardships with this harm reduction approach. Death by overdose has decreased and now ranks the second lowest among neighboring European countries (Ingraham, 2015). HIV cases dropped significantly from 1,400 in 2000 to 400 in 2006 ³¹ (Ingraham, 2015). Rehabilitation and treatment centers also saw a huge surge, with 400% increase of enrollment ³² (Ingraham, 2015). There was also major reduction in court traffic caused by drug related cases, with a 66% drop ³³ (Ingraham, 2015). Across the board, Portugal government seems to have successfully attended to the harms that arise from drug use and thoroughly understood the intricate dynamics of drugs throughout different socioeconomic points.

²⁹ Hari, J. (2015). Portugal Cut Addiction Rates in Half by Connecting Drug Users With Communities Instead of Jailing Them. YES! Magazine. Retrieved 16 March 2018, from <http://www.yesmagazine.org/peace-justice/portugal-cut-drug-addiction-rates-in-half-by-connecting-users-with-communities>

³⁰ Hari, J. (2015). Portugal Cut Addiction Rates in Half by Connecting Drug Users With Communities Instead of Jailing Them. YES! Magazine. Retrieved 16 March 2018, from <http://www.yesmagazine.org/peace-justice/portugal-cut-drug-addiction-rates-in-half-by-connecting-users-with-communities>

³¹ Ingraham, C. (2015). The EU country where drugs are decriminalised – and hardly anyone dies of an overdose. The Independent. Retrieved 16 March 2018, from <http://www.independent.co.uk/news/world/europe/portugal-decriminalised-drugs-14-years-ago-and-now-hardly-anyone-dies-from-overdosing-10301780.html>

³² Ingraham, C. (2015). The EU country where drugs are decriminalised – and hardly anyone dies of an overdose. The Independent. Retrieved 16 March 2018, from <http://www.independent.co.uk/news/world/europe/portugal-decriminalised-drugs-14-years-ago-and-now-hardly-anyone-dies-from-overdosing-10301780.html>

³³ Ingraham, C. (2015). The EU country where drugs are decriminalised – and hardly anyone dies of an overdose. The Independent. Retrieved 16 March 2018, from <http://www.independent.co.uk/news/world/europe/portugal-decriminalised-drugs-14-years-ago-and-now-hardly-anyone-dies-from-overdosing-10301780.html>

Considering the success of Portugal's model for decriminalization we can respond to concerns for practicality by arguing they are misguided. I am concern with whether the methodology in place is adequate to recognize the intersection of drugs and poverty as this is where the most severe harm is felt. What Portugal shows is that with correct methodology in place, we are better situated to assess the real problems rooted in drug use. Concerns for practicality dismiss the flaws of methodology and instead shift to question what this would look in motion. Although, this is relevant at some point in the discussion surrounding drug use, we must first be sure we are set up to accurately assess the issue at hand.

1.5 How Ideal v Non-Ideal Theory Can Help Further this Discussion

When theorizing the justified approach to drugs, the current methodology in the debate for decriminalization presents a very ideal way of looking at the issue. They assume individuals are positioned in a way to mitigate the compulsive behaviors induced by drugs. All possible deviations are adjusted for in order to imagine the way things ought to be. This is utilizing an Ideal approach to conceptualize the issue. The benefit is that we can isolate the problem of drugs and conclude whether drug use itself is problematic.

The problem to this is that by using an ideal approach to theorize justice we are supposed to disregard the deviations that have manifested in society. In Kevin Williams, *Why Ideal theory is not Ideal* (2018) he argues that instead of idealizing the approach we should shift to attend to the experiences in the world ³⁴. By starting here rather than at an idealized point we are better situated to map injustices and ultimately, work against them. Williams goes onto explain this may seem like a more grueling process, but it is one centered around the actual lived hardships. Indeed, it may take more effort but, in this way, we aren't trampling over the experiences of marginalized group. We are recognizing their positions, difficulties and needs (Williams, 2018) ³⁵.

Williams makes a great argument for why we should do away with Ideal theory and instead focus on Non-ideal theory when theorizing justice. His argument is relevant to criticizing the methodology of the current philosophical debate for drug decriminalization. It can also help us further understand the injustices that arise when approaching drugs from an idealized approach.

³⁴ Williams, K. "Why Ideal theory is not Ideal". Print. 2018.

³⁵ Thank you to my colleague Kevin Williams for sharing this point with me.

1.6 Conclusion

The current criminalization of drug use and trade has resulted in a great deal of injustice that has disproportionately impacted marginalized groups³⁶ (Kerby,2018). This reality has sparked a debate for the decriminalization of drugs. Namely, arguing that punishing drug use is unjustified because it is not a guaranteed harm and even in the few occasions harm does result from use, it is not any more harmful than other substances we already allow for and regulate³⁷ (Husak,2003). It is also argued that if individuals wish to use a harmful substance we should have the freedom to do so³⁸ (Huemer, 2008). The flaw I set out to address was in the methodology of the debate. The problem for the methodology used in the debate for decriminalization, is that it does not consider how drugs have a different dynamic with individuals depending on their socioeconomic positioning. My argument consisted of two main points. The first argued that methodology in the current philosophical debate for drug decriminalization is flawed because (A1) it disregards the experiences of the poor which results in misleading claims of harm. The second point argued that it (A2) attempts to universalize a freedom of drug use, that is inconsistent with the experiences of the poor. The methodology used for theorizing the injustices of drugs needs to be reshaped to capture the intersection of drugs and poverty. Although, my view is challenged by questioning the practicality of my proposed methodology. I respond to this by arguing that while questions of practicality are relevant at some point in the discussion, my argument is focused on reshaping the methodology used to arrive at our findings. Highlighting that this is the starting point, assessing practicality comes later down the road. I went on to consider how a different area of philosophy can further this discussion. With this said, I hope to have advocated for a perspective that is often undermined but extremely valuable to understanding how drugs interplay with our world.

³⁶ Kerby, S. (2018). *The Top 10 Most Startling Facts About People of Color and Criminal Justice in the United States* - Center for American Progress. Center for American Progress. Retrieved 16 March 2018, from

<https://www.americanprogress.org/issues/race/news/2012/03/13/11351/the-top-10-most-startling-facts-about-people-of-color-and-criminal-justice-in-the-united-states/>

³⁷ Husak, Douglas (2003). Four points about drug decriminalization. *Criminal Justice Ethics* 22 (1):21-29.

³⁸ Huemer, M. (2008). The drug laws don't work. *The Philosophers' Magazine*, (41), 71-75.

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Trazodone HCl provides sedation and improves handling in laboratory rabbits

Abstract

The unique metabolism, behavior, and fragile anatomy of rabbits (*Oryctolagus cuniculus*) can make sedation and safe handling a challenge. Trazodone hydrochloride (TZN), a selective serotonin antagonist and serotonin reuptake inhibitor has been administered and evaluated in two in-vivo laboratory rabbit trials (n=15 and n=18). In this first trial, a randomized double-blinded crossover study and aggression trial was conducted. Rabbits were given an oral dose of 20mg/ml TZN, and a significant decrease in their levels of tension (26%), struggling (38%), aggressiveness (81%), overall tractability (19%), and complete composite handling score (34%) was observed in comparison to the low decreases from the placebo group. Rabbits (n=18) in trial 2 were given either 80mg/ml TZN (Group A), 80mg/ml placebo TZN (Group B), or 40mg/ml TZN (Group C). Levels of sedation were similar in our second trial, most likely due to familiarity from the rabbits being handled and not a large enough sample size. Future studies include the addition of blood work on the prolonged usage of TZN in rabbits for further analysis of the effects, efficacy, and safety of TZN on rabbits.

Keywords: Trazodone; rabbits; placebo; tractability

Introduction

Domesticated rabbits (*Oryctolagus cuniculus*) are used in laboratories, harvested for food and are kept as pets. The introduction of new rabbits to an environment is often met with aggression and agonistic behavior and this is especially the case in the laboratory environment (Albonetti, Dessifulgheri, & Farabollini, 1991). Although social enrichment has been well-documented as beneficial to rabbits, high levels of aggression in laboratory rabbits can make it difficult for them to be socialized and/or housed together (Chu, Garner, & Mench, 2004; Valuska & Mench, 2013). Many environmental and developmental factors have been investigated and may play a role in that aggression (Andrist, van den Borne, Bigler, Buchwalder, & Roth, 2013; Farabollini, Albonetti, & Dessifulgheri, 1991; Rommers, Reuvekamp, Gunnink, & de Jong, 2014). Once familiarity and dominance has been established, agonistic behaviors generally decline (Albonetti, Dessifulgheri, & Farabollini, 1991). Practically, sedation is sometimes necessary to facilitate handling and minimize conspecific injuries, but in households with aggressive rabbits, there are few sedation options that are feasible and safe long-term.

TZN is a selective serotonin antagonist and serotonin transporter inhibitor (reuptake inhibitor) which has been used to treat aggression and anxiety in humans (Gedye, 1991; Mashiko, Yokoyama, Matsumoto, & Niwa, 1996; Wilcock, Stevens, & Perkins, 1987; Zubieta & Alessi, 1992). In veterinary medicine, TZN is used as a sedative in cases of feline travel and examination anxiety, and has also been found to be effective when treating anxiety and post-surgical activity in dogs (Gruen, Roe, Griffith, Hamilton, & Sherman, 2014; Gruen & Sherman,

2008; Orlando, Case, Thomson, Griffith, & Sherman, 2016; Stevens et al., 2016). TZN has been used as a safe option for multiple months or even years of treatment for dogs (Gruen & Sherman, 2008). In two studies, rabbits were used as a model organism for human biomedicine. In the study done by Yamamoto et al 1976, intravenous and oral trazadone were administered and in the study done by Das & Ghosal 2008, oral, intravenous, and transdermal trazodone were administered (Das & Ghosal, 2008; Yamato, Takahashi, & Fujita, 1976). The studies looked specifically at the pharmacokinetics of trazodone (metabolism, distribution and excretion) and also compared the efficacy of their transdermal administration, but no reference was made to the sedative properties of TZN in rabbits.

Hypothesis

We hypothesize that TZN will provide a low level of sedation, decrease rabbit activity, reduce both the duration and number of agonistic behaviors, and increase the latency time to aggressive behavior. We also hypothesize that rabbits will display an increase in heart rate while not inducing other abnormalities such as tachycardia, serotonin syndrome, fever, heart arrhythmias, or other known disorders.

Trial 1 Materials

- 15 Californian rabbit does housed in individual cages with cage cards. Water given ad libitum
- Pen for physical examinations and labeling treatment groups on cages
- Physical examination forms
- Ethogram records forms
- Aggression records forms
- 3 video cameras with tripods
- Weigh scale
- Stethoscope
- Rectal thermometer
- 1cc syringes
- 10 mg/ml Trazodone Hydrochloride
- 10 mg/ml Placebo
- Timer

Trial 1 Methods

Fifteen female New Zealand Rabbits (*Oryctolagus cuniculus*) were fasted overnight with water given ad libitum in order to standardize the rate of uptake of medication (Das & Ghosal, 2008; Yamato, Takahashi, & Fujita, 1976). The letters Q or X were randomly assigned to the 15 individual cages in our placebo controlled study: 8 were labeled Q (to receive 10 mg/ml TZN) and 7 were labeled X (to receive 10 mg/ml Placebo). To avoid biased results, it was kept unknown to us (until the time of analysis) which letters represented TZN and which one was the placebo, making this a double blinded study. Three video cameras on tripods were set up, each one facing the rabbit cages with their identification cage cards visible.

Early the next morning, a physical examination was performed on each rabbit by a veterinarian. As each rabbit was carried out of her cage and placed onto a weigh scale, her levels of tension, struggling/attempts to escape, aggression, and severe aggression/biting/attacking were each given a numerical score from 0-4 (0=absent, 1=mild, 2=moderate, 3=severe, 4=too severe to complete) by both a student assistant and the veterinarian. The same scoring system was applied throughout the entire physical exam by the veterinarian as he performed an examination of the head, eyes, ears, oral cavity, as well as recording observations on a thoracic auscultation, abdominal palpation, lymph node palpation, and taking the rabbit's rectal temperature. These procedures were done to maximize uniformity in the experiment and safety before administering Trazodone Hydrochloride (or a placebo) to each rabbit.

Following the examination, the rabbit was given an oral dose of liquid Trazodone Hydrochloride (10 mg/ml) or liquid placebo (10 mg/ml) according to which letter group (Q or X) the rabbit was previously assigned to; the exact amount administered varied slightly based on the rabbit's exact weight. The same student assistant who scored the rabbit previously will provide another tension and struggling score from 0-4 while placing it back in its cage. An overall tractability score will be given by the student and veterinarian based on a 0-7 scale (0=Unconscious with most reflexes absent, 1=Fully relaxed and with reflexes intact, 2=Weakly relaxed/easy to examine but not entirely relaxed, 3=Weakly tense, relatively easy to examine, pupils normal, 4=Very tense, pupils partially dilated, some difficulty in handling, 5=Fearful, pupils dilated, restraint needed to examine safely, 6=Very difficult to examine even with restraint, 7=unable to examine). The three video cameras in the room were turned on as the first rabbit was placed back in its cage to monitor any unusual behavior, indicating possible side effects for the 3 hours following drug/placebo administration. A timer was placed on the rabbit's cage and started once the rabbit is put back in its cage after drug/placebo administration to monitor when three hours has gone by. This process continued through all 15 rabbits.

The time to maximum concentration of Trazodone Hydrochloride (T max) is either 2 or 3 hours depending on the literature (Das & Ghosal, 2008; Yamato, Takahashi, & Fujita, 1976 respectively). The half-life of Trazodone Hydrochloride has been reported as 2.4 hours (Das & Ghosal, 2008) and 7 hours (Yamato, Takahashi, & Fujita, 1976). Because we aim to examine the rabbits at the estimated time of maximum drug concentration, we allow a three hour time frame before their reexamination. During these three hours, the rabbits are video recorded to monitor all activity, including periods of resting, sleeping, grooming, drinking, hopping, or any presence of abnormal behavior, as well as the time they started to the time they stopped each activity. Exactly three hours after drug or placebo treatment the animals will be removed from their cage and reexamined, following the same protocol and scoring system previously described (minus the drug treatment).

In the follow-up physical examination, signs of sedation were noted, as well as a presence/absence of any abnormalities which may indicate possible side effects from the drug. Each student assistant handled and scored the same rabbits as done previously to keep uniformity of the experiment and to limit any bias. Once the second physical examinations were performed on all rabbits (and each was proven to be healthy and displayed normal behavior), two rabbits were placed into a new cage together at the same time so as each rabbit is paired with one they have not had contact with before. While in their new cage, each rabbit was monitored for aggressive/agonistic behavior categorized as: attacking, biting, boxing, chasing, kicking, threatening, and other. The latency/onset until aggressive behavior was also quantified, as well as the duration of agonistic behavior. The physical examination, ethogram, and aggression sheets were organized by letter groups Q and X. The ethogram and aggression of group Q and X rabbits were compared to note any significant differences between the two. A comparison analysis was done on each rabbit's physical examination before and after their treatment was given. These analyses included: comparisons in heart rate, temperature, 0-4 behavioral scoring on all procedures, and overall tractability score. The data was inputted into an excel document to visually note any slight or drastic change in any of these areas. Bar graphs were used for each treatment group to compare the physical and behavioral values before and after treatment.

Trial 2 Materials

- 18 Californian rabbit does housed in individual cages with cage cards. Water given ad libitum
- Pen for physical examinations and labeling treatment groups on cages
- Physical examination forms
- 2 video cameras with tripods
- Weigh scale
- Stethoscope
- Rectal thermometer

- 1cc syringes
- 40 mg/ml Trazodone Hydrochloride
- 80 mg/ml Trazodone Hydrochloride
- 80 mg/ml Placebo
- Timer

Trial 2 Methods

Eighteen female New Zealand Rabbits (*Oryctolagus cuniculus*) were fasted overnight with water given ad libitum. Letters A, B, and C were randomly assigned to the 18 individual cages in our placebo controlled study: 7 were labeled A (to receive 80 mg/ml TZN), 4 were labeled B (to receive 80 mg/ml placebo), and 7 were labeled C (to receive 40 mg/ml TZN). Two video cameras on tripods were set up, each one facing the rabbit cages with their identification cage cards visible. The same protocol as in trial 1 was repeated with the exception of the ethogram and aggression components, and adjusted concentrations of TZN and placebo given based on the rabbits' A, B, and C letter assignment.

The physical examination sheets were organized by letter groups A, B, and C. A comparison analysis was done on each rabbit's physical examination before and after their treatment was given. These analyses included: comparisons in heart rate, temperature, 0-4 behavioral scoring on all procedures, and overall tractability score. The data was analyzed via an excel document to visually note any slight or drastic change in any of these areas. Bar graphs were used for each treatment group to compare the physical and behavioral values before and after treatment.

Results: Trial 1

Fig.1 TZN vs. Placebo tractability score comparison.

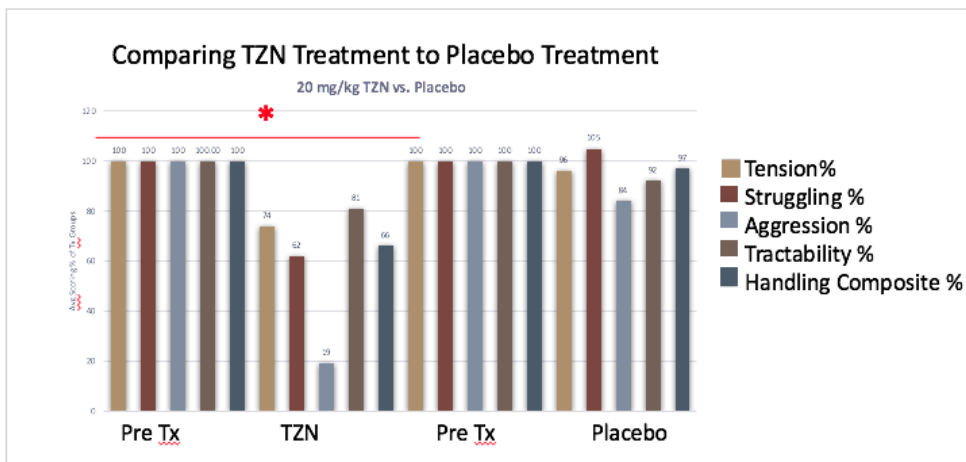


Figure 1 represents the results in comparison of the two treatment groups TZN and the placebo. TZN decreased the level of tension (26%), struggling (38%), aggressiveness (81%), overall tractability (19%), and complete a composite handling score (34%).

Fig.2 Placebo vs. Heart Rate Pre and Post Treatment

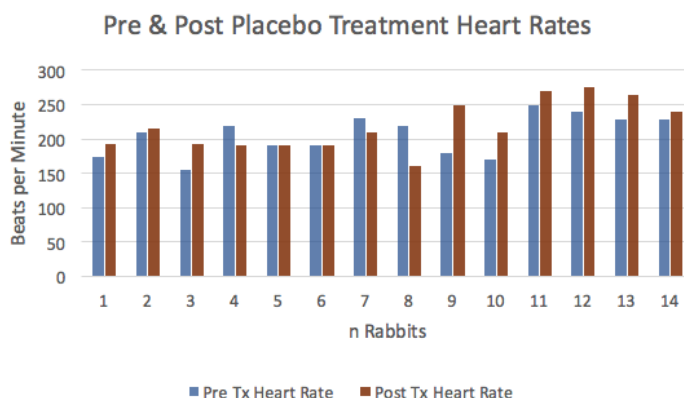


Figure 2 shows the differences in heart rate from the 14 rabbits that received a placebo treatment. There were slight increases and decreases in heart rate, but no significant changes present.

Fig.3 TZN vs. Heart Rate Pre and Post Treatment

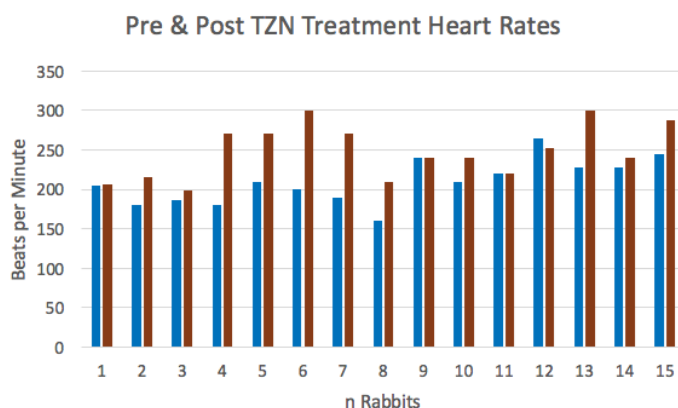


Figure 3 represents the 15 rabbits that received TZN treatment. From this bar graph, we can note that TZN induced a slight increase in heart rate but not significant enough to induce tachycardia.

Rabbits that received TZN showed a reduction in the levels of tension, struggling, aggression, and overall handling tractability compared to rabbits receiving the placebo ($P < 0.05$). Figure 1 represents the results in comparison of the two treatment groups TZN and the placebo. TZN decreased the level of tension (26%), struggling (38%), aggressiveness (81%), overall tractability (19%), and complete composite handling score (34%). Rabbits that received placebo had decreases in tension (4%), aggressiveness (84%), tractability (8%), handling composite score (3%), and increased struggling by 5%.

In the aggression trials, the rabbits who received TZN generally had a longer latency period before signs of aggression/attacking were present, if any at all. Some rabbits who received TZN showed 0 signs of aggression and instead displayed signs of submission and withdrawal to the other rabbit in the cage by lowering their ears to their body and remaining in a low stance. Rabbits who received only a placebo generally fought within 0-3 seconds after being placed with one another in the same cage, allowing their territorial nature to dominate.

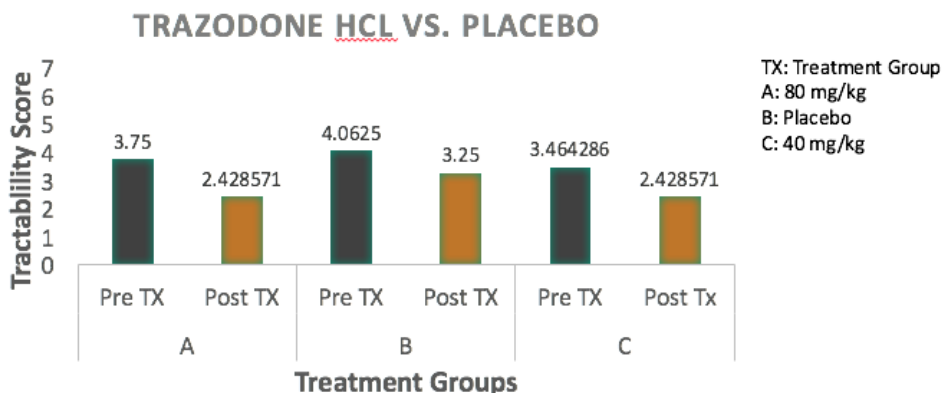
Viewing the rabbits for three hours each via video tapes during the ethogram portion of the protocol, revealed that when rabbits were housed individually post-treatment, there were no significant differences present in behavior based on the treatment administered. None of the rabbits displayed abnormal behavior such as digging on the wire bars, being overly hyperactive, or showing signs of discomfort. Rather, both treatment groups displayed long (up to 30 minute) periods of rest/sleep, self-grooming, regular periodic consumption of cecotropes, drinking water, stretching, yawning, lightly hopping around and sniffing the surrounding cage area. Based on previous experience of rabbit behavior, as well as observing these particular rabbits days before the experimental study, this behavior was concluded to be nothing out of the ordinary.

Discussion: Trial 1

According to Figure 1, the drops in tension, struggling, aggression, tractability, and overall handling composite score in the TZN treatment group compared to the placebo group indicate significant results. During the entire trial, we observed no signs of abnormalities nor side effects on either treatment group, showing the treatment to be safe thus far. Figure 2 shows the differences in heart rate from the 14 rabbits that received a placebo treatment. There were slight increases and decreases in heart rate, but no significant changes present. Figure 3 represented the 15 rabbits that received TZN treatment. From this bar graph, we can note that TZN induced a slight increase in heart rate but not significant enough to induce tachycardia. From this trial we conclude that TZN has shown to be an appropriate sedative and anti-anxiolytic for laboratory rabbits. TZN has displayed potential in reducing risk of spinal injuries and unnecessary stress for laboratory rabbits during handling or veterinary examinations.

Results: Trial 2

Fig.4. Combined Tractability of TZN vs. Placebo Pre and Post Treatment.



The greatest decrease in tractability to rabbits given TZN was observed in the treatment group C, that received 40 mg/kg TZN (70%). Treatment group A, that received 80 mg/kg TZN also showed a significant decrease in tractability (65%). Treatment group B, that received placebo had the greatest decrease in tractability score (80%).

Discussion: Trial 2

In a previous trial, we came to a conclusion that TZN significantly decreases tension, struggling, aggression, tractability scores (i.e. is calm, more relaxed), and the difficulty of handling in laboratory rabbits. These results suggest that TZN may be an appropriate sedative/anti-anxiolytic option for laboratory rabbits during handling or veterinary examinations. A second trial was conducted to test a variation of treatment doses and their effectiveness on handling laboratory rabbits during a physical examination. TZN had the greatest decrease in overall tractability in rabbits who received 40 mg/kg with a 70% decrease. Rabbits given 80 mg/kg of TZN also showed a significant decrease in overall tractability score but not as effective as the rabbits who received 40 mg/kg. Rabbits given placebo showed a overall decrease of 80% in tractability. While the group of rabbits treated with placebo had the largest decrease in tractability scoring, group B only had four rabbits in comparison with treatment groups A and B which had seven rabbits. Therefore, we can conclude that the sample size contributed to the skew in the tractability score between placebo and TZN treatments. In conclusion, the most effective dose of TZN to give laboratory rabbits during an exam was 40 mg/kg.

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Grief-Related Consumer Vulnerability: The Case of Funeral Planning

Abstract

The death of a loved one is a vulnerability that virtually every person will encounter, and yet the funeral planning process is relatively unknown before experiencing it directly. Consumers are often unnecessarily upsold on funerals due to a lack of information or lacking motivation to comparison shop. To empower grieving consumers, and counteract funeral homes taking advantage of the situation, the Federal Trade Commission (FTC) enacted the Funeral Rule. During their annual compliance checks, the FTC found that many funeral homes failed to comply with the regulations set by the Funeral Rule. This exploratory research seeks to better understand the decision-making process of a grieving consumer while they make one of the largest expenditures of their lifetime, during a time of high stress and increased vulnerability. Through personal interviews, the authors qualitatively explore awareness of the Funeral Rule, and whether they were exposed to violations of the Funeral Rule guidelines. We will discuss whether or not consumers felt taken advantage of by the funeral planning industry, and what issues arose during the planning process. In our interviews, we use the three primary psychological needs from Self-Determination Theory as a framework to explore the satisfaction with their decision-making during the funeral planning, and the process as a whole.

Introduction

The United States funeral market is a \$20 billion a year industry. American funerals typically involve burial or cremation with the typical price range of \$8,000-\$10,000. The asymmetry in knowledge between the funeral home and the consumer allows for extreme markups on things like coffins, urns, and other services. Funerals in American culture are often one-time events that don't account for the ongoing nature of grieving. Funerals in American culture are often inauthentic, and don't provide an opportunity for genuine healing (Romanoff and Terenzio, 1998).

According to Gentry et al. (1995), One of the most disruptive transitions faced by a household is the death of one of its members, which causes a discontinuity in household consumption patterns. The death of a loved one causes a deterioration in decision-making skills at a time when one is typically less equipped to handle new consumer roles and financial burdens. Funeral planning can be difficult to navigate, especially when experiencing grief. Making decisions that are often a financial burden on the deceased's family or loved ones, in addition to the stress and heartache felt from the loss of someone dear puts consumers in a more vulnerable position.

Consumer Vulnerability

Definitions of consumer vulnerability have changed over time. Earlier approaches focused on personal characteristics of members who belonged to groups that were often stigmatized and experienced difficulty with their roles as consumers due to their age, race,

sexual orientation, social class, or ethnicity (Adkins and Ozanne, 2005). In particular, work focused on consumers with characteristics that were deemed to be disadvantaged or vulnerable such as the poor, elderly, or ethnic minorities (Andreasen, 1976). Contemporary understandings of consumer vulnerability recognize that the interaction between market and consumer characteristics can place any individual at risk of vulnerability (Brennan et al., 2017).

According to Baker, Gentry and Rittenburg, internal and external factors both can contribute to the experience of vulnerability (2005). This definition emphasizes the individual experience of vulnerability and defines vulnerability as a state, instead of a status. Defining vulnerability on the basis of who experiences it implies that the members of that defined class are always vulnerable. According to Ringold (2005), defining consumer vulnerability as a state means that vulnerability is not just equated with demographic characteristics when there is no empirical basis for it. In contrast, defining vulnerability as a state, based on difficult situations, clarifies that anyone is capable of encountering vulnerability.

Vulnerability can range from a temporary situation to an enduring condition (Gentry et al. 1995). Some consumers are at risk for a limited amount of time, such as those going through a divorce (McAlexander et al., 1993) or those who have a lack of access to technology (Hogg, Howells, and Milman, 2007). Others are targeted due to their potential lack of understanding or emotional state, such as indebted students being aggressively targeted by the credit card industry (Mierzewski 2002), to parents targeted by emotional cues in ads (Stanton and Guion 2013). Such consumers are otherwise believed to be competent in the marketplace. After a period of vulnerability, they are likely to learn from their mistakes and become less prone to encountering negative outcomes (Ringold, 2005), or they develop coping mechanisms to deal with their circumstances (Mansfield and Pinto, 2008).

At the other end of the spectrum, some consumers experience vulnerability of a more permanent nature, such as impoverished consumers with diminished access to goods, (Hill and Stephens 1997) the blind (Rinaldo, 2012), or developmentally disabled consumers (Brenkert 1998). The enduring vulnerability of those with permanent conditions is why Commuri and Ekici (2008) argue that a class-based view of consumer vulnerability should not be abandoned in favor of an exclusively state-based view. An integrative view of state and status provides a proactive tool for marketers and policy makers in their efforts to protect and to empower vulnerable consumers.

The varying definitions of what it means to be a vulnerable consumer gives some insight into the multidimensionality and complexity of the experience. Vulnerability is an interaction of an individual's circumstances and the market, such as the marketplace experiences of consumers with visual impairments (Baker et al., 2001), or the experiences of low literate consumers (Adkins, 2005) and their ability to process and understand the Nutrition Facts panel label on products (Viswanathan, Hastak, and Gau, 2009). Consumer vulnerability can be a shared experience within a community as found by Baker, Hunt, and Rittenburg, (2007) in their study of the recovery process of Wright, Wyoming after a tornado. Victims of natural disasters experience vulnerability together because of geographically

-induced threats to health and safety, in addition to destruction of material possession, financial struggles, and loss of life (Baker et al., 2007).

Consumer vulnerability is defined by Baker, Gentry, and Rittenburg (2005, p. 134) as “a state of powerlessness that arises from an imbalance in marketplace interactions or from the consumption of marketing messages and products.” This definition of a vulnerable consumer moves beyond personal characteristics into a multidimensional interaction of individual circumstances and the external conditions of the market. According to Baker et al. (2005), vulnerability is more about the situation the consumer is in than who the consumer is, emphasizing vulnerability as a state and not a status. This suggests that all of us have the potential to be vulnerable when placed in a consumption situation in which one has little control.

Consumer vulnerability may occur when a consumer is unable to accomplish his or her goals in a consumption situation due to being powerless, or out of control. The disorientation experienced causes people to have little desire or ability to act in their best interests.

“Consider also the Appalachian poor consumers Lee, Ozanne, and Hill (1999) discussed. The experience of vulnerability in health care for these consumers was clearly tied to service providers being insensitive to their needs and abilities. These consumers were treated as “disempowered victims” and were unable to control their surroundings, thus contributing to their lack of control, which defines their experience of vulnerability (Lee, Ozanne, and Hill 1999) (Baker, Gentry, and Rittenburg, 2005, Pg. 132).”

The experience of vulnerability was tied to how sensitive the health care service providers were to the needs of the poor consumers. The Appalachian poor consumers felt less in control of the situation. The lack of control contributed to the experience of consumer vulnerability. When circumstances may become too overwhelming to cope with in any positive way, an individual’s motivation may be negatively affected.

Much research has been done in search of defining what it means to be a vulnerable consumer, but there is a lack of understanding as to what motivates consumers while they are in a vulnerable state. Baker, Gentry, and Rittenburg, (2005) stated that experiences of consumer vulnerability are closely tied to self-perceptions of one’s competence in handling a consumption situation. The lack of fulfillment of basic psychological needs might be hindering consumers from developing coping mechanisms to deal with experiencing vulnerability. In addition to making policies to protect vulnerable consumers, searching for ways to help consumers overcome temporary vulnerability through their psychological needs could be a way to counteract their experiences in the marketplace.

Self Determination Theory

Self Determination Theory (SDT) is a theory of motivation that focuses on the reason that people are motivated instead of the amount of motivation. Ryan and Deci (2008) state

that the type or quality of a person's motivation predicts many important outcomes such as psychological health and well-being, effective performance, creative problem solving, and deep or conceptual learning. Central to the SDT framework is the relationship between need-fulfillment and motivation.

The three primary psychological needs that must be met in order for people to experience fulfillment with their existences are (Ryan and Deci, 2002):

- (1) relatedness or intimate and long-lasting connections to important others,
- (2) autonomy or perceptions of power/control over one's actions, and
- (3) competence or belief in one's capability to perform essential tasks.

According to this definition, something is a psychological need when its satisfaction promotes psychological health and its thwarting undermines psychological health (Ryan and Deci, 2002). Autonomy involves acting with free will and having the experience of choice (Gagne and Deci, 2005). The concept of autonomy support means that an individual in a position of authority acknowledges the other's feelings, and provides the consumer with relevant information and opportunities for choice, without the use of pressure or intimidation. The opposite of that would be the authority using coercion to control or pressure others to behave in certain ways. Competence is characterized by a sense of proficiency or effectiveness in the things one engages in (Ryan and Deci, 2008). Relatedness has to do with the development and maintenance of close personal relationships and belonging to groups. Ryan and Deci's (2000) state that an individual's motivational state is a reflection of the degree to which their three innate psychological needs for competence, autonomy, and relatedness are satisfied.

Self-Determination Theory has been applied as a framework to understand motivation in a variety of fields. For example, SDT has been used to try to find ways to overcome men's unwillingness for seeking professional help for physical and emotional distress (Worthy et al., 2017). The effects of instructors' autonomy support have been studied to understand students' autonomous motivation on learning organic chemistry (Black and Deci, 2000). In addition, applying self-determination theory to educational settings has led to productive changes in the way we view student learning, explaining that students benefit when teachers support their autonomy and that autonomously-motivated students thrive (Reeve, 2002).

SDT has been applied to organizations in human resource development (Rigby and Ryan, 2018), and studying the psychological adjustment to retirement through the satisfaction of the three basic psychological needs (Houlihan et al., 2014).

Self-determination theory has been frequently applied to the areas of health, education, work, and sport, but it has also been used as a framework to study the internalization of political values (Losier et al., 2001) and whether Catholics are more motivated by guilt than Protestants (Sheldon, 2006). The role of self-determined motivation was used to understand the goals and drive of international students, and what helps them adapt to new environments (Chirkov et al., 2007).

SDT has also been used in the entertainment industry to investigate the motivational pull of television dramas (Adachi et al., 2018). SDT has been used in designing video games for motivation and engagement (Peters and Ryan, 2018), and the study of how video games draw us in and hold our attention. (Rigby and Ryan, 2011).

Ryan et al. (2008), proposed that the satisfaction of three fundamental psychological needs of autonomy, competence, and relatedness leads to improved mental health lowering depression and anxiety. Satisfaction of the three needs has been associated with levels of exercise among overweight individuals who participated in an exercise program (Edmunds et al., 2007 and behaviors such as attendance at dental clinics, and taking steps to improve dental health (Halvari et al., 2010).

When health care practitioners have been trained to support the patients' psychological needs, it has been documented that there were significant changes in the patients' motivation, and well-being. Follow-up treatments have generally supported the long-term effects of supporting the psychological needs of the patients. (Ng et al., 2012).

Self-Determination Theory has been used to understand the experience of navigating and overcoming many difficult situations. However, it has not yet been applied in understanding the motivation for consumers to overcome a state of vulnerability. SDT can be used as a framework to find ways that consumers in vulnerable states are lacking in motivation and to help find techniques to fulfill their psychological needs.

When planning a funeral, consumers experience a loss of an intimate connection, and are put in a situation that they have little to no experience in. They might feel pressure from relatives, from the expressed desires of the deceased, a funeral director, or even the stress of not knowing what their loved one may would have wanted. Planning a funeral has the potential to be a situation where consumers experience a lack of all three of the psychological needs described by Ryan and Deci, resulting in lack of motivation to overcome their vulnerable situation potentially prolonging their duration in that position.

Funeral homes not providing opportunities for consumers to explore their options or pressuring people to choose more expensive options or service bundles neglects the need for autonomy, or the perception of control over one's actions. The funeral home using aggressive sales techniques or lacking emotional support for the grieving consumer instead of conveying empathy for the challenges associated with funeral planning decreases the fulfillment of relatedness, or the desire to feel understood and cared for by others. Not allowing people to receive the necessary information concerning the laws surrounding funeral planning, or presenting prices in a deceptive manner inhibits the need for competence, or belief in one's capability to perform essential tasks (Ryan and Deci, 2000).

Funeral homes have the ability to cause more psychological harm to the grieving consumer if they engage in deceptive practices, and inhibit any of the primary psychological needs for well-being. In essence, experiencing loss and having to deal with one of the largest expenditures of one's lifetime at the same time, might lead to a lack of fulfillment in all three of the primary psychological needs that are necessary to feel a sense of fulfillment with one's existence.

Death in America

The United States funeral market is a \$20 billion a year industry. American funerals typically involve burial or cremation with the typical price range of \$8,000-\$10,000. According to the CDC, there are an average of over 2 million deaths a year in America. The cost of funerals has increased nearly 1,328% in just four decades, and with the expected number of Americans 60 and older by 2020 being 73 million, more attention should be paid to the practices of the funeral industry.

In an ideal world, funeral directors would only engage in behavior that increases the well-being of the person planning the funeral. They would be comforting to the families, and find the lowest cost options for the expressed desires of the consumer. However, funeral homes have an economic incentive to take advantage of the increased vulnerability of the grieving consumer. Insurance or will beneficiaries often receive more money than they had ever had at one time. As a result of large sums of money given to beneficiaries at a psychologically vulnerable time, the funeral industry developed lavish funeral rituals and the cost of planning a funeral skyrocketed (Gabel et al., 1996).

Funeral homes sometimes fail to voluntarily inform the consumer of all the information they need to know to make a well-informed decision. For the consumer to become knowledgeable in these matters they would have to take initiative and find the information elsewhere. Extensive research by the consumer on the laws regarding the funeral industry is not likely considering the emotional and psychological state of the grieving consumer. It would seem that the best form of consumer protection would be for death care buyers to make decisions before the products and services are needed. However, consumers are reluctant to do so or resist, creating a situation that increases the potential for their own exploitation (Kopp and Kemp, 2007).

Funeral planning as a time of consumer vulnerability

Planning a funeral for a loved one is a consumption situation in which one might feel inexperience or lack of control. According to Gentry et al. (1995), One of the most disruptive transitions faced by a household is the death of one of its members, which causes a discontinuity in household consumption patterns. The death of a loved one causes a deterioration in decision-making skills at a time when one is typically less equipped to handle new consumer roles and financial burdens. Funeral planning can be difficult to navigate, especially when experiencing grief. Making decisions that are often a financial burden on the deceased's family or loved ones, in addition to the stress and heartache felt from the loss of someone dear puts consumers in a more vulnerable position.

Planning a funeral requires making important and often burdensome financial decisions while dealing with the confrontation with mortality and the loss of power one feels when experiencing grief. Experiencing loss and having to deal with one of the largest expenditures of one's lifetime at the same time, might lead to a feeling of helplessness and an inability to believe themselves capable of performing essential tasks. The death of a family member or other loved one can result in disorientation and instability, increasing the affected individual's vulnerability, and reducing his or her ability to make decisions or conduct routine consumer

activities. “During the grieving period individuals have limited desire or ability to protect their own interests. Decision making is impaired, and susceptibility to fraud is enhanced” (Baker, Gentry, and Rittenburg 2005). For many survivors, the loss is of such magnitude that their life processes seem to shut down or change. The trauma and stress that comes with experiencing the death of a loved one makes survivors a very vulnerable segment of the population.

Most of the individuals taking on these responsibilities cannot learn from experience, as they are unlikely to face these challenges more than once or twice in a lifetime (Quilliam, 2008). The responsibility of planning the funeral and managing the affairs of the deceased often falls to family members who are unlikely to have prior experience with the process (Kopp and Kemp, 2007). For many people planning a funeral is a new experience, and it is made more difficult by the lack of assistance from the funeral industry. Useful information is often not readily available and consumers are left to navigate the maze of figuring out what tasks need to be done, and how much the total cost will be on their own. Until they make an appointment with a funeral director some of the information is hard to find anywhere else.

Death is often seen as a taboo topic of discussion for people, which makes it harder to know how similar other people’s experiences are to one’s own. If people are uncomfortable talking about their funeral planning experience, the knowledge doesn’t get passed on to others and the cycle of confusion, intimidation, and stress continues for first-time funeral planners.

Grief-related vulnerability eventually lessens, but during the liminal period, individuals have limited desire or ability to protect their own interests. Decision making is impaired, and susceptibility to fraud is enhanced (Baker, 2005). In a study done by McGraw et al. (2016), findings showed that when purchasing items symbolic of love, respondents chose higher prices, higher quality items over equally appealing lower price, lower quality items. Respondents searched less for lower priced items, and were less willing to negotiate prices. When a purchase is symbolic of love, such as a funeral or a wedding, people are reluctant to seek cost saving options. Since consumers are less likely to search for lower priced items, it is likely that they will spend more money than is necessary even if equivalent quality lower cost items are available in the marketplace.

In the same study, when either money or love was omitted from the decision context, people were more likely to engage in trade-off reasoning. In order to avoid painful monetary trade-offs, people did not engage in cost-benefit reasoning. People spend more money than if they engaged in trade-off based behaviors, such as seeking lower cost options or requesting lower prices (McGraw et al., 2016). For consumers who are already having trouble making ends meet, the cost of making purchases of items symbolic of love over a lifetime for weddings, funerals, birthdays, and anniversaries could add up to a significant expense. (McGraw et al., 2016).

The need for someone to manage posthumous affairs will not go away. By 2040, it is projected that the number of deaths will increase exponentially as members of the Baby Boom generation begin to die (Kopp and Kemp, 2007; National Center for Health Statistics 2006). The role of handling the deceased’s affairs increasingly falls to family members or

friends who are unprepared for the responsibilities. Consumers can be uninformed in dealing with their finances and plans for their own funeral. When loved ones die, these same consumers are often required to manage someone else's affairs at a time when they are least able to handle the added responsibilities (Quilliam, 2008).

Although the number of third party providers in the funeral industry is increasing rapidly and providing less expensive alternatives to consumers, the availability of more alternatives may not benefit the at-need consumer when he/she may not be rational (Kopp and Kemp, 2007). More options sometimes make it more stressful for people to choose. Even if there are less expensive alternatives, sometimes people still feel the pressure to purchase higher priced items or services in order to avoid looking like they don't care as much for the deceased. Some funeral homes offer lavish, elaborate services at a premium price. This can be challenging for people on a budget to deny because of the love and emotional attachment for that person. "Unlike other major purchases, those for death-related goods and services occur at times of both new consumption roles (e.g., widow, widower, single-parent) and great anxiety and emotional instability. "Relationships that are lovingly complex during life become reduced to package deals. As a society, we've lost the knowledge of caring for our own dead. People feel that they are unable to do anything for a departed friend except spend money so they spend as much money as they can, and then, after the event, feel unfulfilled as well as broke" (Carlson, 1991).

The funeral planning process is a vulnerable situation for consumers. Consumers suffer from the grief and loss of a loved one, and are put in a position of limited understanding. Consumers have to face an industry that they have little experience dealing with, and pay large amounts of money at a time of increased stress. Policies such as The Funeral Rule have been enacted to protect consumers, but awareness of the rights that consumers have are relatively unknown by the average person. If consumers aren't aware of the protections set in place, funeral homes have the opportunity to take advantage of people without knowledge of their rights.

"The Funeral Rule"

Those making funeral decisions may be under time pressure and significant emotional duress, so that they may be considered vulnerable (Gentry et al. 1995). As a result of this, the funeral industry is regulated at the state and federal levels. In 1984, the Funeral Industry Practices Rule, or Funeral Rule, was put into effect by the Federal Trade Commission. "The Rule is premised on the assumption that careful, informed purchase decisions in this expensive product category are difficult because of the emotional stress, time pressure, and lack of familiarity with the available goods and services." (Kopp and Kemp, 2007). Based on these assumptions, the Funeral Rule prohibits funeral homes from certain practices and requires them to comply with others. The Funeral Rule asserts that consumers have the right to choose the funeral goods and services they want. Funeral providers must state this right in writing on the general price list (GPL). If state or local law requires the purchase of any particular item, the funeral provider must disclose it on the price list, with a reference to the specific law (Kopp and Kemp, 2007). Funeral homes are required to provide three price lists: the GPL, the casket price list, and the outer burial container price list. The GPL must be given

to anyone who asks, in person, about funeral goods, funeral services, or the prices of such goods or services. The Rule explicitly requires that the pricing information also be provided over the telephone.

Recognition of the fragile state of mourners is the foundation for the Funeral Industry Practices Rule of the Federal Trade Commission (Kopp and Kemp 2007). The Federal Trade Commission found during their yearly inspection of funeral homes around the country, that 1 in 4 funeral homes did not comply with the guidelines set by the Funeral Rule. Therefore,

In conclusion, since many consumers are not aware of their protections, and some funeral homes are not complying with the guidelines set in place to protect those consumers, consumers planning a funeral are still at risk to be taken advantage of. More steps should be taken to increase awareness of the Funeral Rule in order to decrease the vulnerability of the person planning a funeral. Self Determination Theory could be used as a framework to be aware of the psychological needs of grieving consumers, and to develop ways to protect the consumer from being taken advantage of. Taking the psychological needs of consumers into consideration could ease the stress of making a big expenditure while grieving, and motivate consumers to find ways to cope with the funeral planning process, and to ideally find a way to end the period of increased vulnerability.

Grief can take years to overcome, and even then, it is sometimes a life-long journey of recovery from the loss of a loved one. It is important to make laws that protect consumers from being advantage of during the funeral planning process. However, since grief can be long-lasting, it is worth analyzing the psychological impact that funeral homes can have on the vulnerability of a consumer if they inhibit them from fulfilling their basic needs.

Methodology

Data Selection

A total of 20 semi-structured interviews were conducted ranging from 25 minutes to 2 hours. We used convenience sampling to identify interviewees that had been in charge of, or part of planning a funeral for a family member or a loved one. The participants selected ranged in age from 24-72 years old. To obtain further subjects we used snowball sampling, that is: the first round of interviewees were sent a recruitment email which they then passed on to other potential interviewees that they knew.

Table 1. Participant Demographics

Name	Gender	Age	Funeral Type	Relationship of Deceased
Rick J.	Male	57	Cremation	Son
Audrey R.	Female	73	Burial/Cremation	Daughter/Ex-Wife
Camila R.	Female	56	Burial	Daughter
Diana J.	Female	24	Cremation	Daughter
Rachel C.	Female	59	Burial	Wife

Interview Protocol

After we received approval from our Institutional Review Board, an interview script was used to collect data from interviewees. The participants gave their consent to be audio recorded for the purpose of the interview. The interviews began with questions addressing relative neutral information about the interviewee's consumption behavior. Participants answered questions, such as (a) Do you consider yourself a comparison shopper? (b) Do you consider yourself an impulse buyer?

The interviews then explored the participant's interaction with the funeral home including whether they were provided with pricing information, brochures, and product lists. We explored the views and experiences of consumers through the funeral planning process. In particular, we probe for awareness of the Funeral Rule, a Federal Trade Commission mandated protection that requires funeral homes to provide an itemized price list of services offered. During their annual compliance checks, the FTC found that in 2015 to 2016, 31 of the 133 funeral service providers that were inspected failed to comply with the regulations set by the Funeral Rule. Even though rules and regulations were set in place to protect consumers from being taken advantage of by the funeral industry, many consumers are not aware of those protections and still are vulnerable.

Within our interviews we discussed whether or not consumers felt taken advantage of by the funeral planning industry, and what issues arose during the planning process. We explored consumers' psychological states during the experience of planning a funeral, and connected it to self-determination theory in order to create a framework to better understand consumer vulnerability in this specific situation.

Coding Procedures and Data Analyses

Using the QDA Miner software package, we descriptively coded data and examined how frequently different codes occurred simultaneously to identify patterns and themes. The participants selected for further analysis were:

- Rick J., a 57-year-old male who had been in charge of his father's funeral arrangements.
- Audrey R., a 73-year-old female who had planned funeral services for both her parents, and her ex-husband, as well as for herself in pre-arranged form.
- Camila R., a 56-year-old female who had recently made burial arrangements for her mother.
- Diana J., a 24-year-old female who was responsible for her father's funeral arrangements.
- Rachel C., a 59-year-old female who coordinated her husband's funeral and made pre-arrangements for her own.

The interviews of the chosen participants were then analyzed using Self-Determination Theory as a framework to explore the connection between the experience of funeral planning and whether the basic psychological needs defined in SDT were fulfilled. Questions were asked that related to each of the three basic psychological needs: autonomy, relatedness, and competence. The interviewees were asked questions such as (a) whether they had a support system (relatedness), (b) whether they felt that they had enough information to make decisions (competence), and (c) if they felt that the funeral home respected their expressed desires (autonomy).

Research Findings:

Consumer Vulnerability

Consumer vulnerability may occur when a consumer is unable to accomplish his or her goals in a consumption situation due to being powerless, or out of control. The informants had a loved one die, and were placed in a situation where they felt disoriented and had little to no experience. Having to make decisions while being in a state of increased stress and grief put them in a vulnerable position. Many of the informants were unprepared for the role mentally and financially.

Most of the informants went into the experience of planning a funeral with expectations that the funeral home would try to take advantage of them or at the very least be aggressive with their sales techniques. Most of the informants took someone with them in preparation, or went with the mentality that they would have to defend themselves or their loved ones from being taken advantage of by the funeral home.

The negative stereotype of funeral homes makes it more difficult for consumers to go into the funeral planning process feeling comfortable. One of the informants, Rick J., compared funeral home employees to used car salesmen referring to aggressive sales techniques and relentless attempts to upsell.

“At one point, if I remember correctly I just had to say ‘You know what, don’t bother trying to upsell us anymore. If you know we’re missing something then inform us, but if not let’s stick to what we have.’”

Another interviewee, Rachel C., went with her mother to a funeral home and had such a bad experience with the employee trying to sell additional items or services to them that Rachel’s mother made the extreme choice of cancelling her late husband’s memorial service.

“It was just very insensitive. It was the pushing, pushing, pushing, and so we ended up not doing a service. My mom just wasn’t up for it.”

Many of the informants mentioned feeling rushed to make decisions. They did not blame the funeral home but instead stated the urgency of the situation as being the cause of the stress. They felt rushed by the idea that you have to bury or cremate someone soon, even though in some parts of the world if someone dies in the winter, they will wait weeks or even months until the ground isn't as hard and cold to bury someone. Some funeral homes close down in the winter and open up again in the spring to a backlog of burials. In New York, the bodies of people who die in the winter are stored in cemetery vaults and at funeral homes until it is warm enough to dig into the earth (NYT, 2005). In California waiting to bury someone isn't very common, and so the sense of urgency might be stronger. None of the informants mentioned wanting to delay the funeral, but they did mention feeling stress due to the short amount of time they had to plan the funeral.

Although the interviewees did not blame the funeral service providers for putting pressure on them, they still felt rushed to make plans because of the natural breakdown of the body after death, and because of family members coming in from different parts of the country for the funeral. Camila R.'s sister came in from a different state to plan their mother's funeral, and they did not seem to consider delaying the burial as an option.

“Plus, time is an issue too. You only have a certain amount of time to get everything together. My sister was here from Ohio so there's only a certain amount of time together. I just felt that we had to get her buried. I really only remember considering where she was going to be buried.”

Consumer desires to expedite the funeral planning process often leads into opportunistic situations for funeral service providers. Many of the interviewees stated a desire to get the process over with, and felt as if decisions needed to be made within a short timeframe. This puts consumers in a position of vulnerability, in which they are in a hurry to end the discomfort so they might make rash decisions or choose services or products without putting much thought into it.

Most of the informants were not expecting the deaths of their loved ones at that time, and were caught off guard. They then had to plan a funeral and make quick decisions without knowing with certainty what their loved one would have wanted. All five of the interviewees' loved ones had not done any pre-planning and did not discuss what they wanted for funeral arrangements while they were alive. The interviewees had to plan the funerals based on the way their loved ones lived their lives.

Each of the respondents mentioned ways to overcome the time-related pressure they experienced. They came to the individual conclusions that quick decisions could be avoided through pre-planning. Camila R., Rachel C., Rick J., and Audrey R. each began pre-planning for their own funerals after going through the funeral planning process. Their desire to pre-plan their own funerals was in the interest of keeping their family members from experiencing the same stress that the informants had experienced.

The search for peace of mind

Most of the interviewees did not resent the funeral homes but did have some sort of frustration with family members, or were upset with the funeral home for trying to be pushy with their family members.

It didn't seem as if the informants believed that the way funeral homes conduct themselves should change or could change. They instead came up with ways that a consumer can protect themselves against the funeral homes, not necessarily how funeral homes can change their methods. Informants stated that pre-planning is the way to avoid aggressive selling techniques or the stress of making decisions in a hurry. Most informants did not have their own funerals planned at the time of their loved ones' death. 4 out of 5 of these interviewees went on to plan their own funerals after their experience. The only one that didn't do that was 20-year-old Diana J., perhaps because she does not feel a sense of obligation due to not having a spouse or children yet.

The informants stated that they did not want their spouses or children to go through what they went through and felt an obligation to protect them from inheriting the responsibility. The informants felt that being in that situation or role is not something that they want others to go through.

There has been a cycle of having funeral planning be something that is passed on to the next generation, but in this case the informants wanted to break the cycle and release the next generation from that unwanted role. This might lead to a change in the way that funeral homes conduct business if more funerals are pre-planned. If consumers pre-plan their funeral, they will have more time to comparison shop and make decisions without feeling rushed. This could be an interesting shift in consumer behavior that would lead to less people being taken advantage of even without further policy reform in the funeral service industry.

Awareness of protection

The informants were asked if they were aware of The Funeral Rule before or after the funeral planning process. None of the informants were aware of the Funeral Rule or any of the protections set in place by the Federal Trade Commission. In addition, none of the informants had looked into the protections that are set in place for consumers concerning funeral planning. Some interviewees stated that they did not feel taken advantage of, but went on to say that making decisions during that time is stressful and hard. It is unrealistic to expect consumers to want to learn or research about funeral planning for others, when many have not even considered planning for themselves.

The interviewees were shown a printout of the Funeral Rule guidelines that funeral homes have to comply with. Funeral homes are not required to specifically disclose the Funeral Rule to consumers but they are required to have certain disclosures on the General Price List that all consumers must receive.

The Funeral Rule requires you to make six disclosures on your General Price List. These disclosures discuss:

1. The consumer's right to select only the goods and services desired
The first disclosure informs consumers that they have a right to select only the items they want to buy, besides a non-declinable basic services fee.
2. Embalming
The second disclosure tells consumers that the law usually does not require embalming.
3. Alternative containers for direct cremation;
The third disclosure informs consumers that they may use alternative containers for direct cremations.
4. The basic services fee
The fourth disclosure tells consumers about any "basic services fee will be added to the total cost of the funeral arrangements.
5. The Casket Price List
The fifth disclosure tells consumers that a Casket Price List is available.
6. The Outer Burial Container Price List.
The sixth disclosure informs consumers that an Outer Burial Container Price List is available.

Each informant perceived that the respective funeral homes complied with the funeral home guidelines. Despite not being able to remember receiving a price list specifically, all of the informants stated that they believed that the funeral home abided by the Funeral Rule guidelines. Based on the interviews, it seems as if the funeral homes did comply with the guidelines, even if they did not explicitly mention the Funeral Rule.

Self-Determination Theory

Most of the informants felt competent during the decision-making process. When asked if they felt that they had enough information to make decisions, all of the informants agreed that the funeral home provided them with enough information about the prices and options available. None of the informants mentioned feeling that they were not capable of planning the funeral or performing the tasks that needed to be done.

Most of the informants felt in control of the situation and did not feel pressured by the funeral homes to choose different products. The funeral homes seemed to respect the desires and choices of the informants. The exception was Rachel C.'s mother being overwhelmed by the aggressive approach of the funeral home employee, which led to the cancellation of the funeral service.

The informants kept suggesting that consumers are not in a place emotionally or mentally to be informed. They did not place the blame of the stress on the funeral home, they instead were resentful of either doing it by themselves,

or the lack of participation from family members.

“It was like a nightmare to like to put on a face and like, get stuff done. but I did that because I felt like no one else was doing that.”

Consumers cannot pass off the responsibilities if there is no one to take on the role other than themselves. The informants didn't seem to be blaming the funeral home for any emotional distress. Instead, they seem to be blaming themselves or family members who didn't step up during the process. Most of the informants recommended taking someone else to the funeral home for support. The informants that had taken someone with them for support, had a more positive experience at the funeral home.

The informants' suggestion of taking someone with you to a funeral home implies that they do not believe themselves capable of handling all the stress by themselves or that they desired someone to share the burden with. They didn't seem to expect the funeral service industry to change the way they deal with consumers, instead recommending approaching the funeral planning process with a support system.

The search for relatedness seems to be the strongest psychological need stated in Self-Determination Theory for the interviewees during the funeral planning process:

1. If they received support from someone they were very grateful for it.
2. If they didn't believe that someone was doing their part, they were very resentful of that.
3. They recommend taking someone with you to the funeral home.

It could be that the loss of a loved one augments the need for relatedness, and that is why the informants placed such an emphasis on this part of their experience as opposed to mainly discussing what their interactions with the funeral homes were. The semi-structured interviews were conducted to explore the interactions between the interviewees and the funeral homes. Since the interviews were on such a sensitive subject, the respondents were given the ability to lead the conversation in the direction of what that they felt was the most impactful part of their experience. The interviewees answered the questions on vulnerability and Funeral Rule compliance, but then would head back into discussing their relationships with their families and whether or not they felt supported by them.

Diana J. was very resentful of her step-mother not playing a more significant role in the planning stating that the things that her step-mother chose were unimportant things or were “whatever.” She also thinks that her step-mother's grieving was “over the top” and that her step-mother was putting on a show. Diana J. felt a strong sense of obligation at the age of 20 to be in charge of planning her father's funeral. She felt a strong desire to honor her father's memory, but she also acted out of indignation and lack of belief that her step-mother would be capable of planning the funeral by herself. Despite feeling resentment toward her step-mother, Diana J. mentioned being upset that her step-mother didn't take on more responsibility.

Rick J. did not think that taking someone with you is a good idea, but he also said multiple times that he did not have the chance to grieve at all even to this day. Perhaps Rick J.'s lack of connection or support system during that time is what made him feel unable to grieve since he states that having to be strong for his mother made him miss out on the "luxury" of grieving. Rick J. felt that taking on the role of being a support system for his mother meant that he would not be able to or allowed to grieve for his father.

Conclusion

The informants had a complicated relationship with the idea of planning a funeral. All of the informants were willing to plan the funeral for their loved ones, but it isn't a situation that they would willingly place themselves into had the funeral not been for someone that they really cared about.

Even though each individual is willing in a certain sense, to undertake the task of planning a funeral for their loved one, it is nonetheless a task which most are reluctant to tackle of their own accord. The informants chose to plan the funerals out of a sense of obligation to their family. Informants mentioned the responsibility "falling on them". Rick J. felt that other family members that could've taken the roles were too emotional, and decided to take the lead in order to spare his mother and siblings from the situation. The obligation to fulfill one's perceived duty to the deceased often overshadows the ability to allow or ask others to step in and help with the funeral planning process.

Our interviews revealed that relatedness seems to be the most important psychological need for the informants. The informants would answer questions about their interactions with the funeral homes, and then transition into talking about their experience with their support system or lack thereof. The lack of a support system seemed to overshadow the interaction with the funeral home.

None of the informants were aware of the Funeral Rule or any funeral industry regulations. The informants were not taken advantage of by the funeral home in the sense of being lied to about state or federal requirements, or not being given clear price information. However, they were not knowledgeable about their rights when it comes to the funeral service industry. The consumer's lack of information concerning funeral service regulations doesn't seem to be an issue when the funeral home complies with said guidelines. The problem for the consumer is when the funeral home does not abide by the rules. The combination of lack of experience, lack of knowledge, and increased stress can be a very vulnerable situation for the consumer. If the funeral homes choose to violate the rules set by the Federal Trade Commission, many consumers would not even be aware.

When the informants were shown a printout of the Funeral Rule they did not recognize the rules, but they were glad to know that the protections existed. The public policy recommendations from this research would be to increase awareness of the Funeral Rule to empower consumers. If consumers know that there are protections set in place for them while funeral planning, it might give them a sense of security. The informants wanted someone to go with them to the funeral home because they felt intimidated or that they were likely to get taken advantage of. If they feel confident in themselves and knowledgeable in the regulations

that funeral homes must follow, perhaps consumers will not feel the need to take someone else with them as strongly.

The funeral service industry is viewed by consumers as an opportunistic and sometimes even predatory business. Even though the informants stated that they did not feel taken advantage of, most of them still highly recommended taking someone with you, and that if funeral plans were made in advance, they would be less likely to be taken advantage of. It is unfortunate that consumers have to feel on edge and prepare themselves to defend against the practices of the funeral industry during such a vulnerable time.

Limitations and Future Research

Self-Determination Theory was used to understand the motivation for consumers to overcome a state of vulnerability. Our findings showed that the informants that had a support system, or had the psychological need of relatedness even partly fulfilled had a better overall opinion of their funeral planning experience than others who mentioned a lack in that area. However, our sample size being small and consisting mainly of middle class Americans over the age of 50, means that the generalizability of our finding to the general population is restricted. Future research efforts could investigate the differences in motivation in other cultures or other age groups.

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The Relationship Between Language Brokering and Pro-Social Behaviors Among Latina/o College Students

Abstract

The psychological literature has historically ignored the contributions immigrant children make to their families in the US. One example of such understudied contribution is language brokering (LB). That is when children of immigrants translate and interpret for their non-English speaking parents and other members of the family. Child brokers interpret in a variety of situations including doctor's office, government agencies, supermarkets, and department stores. They also translate documents such as, bank statements, letters from school, TV shows, etc. Research on LB is growing and illuminating the relevance it has on the child who plays this role and overall impact on the family. One question that remains unanswered is how LB may facilitate or impact the broker's pro-social behaviors. Hence, the purpose of this study was to test how the different components of LB (i.e., translating, interpreting, and feelings) may predict to pro-social behaviors among Latino college students who are active brokers. A sample of 678 participants answered a demographic questionnaire, the Language Brokering Scales, and the Prosocial Tendencies Measure. To answer our research question, we will run a series of correlations and hierarchical regression analyses. Ideas for theory, practice, and future research will be addressed

Major Objective:

The purpose of this study is to address the gap between constantly translating/interpreting and prosocial development and investigate how different dimensions of language brokering influence the prosocial development in Latino college students.

Background and Literature Review:

The Latino population in the US has been growing over the past several decades; from 2004, the population has increased from 13% to 17%, an increase of 9 million people (Excelencia in Education, 2015). Currently, they are the second largest racial/ethnic group in the US. There are numerous nationalities that classify as Latinos, and amongst these 53 million Latinos, 64% of Hispanics were of Mexican descent, 9% Puerto Rican, 8% Central American, 6% South American, 3% Cuban, and 9% from other places of origin. Similarly, college enrollment rates among Latinos has also increased over the decades from 54 to 70 percent, with higher numbers of students attending right after high school than White and African-Americans (Excelencia in Education, 2015). Evidently, the increase in Latino population and improved opportunities led to the yearning and prospect to attend higher education and obtain a college degree. This group of Latino students represents different generations, whether they immigrated or are the children of immigrants. More specifically, in 2007-2008, 21% of Latino undergraduates were immigrants, 45% were second-generation Latino Americans, and 33% were a third or higher generation Latino Americans (Excelencia in Education, 2015).

When coming to the US, Latino immigrants often require assistance in communicating because they may not have command of the English language. This type of barrier results in children of immigrant families to perform as translators and interpreters, or language brokers. Language brokering can be described as when youth “interpret and translate between culturally and linguistically different people and mediate interactions in a variety of situation” (Dorner, 2008, p. 516). Language brokers interpret/translate different forms of information and in many situations, such as legal documents, doctor visits, and parent-teacher conferences (Harper & Pappas, 2011). Language brokering is essential for the survival of non-English speaking immigrants, and has impact on family relationships, and the development of the children who played these roles (Kam, 2011).

The majority of immigrant children report translating or interpreting for their family even if they are not fluent in the second language. They are children of immigrants trying to fulfill their role in their family. Child language brokers are typically either born in the US or immigrants to the US like their parents. The age at which most language brokers typically start acting as language brokers typically ranges from age 8-12 and continuing onto adulthood. Children and adolescent language brokers tend to have a unique set of characteristics than non-language brokers for they have different roles and responsibilities, usually highly important. Reports demonstrate that language brokers illustrate numerous special characteristics, such as being confident, extroverted, respectful, obedient, good-natured, friendly, sociable, good at listening, detailed, and fluent in English and Spanish as well as a tendency to emphasize feelings and emotions when translating (Granillo, 2011). Language brokers come in a variety of forms: they are grade-school students, college students, working sons/daughters, professions, and variations of any of these (Granillo, 2011).

Latino language brokers in particular, are significantly influenced by family because their close family bonds and cultural orientation (Lazarevic, 2012). Typically, among Latino culture interdependent values are emphasized. First and second-generation Latino children tend to adopt their parent’s values of respect for elders and obligation to assist their families as much as possible (Guan, 2014). This phenomenon leads to children of immigrants to feel responsible to take on tasks that will help the family (Guan, 2011). Some of these obligated tasks include and are not limited to translating for parents or other family members, spending time with family, helping around the house, taking care of siblings, and making financial contributions to the family (Sy, 2008). These obligations may also influence immigrant children to develop the role of a language broker (Sy, 2008). Ultimately, the greatest effect immigrant families may have on child brokers is on their development. Immigrant young adults may be trying to define their independence while they are expected to contribute to their family (Lazaric, 2012).

Strong bonds and high degree of closeness can describe immigrant families, including Latinos. Research on immigrant families shows that immigrant youth place higher values on family than US youth. *Familismo*, a cultural value emphasizing family closeness and loyalty, is an important concept in most Latino cultures. It requires a family member to put the needs of the family first, even if it means making personal sacrifices emphasis placed on prioritizing family needs over personal needs (Sy, 2008). Conversely, research has shown that immigrant children have different perception on their family roles and feel obligated to assist their family over anything else compared to US born children (Lazaric, 2012).

Some researchers assert that a strong ethnic identity, like that of Latinos, is related to stronger family obligations (Lazaric, 2012), thus, why language brokering is taken seriously amongst those brokers, and is why the role is often given to the eldest child.

Language brokering can lead to the development of prosocial behaviors, which are defined as “the intent to help or act in the benefit of others regardless of the reward gained (e.g., recognition, self-satisfaction, monetary compensation) (Guan, 2014, p. 334).” Empathy is the emotional response associated with prosocial behaviors and this may explain why brokers tend to volunteer and help when they are needed, especially as they get older. Prosocial behaviors may prove to be culturally bound to the Latino community because Latinos tend to be more interdependent than other races/ethnicities in the US (Guan, 2014, p. 333). This cultural lifestyle may be an influencing factor for Latino students demonstrating prosocial behaviors. Additionally, language brokers may feel more empathy because they know of their parents’ language struggles.

There can also be positive and negative effects to language brokering; for example, if an individual finds translating burdensome, then they may also feel poorly about themselves, low in self-esteem and in self-efficacy (Weisskirch, 2012). However, if they enjoy the experience, then they may feel good about themselves as manifest in high self-esteem and self-efficacy (Weisskirch, 2012). Furthermore, brokering may also enhance cognitive and social skills because brokers use linguistic, social, and cultural skills in their translating/interpreting interactions, which they eventually expand beyond the family onto the outside world in social settings (Guan, 2014). Ultimately, depending on the individual, it can have negative and positive effects on a person’s self-esteem, which may lead positive or negative social skills.

Language brokering may have a noticeable impact on social development of those who play this role. Studies have found that students who broker demonstrate more skills that emulate the qualities educators look for in gifted and talented students (Harper & Pappas, 2011; Valdes, 2005). Therefore, language brokering may have an impact on intelligence and positive skills that can be used socially as the person grows and develops. These are important skills that can be utilized as the individual establishes personal relationships, networks, connections, or in their career (Harper & Pappas, 2011).

The literature presented demonstrates the importance of conducting research on language brokering among immigrant communities. Specifically, language brokering scholars continue speculating how constantly translating and interpreting may influence brokers’ prosocial development. Thus, the purpose of this study is to address this gap and investigate how different dimensions of language brokering influence the prosocial development in Latino college students. We hypothesize a positive relationship between language brokering and prosocial behaviors.

Method:

Participants

A sample of 737 adult Latina/o college students participated in an online study. The

students come from two large 4-year public universities in the west coast of the US. Participants' age ranged from 18 to 47 years of age with a mean age of 21 (SD = 3.44). The majority of the participants were female (80%, n = 595). The vast majority of the participants were born in the US (74%, n = 544). About 76.5% (n = 564) of the participants reported Spanish as their first language. In terms of class status, 34% (n = 254) were in their senior year of college 28% (n = 206) junior year, 21% (n = 153) sophomore year, 16% (n = 114) freshman, and 1% (n = 10) graduate. Participants reported starting to translate as early as 5 years of age (10%, n = 87) with mean age at 9 years (SD = 3.27). Responses on when was the last time participants translated included, less than a week ago (53%, n = 388), one to two weeks ago (24%, n = 176), three to four weeks ago (13%, n = 93), two months ago (3%, n = 21), three months ago (2%, n = 15), six months ago (2%, n = 16), and 1 year ago (3%, n = 24).

Measures

Language Brokering. The Language Brokering Scale was developed by Tse (1995) and later revised by Buriel et al. (1998). The scale consists of four subscales including: (a) persons for whom one has brokered (people), (b) places where one has brokered (places), (c) things brokered (things), and (d) one's feelings about brokering (feelings). The people subscale consists of 10 questions asking participants how often they translate for their family, friends, neighbors, teachers, and strangers using 0 (never) to 3 (always) scale. The places subscale asked participants to choose yes or no to 12 places they may have brokered. Due to the complexities and intricacies in brokering in certain situations, a 1 to 3 scale is used. For example, a score of 3 given to answering "yes" to translating at the hospital because it requires interpretation and translation of sophisticated medical terminology, a score of 2 is given to translating at the post office, and a score of 1 is given to translating at a restaurant which requires translating and interpreting information that a broker is more familiar. A "no" response is given a score of 0. For the things subscale, participants had to answer yes or no to 12 things they may have brokered. Similar to the previous subscale, a 1 to 3 scale was used. A score of 3 given to answering "yes" to translating insurance forms, which require a higher level of vocabulary, a score of 2 is given to translating credit card bills because the vocabulary is less complex, and a score of 1 is given to translating over the phone because of the everyday vocabulary.

Pro-social Behaviors. The Prosocial Tendencies Measure (Carlo & Randall, 2002) was used to assess participants' prosocial behaviors. The scale consists of 23 items using a 1 (does not describe me at all) to 5 (describes me greatly) scale. Six types of prosocial behaviors subscale scores can be calculated including, altruistic, compliant, emotional, dire, public, and anonymous. Previous studies with culturally diverse college students and adolescents using the Prosocial Tendencies Measure have reported high internal consistency alpha coefficients for the total scale (Carlo, Knight, McGinley, Zamboanga, & Jarvis, 2010; Carlo, Hausmann, Christiansen, & Randall, 2003; Carlo & Randall, 2002). In this study, the internal consistency coefficient for this scale was $\alpha = .80$.

Procedure

To participate, students had to self-identified as Latina/o, enrolled as a full-time college student, and have translated and/or interpreted for their family members at least once in the past year. Upon approval of the two universities' Internal Review Board, an online survey was created. We used the online survey service, Qualtrics to collect the data. The link to the survey was posted on the online subject pool through the departments of psychology from the two universities. This program allows researchers to collect data from students enrolled in Psychology courses who have to participate in research as part of their class requirements or for extra credit. The link to the survey was also emailed to professors at the two universities from different disciplines. Coordinators of cultural centers were also contacted and asked to forward the link to their respective listservs. Informed consent was obtained from all participants. The online survey remained active for a period of 9 months and it took approximately 20 to 25 minutes to complete.

Summary of Results

The results showed that all four dimensions correlate to the Pro-Social Tendency Measures (PTM). After running a multiple regression to look at how each of the different dimensions of Language Brokering (LB) predicted Pro-Social Behaviors, we found that two significant predictors of Language Brokering were experiences with people and feelings. More specifically, the more experiences with people, the more likely to demonstrate prosocial behaviors. Also, the more positive feelings associated with Language Brokering, the more likely to demonstrate prosocial behaviors. To sum up, LB is an intense and emotional experience leading to prosocial behaviors, and LB allows for exposure to different people also leading to prosocial behaviors.

Discussion

Significant limitations to the study was that it is female dominated sample with 80% (n=595) and a college sample (more educated sample). In future research, we will address the lack of balance between male and female sample and look into a participant with more diverse levels of education. Further, we will conduct a qualitative follow-up study to understand if gender roles in Latinx families have an effect on language brokering and the development of prosocial behavior. We will also conduct a quantitative study to assess mediators and moderatos that may have been present in the current study. For example, we can look into birth order and if it has an effect on language brokering responsibilities and prosocial behaviors.

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Spanish Heritage Language Processing: Using Rosetta Stone to impact Heritage Spanish

Abstract

Throughout history, millions of individuals migrated to United States of America, bringing along their native language. When Heritage Spanish Speakers are born, they are typically exposed to their family's language and the country's majority language. In the academic system of United States of America, minority languages are treated as "foreign" with a negative connotation. As a result, many heritage speakers do not continue learning their heritage language and become more dominant in the majority language, English. The goal of this study is to start investigating if and to what extent engaging in furthering Spanish through a computerized program (i.e., Rosetta Stone) will affect proficiency levels for Heritage Spanish Speakers (HSS). Moreover, in line with recent findings that show that short, intensive exposure to a new language modulates cognitive performance, we will test whether the process of engaging in relearning the heritage language leads to similar effects. The study will be a pre-post between-group design. We plan to test and compare performance between the participants who further their Spanish skills through Rosetta Stone.

Author Keywords

Heritage Speakers, Spanish, Rosetta Stone, bilingual

Introduction

Throughout the history of United States of America, different ethnic populations have immigrated bringing along not only their cultures, but their native language as well. In United States of America, there exists at least two types of minority languages (Montrul, 2011). The first includes indigenous languages that have become the minority where a new majority language exist (Montrul, 2011). For example, Native American Tribes and their languages have become the minority to English in United States of America. The second type, which this study will focus heavily on, is "languages spoken by groups of immigrants who move to a host country where another majority language is spoken" (Montrul, 2011). For example, individuals from South America who immigrate bring their native language to United States of America.

When the minority language is exposed to the majority language, a certain linguistic shift begins to occur. The children from monolingual parents in the language minority groups are now exposed to two languages during the developing process. This situation has an enormous impact on the children's oral, audio, and grammatical ability (Polinsky, 2011). These bilingual children are known as heritage speakers. According to the Valdes definition, a heritage speaker is "a student who is raised in a home where a non-English language is spoken, who speaks or merely understands the heritage language, and who is to some degree bilingual in English and the heritage language" (Valdés, 2000).

In United States of America, different minority languages are treated as “foreign”, especially in academic settings. For example, Jim Cummins explains that the term heritage language in the United States, “refers to the languages of immigrant, refugee, and indigenous groups” (Cummins, 1995). Thus, the United States School System develops programs to “Americanize” heritage speakers by transforming fluent speakers of foreign languages into monolingual English speakers (Cummins, 1995). Consequently, heritage language speakers understand from a young age that school is an English-only zone and develop shame in their linguistic and cultural language (Cummins, 1995).

In United States of America, languages such as Spanish continue to persevere in the country because of the continuous immigration, but the pattern of declining bilingualism shows that heritage languages do not survive intergenerational transmission. The pattern of declining bilingualism can best be explained as a linguistic cycle when the family transitions away from their heritage language and into the dominant language. The cycle starts with first-generations. The first-generation immigrants tend to preserve full command of their native language as they learn the majority host country language since it is assumed that they established a linguistic foundation in their native country (Montrul, 2011). For example, a Mexican immigrant, who spend most of their linguistic development time in Mexico, came to United States of America. They are considered first-generation immigrants. This individual would usually be monolingual and very dominant in their Spanish ability. Second-generations are children of the first-generation immigrants or immigrant children who come to the host country before age of 5 (Montrul, 2011). Second-generations have the most variability in bilinguals’ ability and undergo dramatic linguistic change because they have been exposed to two dominant languages at a young age: their family’s language and their country’s language (Montrul, 2011). As a result of its covert English-only language policies and wanting to fit in into society, the second-generation heritage speaker becomes dominant in the majority language by the time they reach young adults (Montrul, 2011). Due to this rapid shift, the heritage speaker is now a native speaker of the majority language by the third generation and the heritage language is no longer used in the family by fourth and subsequent generations (Montrule, 2011). This transformation of the heritage language being replaced for the dominant language illustrates the end of the pattern of declining bilingualism.

Given few language opportunities for the child to use or become literate in their heritage language, the child’s heritage language begins to undergo gradual attrition over its life-span. Polinsky compared child and adult heritage speakers who have a comparable language learning background and that arrived in the country at roughly the same age or were born there (Polinsky, 2011). The results of that study revealed that heritage children perform equivalent to monolingual children, but heritage children outperform heritage adults; therefore, the linguistic knowledge of adult heritage speakers shows significant degradation (Polinsky, 2011). If a language is not properly used, the heritage speaker starts to undergo gradual attrition. As Polinsky described, “In the absence of sustained input and without the influence of the dominant language, their heritage language system undergoes restructuring” (Polinsky, 2011). This means that language is extremely flexible and can undergo dramatic changes to the point where it undergoes gradual attrition. This may explain the pattern of declining bilingualism, and the declining proficiency in the heritage language.

My research will focus on the linguistic and cognitive effects that relearning of the heritage language has on heritage speakers. More specifically, in this study, I seek to investigate to what extent engaging in relearning Spanish through a computerized program, such as Rosetta Stone, will affect proficiency levels for Heritage Spanish Speakers (HSS). Additionally, a second goal of the study, will be to investigate if active relearning of the heritage language modulates non-linguistic cognitive functions such as memory and cognitive control. Recent evidence has indeed suggested that a short but intensive period of learning of a new language shapes cognition (Bak et al., 2016).

In the current literature, the definition of heritage language varies from very broad to very narrow (Montrul, 2011). As Montrul states, “unlike monolingual children, the range of linguistic ability and proficiencies reached by the heritage language speakers in the adulthood varies considerably- from minimal comprehension ability to full fluency in written and spoken registers, and everything else in between” (Montrul, 2011). Under this framework, having a very narrow language ability means that the individual is more dominant in the family’s minority language; in contrast, having a very broad language means that the individual is more dominant in the language of the local environment (Montrul, 2011).

For the purpose of this research, I will be aiming at working with individuals who are closer to the narrower scale. Ideally, these individuals will have had the most exposure to the heritage language from a young age. The idea that early language exposure shapes its processing has been supported by a large body of literature demonstrating that individuals categorize languages already prenatally and in the first stages of life. For example, newborns learn to group speech sounds into consonants and vowels during their first year (Au, 2002). Moreover, past literature has demonstrated that overhearing any language regularly during childhood helps heritage speaking and monolingual adult learners to speak that language with a better accent later on (Au, 2002).

Methods

Participants

The sample (N = 30) will consist of participants who are Heritage Spanish Speakers (HSS) and will vary in gender, age, and college grade level. Participants will be recruited on campus through snowball methodology, and flyers (attached under subjects). The study will also be contacting University Clubs and Societies, that might have a large number of Heritage Spanish Speakers, through email. All participants will be part of the Voluntary samples. Participants will be chosen depending on their level of proficiency in Heritage Spanish. In this research, we are looking for individuals located around the conversant spectrum; these individuals are not proficient in Spanish, but have a decent level of understanding in Spanish, such as speaking and/or writing. Participants who are closer to the narrower scale of conversant spectrum will be chosen to continue the study. Also, we will place all the names of willing participants into a hat and chose 15 random sampled names to be in the control group and 15 random sampled names to be in the experiential group.

Procedure

Procedure

The study will be a pre-post between-group design. We will test and compare performance between the participants who continue learning Spanish through the Rosetta Stone Program. There will be two groups in this research: a Control Group and an experimental group (who will learn Spanish through Rosetta Stone). Participants who will be tested in the Control Group will not utilize the Rosetta Stone Program. The Control Group will be tested two times throughout the Fall Semester 2018. The first testing session will take place around week one and the participants will be given a Verbal Fluency Test, a Grammar Test through Diploma de Español como Lengua Extranjera (DELE), Linguistic Battery, and Cognitive Battery. A Verbal Fluency Test is a test to measure the participant's recall memory. For example, we will ask a participant to name as many animals as they can in one minute in Spanish, then will ask them to repeat the exercise, but in English. The Linguistic Battery and Cognitive Battery tests are online tests which will record the participant's cognitive ability--mental capacity and the extent in which it's used. The second session will be done around week eleven and the participants who will be tested in the Control Group will be asked to perform the same tests as the first session. Participants in the experimental group (the Rosetta Stone Program Group), will learn Spanish through Rosetta Stone for five weeks. Researchers will meet with participants every other day virtually through the Rosetta Stone tutor portal to check on their Rosetta Stone Progress. In addition, weekly emails will be sent to participants to remind them of the study and Weekly Questionnaire in either English or Spanish (the participants get to choose) will be sent to measure exercise difficulties, participants' efforts, and participants' satisfaction with Rosetta Stone's exercises. Participants in the experimental group will be tested two times: around week one and around week five to complete the Verbal Fluency Test, a Grammar Test through Diploma de Español como Lengua Extranjera (DELE), Linguistic Battery, and Cognitive Battery. All participants who will agree to participate in the research will receive consent forms prior to the start of the study. To ensure confidentiality, participant names will be removed from interviews prior to data entry, and the interviews will be identified only by a number code. The information from the interviews will be stored in a locked locker in which only the main researcher and faculty adviser will have access.

Results

This research has not yet been conducted; therefore, there is no data to analyze.

Discussion

The proposed project will make significant contributions, both to a theoretical understanding of Spanish Heritage Speakers and to providing needed information on the topic of continuing learning a language academically. When Heritage Spanish Speakers are born, they are typically exposed to the minority family's language (e.g. Spanish) and the majority country's language (e.g. English). In the academic system of United States of America, minority languages are treated as "foreign" with a negative connotation; therefore, at a young age, Heritage Speakers feel pressured to conform to society and they end up sacrificing their first dominant family language to the country's dominant language. If a language is not properly used, the heritage speaker starts to undergo gradual attrition. As a

result, United States of America is going through a pattern of declining bilingualism.

In United States of America, different minority languages are treated as “foreign”, especially in academic settings. For example, Jim Cummins explains that the term heritage language in the United States, “refers to the languages of immigrant, refugee, and indigenous groups” (Cummins, 1995). Thus, the United States School System develops programs to “Americanize” heritage speakers by transforming fluent speakers of foreign languages into monolingual English speakers (Cummins, 1995). Consequently, heritage language speakers understand from a young age that school is an English-only zone and develop shame in their linguistic and cultural language (Cummins, 1995).

In United States of America, languages such as Spanish continue to persevere in the country because of the continuous immigration, but the pattern of declining bilingualism shows that heritage languages do not survive intergenerational transmission. The pattern of declining bilingualism can best be explained as a linguistic cycle when the family transitions away from their heritage language and into the dominant language. The cycle starts with first-generations. The first-generation immigrants tend to preserve full command of their native language as they learn the majority host country language since it is assumed that they established a linguistic foundation in their native country (Montrul, 2011). For example, a Mexican immigrant, who spend most of their linguistic development time in Mexico, came to United States of America. They are considered first-generation immigrants. This individual would usually be monolingual and very dominant in their Spanish ability. Second-generations are children of the first-generation immigrants or immigrant children who come to the host country before age of 5 (Montrul, 2011). Second-generations have the most variability in bilinguals’ ability and undergo dramatic linguistic change because they have been exposed to two dominant languages at a young age: their family’s language and their country’s language (Montrul, 2011). As a result of its covert English-only language policies and wanting to fit in into society, the second-generation heritage speaker becomes dominant in the majority language by the time they reach young adults (Montrul, 2011). Due to this rapid shift, the heritage speaker is now a native speaker of the majority language by the third generation and the heritage language is no longer used in the family by fourth and subsequent generations (Montrule, 2011). This transformation of the heritage language being replaced for the dominant language illustrates the end of the pattern of declining bilingualism.

Given few language opportunities for the child to use or become literate in their heritage language, the child’s heritage language begins to undergo gradual attrition over its life-span. Polinsky compared child and adult heritage speakers who have a comparable language learning background and that arrived in the country at roughly the same age or were born there (Polinsky, 2011). The results of that study revealed that heritage children perform equivalent to monolingual children, but heritage children outperform heritage adults; therefore, the linguistic knowledge of adult heritage speakers shows significant degradation (Polinsky, 2011). If a language is not properly used, the heritage speaker starts to undergo gradual attrition. As Polinsky described, “In the absence of sustained input and without the influence of the dominant language, their heritage language system undergoes restructuring” (Polinsky, 2011). This means that language is extremely flexible and can undergo dramatic changes to the point where it undergoes gradual attrition. This may explain the pattern of declining bilingualism, and the declining proficiency in the heritage language.

The proposed research will afford an understanding on breaking the pattern of declining bilingualism and gain an understanding on the impacts of relearning the minority language using Rosetta Stone; since Rosetta Stone is an easy and affordable language program that goes at the same pace as the individual, it is extremely useful for this project. Most importantly, it will provide guidelines for academia on assisting Heritage Speakers through their academic progress by encouraging them to preserve their family's language(s) instead of feeling ashamed of it. This research will gain an understanding on the consequences of relearning the minority language to the Heritage Speaker after the language has gone through gradual attrition. Also, to bring awareness on the positive consequences of having a second language; therefore, informing the school system on the importance to establish bilingual programs.

Ideas for Future Research

Significant limitations to the study is that the sample are only California Polytechnic University of Pomona's Students; therefore, in the near future, having a more diverse sample from different universities will help diversify the data. In the future, our research will consider participants with more diverse levels of education and similar age.

Acknowledgements

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Conflict of interest

The authors declare that they have no conflict of interest.

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Characterization of Welded 15-5 PH Stainless Steel Joint Produced by Additive Manufacturing

Abstract

Additive manufacturing (AM), commonly known as 3D printing, has been receiving a tremendous amount of attention for its potential to revolutionize the manufacturing industry. This type of processing has the ability to rapidly produce highly complex geometries while eliminating costly, part specific tooling. Despite the success of existing methods, this manufacturing technique has yet to become ubiquitous though out industry. AM as a manufacturing choice remains less competitive compared to conventional manufacturing methods. This is due to current technological limitations including the strength of printed parts and manufacturing size limitations.

As the complexity of 3D printed parts increases, the ability to attach multiple parts together requires investigation. The physical characteristics of welded, 3D printed material has yet to receive significant attention from industry researchers. In order for these types of joints to become a common design feature, the mechanical behavior of the joint must be well understood.

Although a number of studies on tensile properties of AM parts have been performed, endurance properties of AM parts have been the subject of only limited studies, particularly with respect to weld joints. The objective of this study is to investigate the structural integrity and microstructures of welded joints subjected to tension and fatigue loading. For this study, the common aerospace material of PH 15-5 stainless steel alloy has been selected. A comparison is made between the mechanical behavior of welded joints using a substrate of conventionally formed 15-5 plate vs EOS's Direct Metal Laser Sintering AM machine coupons. The method of attachment used on both is Gas Tungsten Arc Welding (GTAW).

Objective

The objective of this study is to perform the investigation of the structural integrity and microstructures of welded additive manufactured PH15-5 joints subjected to tension and fatigue loading, by conducting a comparison of welded joint between additive manufactured and standard PH15-5.

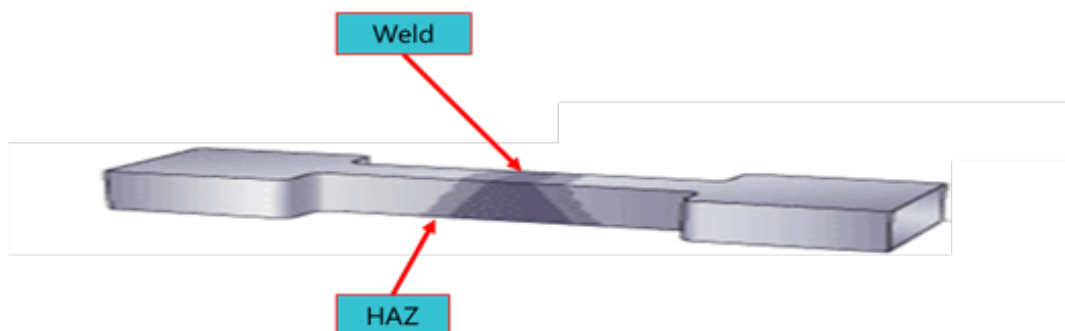


Figure 1 – Illustration of welded tension samples

Methods (Experimental procedure/design)

AM samples are produced by EOS powder PH-1 using EOS M280 Additive Manufacturing Printer with Direct Metal Laser Sintering (DMLS) technology. Stainless Steel PH1 is a pre-alloy stainless steel in fine powder form. Its composition corresponds to US classification 15-5PH and fulfils the requirements of AMS 5659 for Mn, Mo, Ni, Si, C, Cr, and Cu.

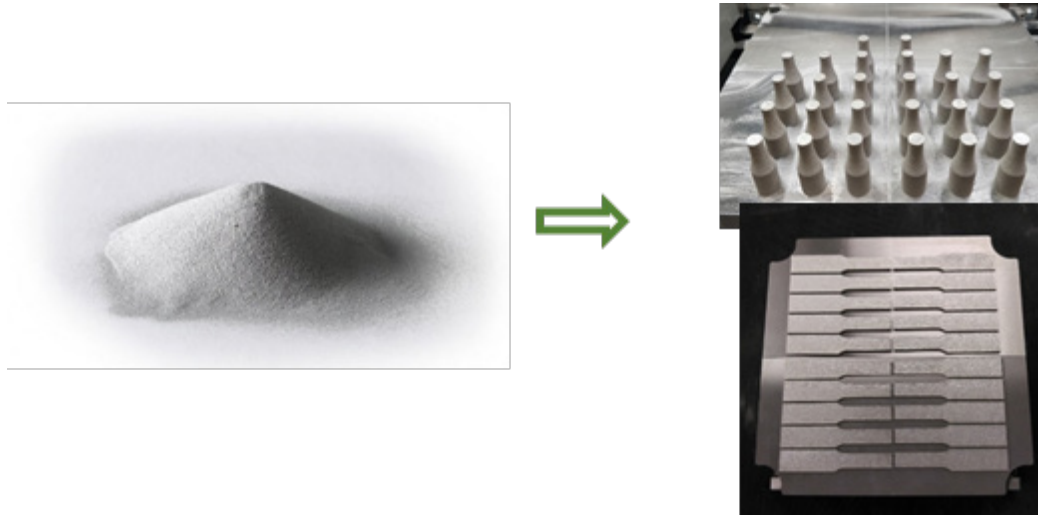


Figure 2 – EOS PH-1 powder

Standard samples are machined from round bars for fatigue testing and flat plate for tension testing.

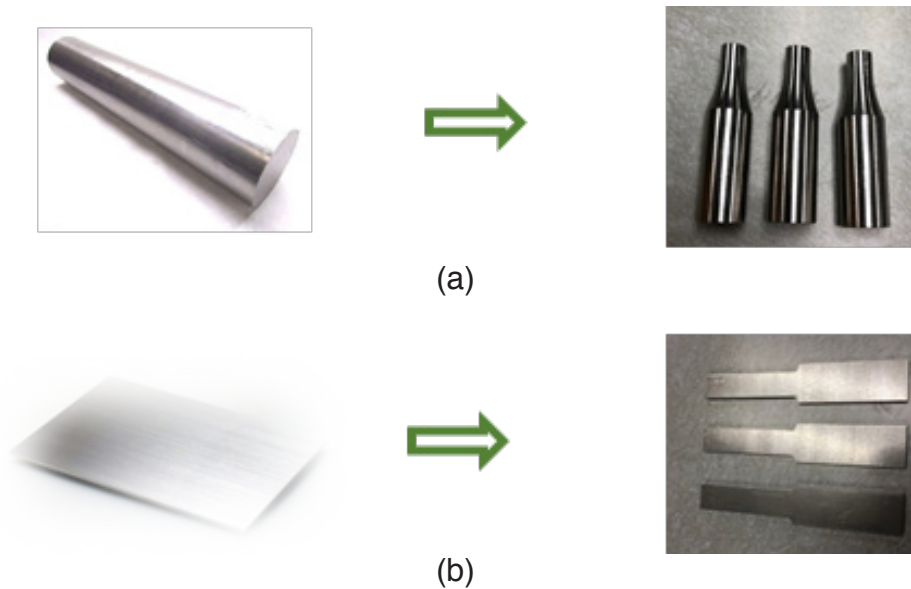


Figure 3 – Conventionally produced 15-5 round bar (a), flat plate (b)

Both AM samples and machined samples are fabricated in halves. Their dimensions and testing method conform to ASTM specs.

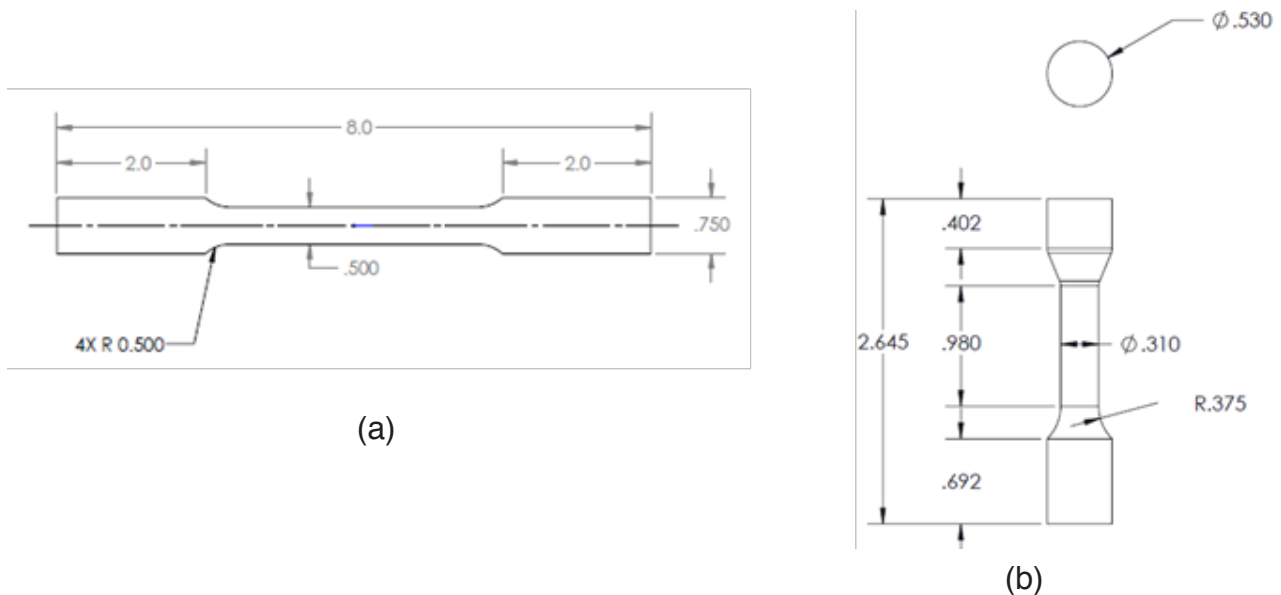


Figure 4 – (a) Manufacturing print of a whole, flat tension sample
 (b) Manufacturing print of a whole, round fatigue sample

Each tension sample set has a quantity of 10 and quantity of 14 for set of fatigue samples.

Table 1 – Test quantity for tensile and fatigue samples

Samples	Quantity
Tensile	10
Fatigue	20

Prior to weld preparation, all material, were heat treated to H900 condition to achieve an ultimate tensile strength of approximately 190 ksi. AM samples are surface ground to attain similar surface condition as the 15-5 bar and sheet. Preparation of weld includes cleaning the joint area to eliminate possible contamination. The flat samples have two-side square butt joint and round samples require double V-groove butt joints. The welding method is GTAW (Gas Tungsten Arc Welding), using Miller 280 Syncrowaves. The same filler rod is used across all samples: S-180 WELTEC. This is a universal welding rod and widely used with many types of steel base metal. Welding process also includes using appropriate fixtures to minimize distortion and warping of samples.



Figure 5 – Machined samples prior to being placed in the furnace

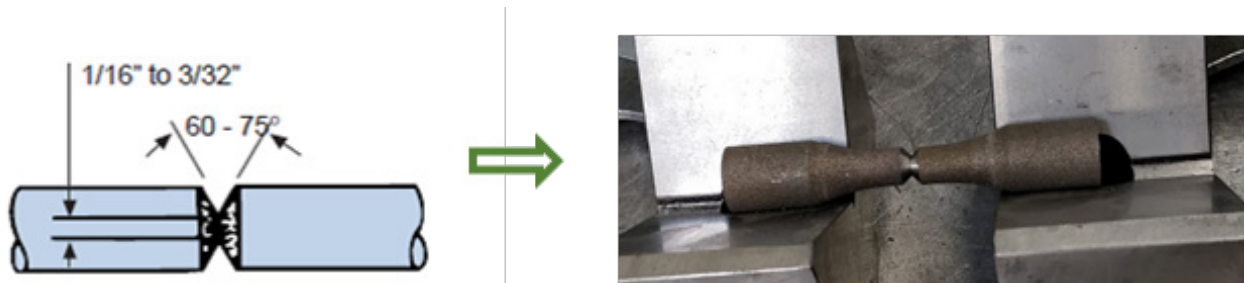


Figure 7 – Layout and weld preparation of round fatigue samples



Figure 8 – Weld preparation and layout of tension samples

Post weld clean up includes machining off reinforcement (Figure 10) to have consistent cross-sectional areas of flat tensions bar and round fatigue bars. Fatigue samples are required to be threaded to 1/2-20 UNF as shown in Figure 10. In addition, machining reinforcement also eliminates the stress concentration factor at weld toe when performing analysis.

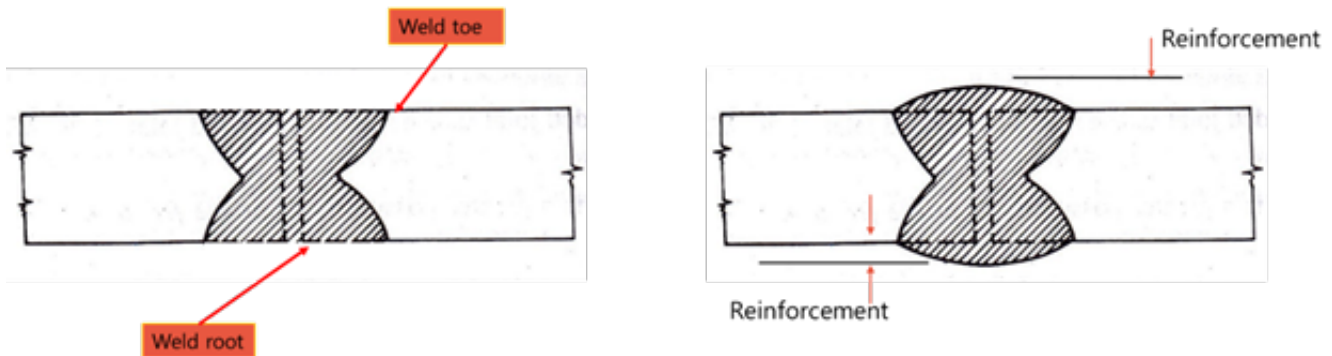


Figure 9 – Illustration of two-side square butt joint on tension samples before and after post weld clean up



Figure 10 – Actual samples after welding



Figure 11 – Actual samples post machining

All samples will be tested on tension and fatigue testing machines. The data from static testing will be used to determine the mechanical properties at the joint: tensile strength, yield strength, % elongation, % area reduction. Data from testing the samples on the fatigue machine will be used to plot the S-N semi log and log curve to see how the curve, for the AM samples, behaves in comparison to the standard samples. Microstructure of the material at the weld will also be investigated for all samples. A Scanning Electron Microscope will be utilized for this purpose.

Current progress

Samples are waiting for non-destructive testing (NDT) to verify the integrity of the complete welded zone on all samples. Evaluation is necessary to eliminate mechanical failures caused by unexpected voids or cracks within the welded joint. Die penetrant was used to validate welds after samples were surface ground. Data were recorded and presented in Appendix A. Samples with indicator of discontinuity are reworked. As this procedure merely provided insights on the surface of the samples, prior to tension and fatigue testing, further NDT such as ultrasonic or X-ray will be implemented to accurately determine reliability of the welded joints.

Analysis

A set of unwelded samples will also be prepared to test for the material's ultimate load, S_{ut} . Since published data is based on the manufacture's testing process and parameters, the testing condition of this study and the lot of powder might result in a slightly different value of S_{ut} .

Preliminary analysis shows that the tension samples fails at approximately 10 kips. The samples will most likely fail at the joint, either weld toe or weld root, as it experiences heat treatment in the HAZ (heat affected zone) from the welding process. The ultimate stress used to calculate this load is the ultimate strength of the material in the annealed condition. The prediction applies to both machined samples and AM samples. A quick calculation for fatigue prediction showed that for 1000 cycles, which is the inflection point between the low cycle fatigue region and high cycle fatigue region, samples fail at approximately 127 ksi.

Preliminary analysis has been calculated based on the assumptions that welds are homogenous, no deformation and no residual stress. If time and resources allow, a post weld heat treatment will be included in the process to relief stress in the material prior to testing.

Appendix A



Arconic Fastening Systems

Aerospace Fasteners Division
 800 S State College Boulevard
 Fullerton, CA 92831 USA
 Tel: 1 714 871 1550

RESULTS OF PENETRANT TEST OF AIRCRAFT MATERIALS

Samples for Tensile Stress Test: Technique Sheet 1-11, Type 1, Method A, Sensitivity Level 3

Description	Qty	Mark	Basket	Results	Stamp	Date
15-SPH Plate	1	M1		INDIC-AS MARKED	(KP 73)	8-9-18
15-SPH Plate	1	M2		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	M3		OK	(KP 73)	"
15-SPH Plate	1	M4		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	M5		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	M6		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	M7		OK	(KP 73)	"
15-SPH Plate	1	M8		OK	(KP 73)	"
15-SPH Plate	1	M9		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	M10		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P1		OK	(KP 73)	"
15-SPH Plate	1	P2		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P3		OK	(KP 73)	"
15-SPH Plate	1	P4		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P5		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P6		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P7		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P8		OK	(KP 73)	"
15-SPH Plate	1	P9		INDIC-AS MARKED	(KP 73)	"
15-SPH Plate	1	P10		OK	(KP 73)	"
PH1 Round, threaded	1	N/A		OK	(KP 73)	"
PH1 Round, welded	11	N/A		7/11PCS W/INDIC-AS MARKED	(KP 73)	"

[Signature] 08/09/18
 Dominador Fonacier
 Responsible Level 3

Kristen
Khair
Dr. M. Guerrero
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Do Attorneys Matter: A Deeper Look At Supreme Court Decision-Making

Abstract

The Supreme Court is the ultimate decision maker in determining what laws we follow in our everyday lives, but is the Court's opinion affected by the parties who present cases to the Court? This paper examines whether attorneys within the last decade have been able to affect the outcome on cases that are partisanly divided in the Supreme Court. This paper will argue that when a politically polarized issue is heard before the Supreme Court, the justices are more likely to be influenced by their own previously held political beliefs as oppose to the argument made by the attorneys before the Court. This study uses quantitative analysis, specifically a content analysis, focusing on oral arguments that have been heard before the Supreme Court. Through this analysis, I was able to find that an attorney does not have an effect, especially in cases that are partisanly divided. Justices in the Supreme Court are basing their decisions off of issues they know to be true or off their own interpretation of the Constitution. Therefore an attorney's oral argument is not the primary reason for a justice's decision making.

Introduction

Many people use pejorative terms to describe the role an attorney plays in American society, yet many neglect to appreciate the fact that an attorney has a more significant impact on politics and policy. For example, when attorneys appear in front of the Supreme Court, they are able to argue about issues that affect our everyday lives, issues that decide what limitations are placed or removed from our constitutional rights.

It is the responsibility of Supreme Court justices to interpret the Constitution. Yet, what forces influence the justices when they interpret the Constitution? Attorneys appear before the Court to fight for our rights, to defend the Constitution, and argue what is best for society; in some ways, attorneys are our voice in the Supreme Court. But how effective are the attorneys who argue before the Court? Attorneys can argue persuasive cases in front of the Court, but it might have no effect if justices have already made up their mind.

Oral arguments are an important component of Supreme Court cases. Justices allegedly use the oral arguments to question each side of a case and these transcripts are released to the American public for consumption. However, since the Supreme Court is an exclusive club restricted to no more than nine members at a time, justices have a wide array of discretion in how they want to use oral arguments to make their decision. It may be the case that an attorney's oral argument might not have an impact on justices and oral arguments have merely continued through American history for tradition's sake. If this is the case, Supreme Court decision-making is a more mysterious process than even scholars currently suggest. As a part of our democratic institutions, oral arguments allow the public to have a tiny bit of ownership in an already obscure process. The Supreme Court has an impact on every single American, whether we notice or not. As Americans are forced to abide by what

Supreme Court says, we should address how exactly justices are influenced while making their decisions.

This thesis builds on the scholarship of public law scholars to investigate the impact of an attorney's oral argument in Supreme Court cases. Scholars have long recognized the importance of Supreme Court decision-making, as this field of study helps us understand how certain rights and laws are adjudicated. The Supreme Court has had far-reaching effects over the course of American history. However, an attorney litigates at the Supreme Court in order to maintain and fight for the law, the people, and what they believe is best for society. Scholars have paid little attention to the impact attorneys have on decision-making. These attorneys are one of the few people outside the Court who have a direct effect or impact on the justices, they stand in front of the Court and are given a chance to present their case, and no one else is given this opportunity. While history will remember justices, we pay little attention to the attorneys who have argued in front of the Court. At the broadest level, this research seeks to understand the effectiveness of these attorneys on the Supreme Court. More specifically, within the last decade, are attorneys in the Supreme Court able to effect the outcome of partisan cases?

Before we examine these ideas in depth, a few key concepts must be defined from this question. First, this research examines an attorney's effectiveness; in order to determine effectiveness we are only examining the attorney's oral argument in front of the Supreme Court. In oral arguments, an attorney argues their side in front of the Supreme Court justices. In terms of this paper, we will not be exploring the state Supreme Courts, only the federal Supreme Court. Lastly, this paper seeks to focus on partisan cases. This simply means these cases are issues that have been typically known to be ideologically split, for example, abortion; both the Democratic Party and the Republican Party have distinct positions on the issue of abortion.

This research directly contributes to the ongoing scholarship on the Supreme Court in two ways. As stated prior, not a lot of research has been done to show that an attorney has or has not had an effect on the Supreme Court. This thesis will help advance the literature by advancing a differing perspective. Most literature published today focuses on effectiveness in a broad sense, few articles focus specifically on partisan issues. Also, most articles were written with a focus on Supreme Court cases from the 1990s or early 2000s, therefore not a lot of research is focused on present arguments or present day cases. There is reason to believe that partisanship has drastically affected politics in the last decade and the scholarship needs to be updated in order to reflect that. Furthermore, effectiveness is hard to measure, leaving it open to various different interpretations. The interpretations or study used in this thesis differs from earlier work in that it will be more quantitative. This quantitative analysis can offer more breadth than previous work, taking more issues and characteristics into account.

Ultimately, this thesis hopes to argue that when a politically polarized issue is heard before the Supreme Court, the justices are more likely to be influenced by their own previously held political beliefs as opposed to the argument made by the attorneys before the Court. Given a cursory look at Supreme Court cases and the opinions we expect justices to hold, it seems that even before a case is heard, we can determine the outcomes of the case

based off of the justice's party affiliation. We have strong expectations of the ideology held by sitting justices. Scholars and analysts readily identify extreme right to extreme left positions and somewhat successfully anticipate how a justice will vote on an issue. For example, it is widely accepted that Justice Kennedy is more of a moderate and is often the justice that splits the Court's vote. The fact that we can dissect this information before even hearing the case or the oral arguments should be troubling. This proves, in a sense, that the justices already have their minds made up; in this sense, we may even be questioning the legitimacy of oral arguments.

Of course, justices may very well be influenced by oral arguments, but even in this instance, only in a limited sense. If the justice has a hazy understanding of the facts of the cases that are being presented to them, then an attorney would be able to clear up the confusion and in that sense have an influence on the opinion or final outcome of the case. The key problem is that a wide amount of information could be presented to the Supreme Court during the oral argument and thus an attorney could just be repeating the facts or law that the justices are already aware of. In this case, the argument can really go either way.

This thesis utilizes a quantitative research design in order to examine whether or not Supreme Court justices are influenced by oral arguments. An original dataset was created for this thesis. The cases for this thesis were selected by looking at the three attorneys who have argued the most amount of time before the Court in the 21st century. These cases were selected because the attorneys who appear the most before the Court will likely hold the most credibility and skill when arguing their cases, meaning they are the most likely to have an impact on the justices. There are 100 cases, that took place from 2006-2016, that will be analyzed and placed into the dataset. This dataset accounted for several variables including how many conservative justices voted yes on the issues vs. voting no, how many liberal justices voted yes on an issue vs. voting no, how many implied questions were asked of the attorney, how polarized the issue was, etc. In order to produce this dataset, the first factor that needed to be determined was the ideological leaning of each justice. This was done by conducting an online search of each of the justice's political affiliation. The next main factor was extracting data from the oral argumentation in order to identify whether each attorney is being asked a question with an implied answer. An implied question is a question that does not seek an answer meaning that despite what the attorney responds, the justice already has a defined point of view on the matter. Examples of implied questions include questions that start with "wouldn't you agree" or "I am right in saying" and questions that end with the words "right" or "correct." If the attorney is asked more implied questions then this is an indication that the attorney is most likely not having an effect on the justices. This is because implied questions illustrate ideas that the justice already held before hearing the oral argument. Lastly, data is collected to compare the oral arguments of the attorneys with the Court's written opinions to see if any similarities exist between the two and if so, then how many. This data collection will include both partisan issues as well as nonpartisan issues to see if a difference is present and how significant that difference is. In order to determine partisanship, the political platforms of the Republican and Democratic parties will be examined to see whether they have a stance on the case being examined by the Court. If there is a clear opinion on a certain issue then that issue will be ranked based on the parties' beliefs, if there is not then that issue will be non-partisan.

At the conclusion of this study, we hope to find that in partisan issues an attorney's influence is nonexistent or at best very minimal and weak; proving that the Supreme Court may be biased on partisan issues. Before embarking upon the study, we must first take a look at what existing scholarship has said about the Supreme Court, attorneys, and decision-making.

Literature Review

The impact of the Supreme Court has been widely examined in existing literature. This literature review will specifically outline three key understandings of a Supreme Court justice's decision-making: the attitudinal model, the legal/professional model and the rational choice model. Scholars have developed these models to examine and help summarize how justices have decided on cases throughout history. The second section of the literature review will examine factors the literature highlights in terms of what forces can potentially affect a justice's opinions. This section will discuss three factors: amicus briefs, solicitor generals, and attorneys. Finally, in the last two sections attorneys will be examined in terms of how effective they are in cases that are divided amongst partisan lines and those that are not. The literature presented will demonstrate ideas that both help advance and argue against the perspective of this thesis. The argument of this paper is that an attorney has a lack of an effect on the Supreme Court justice's opinions when the issue being argued is partisan.

Models of Supreme Court Decision-Making

There are three key models that previous studies have utilized in terms of analyzing Supreme Court decision making: the attitudinal model, the legal/professional model, and the rational choice model. Cases are constantly selected and heard in front of the Supreme Court. Political science has analyzed these cases in the formulation of these three methods. Some theories have been more deeply analyzed and researched than others, but a brief understanding of each of these theories is necessary in order to gain an insight into what the justices will consider when ruling one way or another.

The first model, the attitudinal model, states that judges decide cases in terms of their ideological attitudes and biases to reach a conclusion or outcome for the case presented to them (Seamon 548). In a sense, this model is constructed from a mix of various ideas including legal realism, political science, psychology, and economics (Segal 86). It is believed that these justices gather their ideological beliefs from their peers and the environment they grew up (Seamon 548). The attitudinal model can be proved by the fact that cases that contain federal questions are seldom representative of the public opinion or the public's desired outcome (Segal 89). This model was established by Gledon Schubert when he decided to use psychology in order to create the attitudinal model. Gledon wanted to find a way to scale the justice's ideology in terms of their values and the cases presented in front of them (Segal 88). The study focuses on the fact that the Supreme Court controls their own docket and no case is presented in front of them unless they choose to have it be presented in front of them (Segal 88). Justices are believed to pick cases that most align with their ideological beliefs and refuse ones they see as meritless cases (Segal 88). An example of this model is if Justice Gorsuch votes on a case, we would expect him to vote conservatively due to his extremely conservative beliefs. In terms of this paper, the attitudinal model could be an accurate

predictor of Supreme Court decision making and it would further explain the lack of effect of an attorney's oral arguments.

The second model, the legal/professional model of decision-making, argues that judges use facts and law in order to decide the outcome of the case. In this sense, "judge's decision-making process is shaped by their legal training, which includes traditional principles of logic, constitutional and statutory interpretation of the law" (Seamon 550). This model states that justices are coming to their decisions based on the facts of the case, on precedent, plain meaning of the Constitution and the intent of the Framers (Segal 86). The legal/professional model has not been studied to a deeper extent due to the criticism that this model has received. An issue with this model is that it uses the fact that litigants/attorneys have precedent when arguing a case, but justices also rely on precedent in their decision making (Segal 86). This model is not a helpful measure of how the justices are coming to their decision because it references an overlap between the attorney's argument and the justices both using legal precedent.

The last model in terms of judicial decision-making is the rational choice model. Rational choice is weighing cost and benefits against one another to determine what is better for the people, as well as the society. This looks at decisions in a way that derives mathematical and/or logical deductions (Segal 110). The goal for this model is to find the equilibrium of an outcome, meaning that the justices find a decision that is at the maximum point of equally pleasing society, as well as individual citizens (Segal 110). This model can be divided into two groups of scholars: those that have become known as internal camp and those known as the external camp. The internal camp "focuses on the interactions among the justices" (Segal 111). The external camp "focuses on constraints imposed on the Court by other political actors" (Segal 111). Some criticisms of this theory is that this type of decision-making cannot be directly observed, it is just merely assumed that a justice would feel unethical from choosing an outcome that would negatively affect our society (Segal 112). Furthermore, the rational choice model has not derived any actual equilibrium solutions and justices do not always choose what is best for our society (Segal 112). Due to the lack of research we have on this model, it is hard to determine if the rational choice model actually explains justices' decision making.

In terms of these three models, we begin to see a basis of what could potentially be impacting a justice's decision-making when it comes to voting on any given case. However, there are definitely other factors that might potentially influence Supreme Court justices in how they make decisions.

Other Factors that Influences the Court

The Supreme Court can be influenced by a number of different factors including public influences, amicus curie briefs, and arguments from the solicitor general. These influences must be examined because if these play a viable role in helping a justice come to their decision, then it makes it more likely that an attorney will not have any type of effect on the ultimate decision of the justice.

In regards to the public influences, or public opinion, we can see that some scholars argue that public opinion has a strong indirect effect on the Supreme Court justices. Public opinion plays an influence on what cases the Supreme Court chooses to hear and what the court decides to rule on such cases (Mishler 167). Supreme Court justices are not accountable for their rulings, giving the justices freedom to fluctuate between decisions on similar cases (Mishler 174). The Supreme Court's fluctuations coincide with the rapid shift in public opinion (Mishler 175). Therefore, there is evidence that suggests the justices are not being influenced by an attorney's oral arguments, but rather the changes in public opinion.

Boucher disagrees with this view. Boucher argues that justices are not "strategic policy-minded decision makers" (826). In certain cases, justices consider their outside environment, public opinion, etc. as a means for deciding case outcomes but that seldom occurs. Most of the time, justices are reliant on their already held beliefs or the idea of being nonstrategic (Boucher 826). This idea of being nonstrategic indicates that some justices are more likely to side with the lower courts, as oppose to the individual seeking an appeal (Boucher 829), showing a disregard of public opinion.

Amicus curiae briefs can also be explored as having an effect. Justice Scalia views amicus curie briefs as a representation of the public's opinion and the outcome the public prefers. Amicus curiae briefs can be written by someone in the legal profession or by a citizen and sent to the court. According to a few sources, the effectiveness of amicus briefs are very limited (Nicholson 23). Kearne states that amicus briefs were very rare in the early centuries of the Supreme Court but that today oral arguments by attorneys have been shortened and amicus briefs have become more common (743). This literature therefore argues that the shortening of an attorney's oral arguments did not have an effect on the Supreme Court, but that the greater amount of amicus briefs being submitted did (Kearne 745). Research states that an amicus curie brief, "presents an argument or cites authorities not found in the briefs of the parties, and these materials can occasionally play a critical role in the Court's rationale for a decision" (Kearne 757). Yet, this is not an accepted fact. Certain justices have spoken out about this; for example, Chief Judge Richard Posner believes that amicus curie briefs have little to no effect on the justice's choice or outcome. According to Shapiro, the clerks in the Supreme Court offices agreed that many amicus curiae briefs are a waste of time and money (22). The Court receives hundreds of amicus briefs every day and most do not contain useful information. More often than not, these briefs either talk about issues far removed from the court, or they file a one page brief that contains limited useful information to the court (Shapiro 22). It is also argued that state attorney generals are frequent filers of amicus briefs, yet they still have a limited effect as Supreme Court justices rarely view these briefs and do not include them in their arguments (Nicholson 23).

In terms of other forms of effectiveness, "the Solicitor General, is the most successful advocate to appear before the Court; in fact, the Solicitor General's office wins well over 70 percent of the cases in which the government participates" (Wahlbeck 104). Therefore, an attorney might not have as much of an effect as we believe, since the Solicitor General accounts for most of the success in these Supreme Court cases.

On top of all this, literature suggests that justices might not be influenced by any one individual. Rather, it is argued that the justices are only relying on the Constitution to make their decisions; not any outside forces (Mason 1387). But is this accurate? According to existing literature, it has been determined that the effect of amicus curiae briefs can be put aside (McGuire 188). Yet, before we assume the justices are not being influenced by a single person, we need to look at the impact attorneys have.

The Effectiveness of Attorneys on Partisan Issues

The main focus of this paper is on the effect of an attorney before the Courts, specifically the oral argument that the attorney presents to the Court. This section seeks to extract information from existing literature to demonstrate that an attorney is having an effect on the Supreme Court justice's opinions.

Some literature suggests that an attorney's oral argument does have an effect on the Supreme Court justices, however this effect differs in significance. A justice's position fluctuates constantly throughout the process of a case before they cast their final vote and therefore the vote can be influenced by an exogenous force (Ringsmuth 433). Oral arguments can play a role in case outcome for several reasons. First, oral arguments can assist justices in understanding complex legal or factual issues (Wahlbeck 99). Written briefs or decisions filed in the lower courts can be confusing at times. Therefore, an attorney's oral argument can help clear that confusion and provide a better analysis of the case (Wahlbeck 99). According to Wahlbeck, "justices often face uncertainty, and they need information about a case and the law in order to set policy in ways that will promote the Justice's goals" (100). Justice Brennan has said that, "often my idea of how a case shapes up is changed by an oral argument." Justices therefore do not always have their minds decided when they are presented with oral arguments; oral arguments are needed in order to demonstrate new information that a justice was not aware of before (Wahlbeck 100). Based off of McAtee's analysis, we can assume that the more a justice lacks knowledge on an issue, the greater the justice will be able to be persuaded and affected by the attorney's argument (271). Oral arguments do serve a purpose in the Supreme Court as "they provide justices a unique venue from which to seek novel information and then for justices to use that information to inform their conclusion" (McAtee 271). The arguments that are presented to the Supreme Court usually sway justices into moving to side with the majority opinion but a bad oral argument can help push a justice to a certain direction as well (Ringsmuth 436).

There are some key factors however that make an oral argument have a greater effect. For example, how an attorney presents their position during their oral argument is key to the outcome they receive from the justices (Wahlbeck 107). Furthermore, an attorney's credibility is said to affect the attorney's performance in front of the justices. According to Wahlbeck, "in the context of the Supreme Court, a key indicator of credibility is the litigating experience of a lawyer, especially the extent to which he or she has appeared before the Court in the past" (107). An attorney's credibility can also be influenced by their educational experience as an attorney who went to a top law school is more likely to receive "respect" from the justices and therefore have a greater impact (Wahlbeck 109). Therefore, the more credibility an attorney has the more likely they are to have a stronger effect on the justices

Some attorneys try to take a different route and instead of using credibility and the facts of the case, they use rhetoric and wisdom in order to draw the justice's attention and persuade them through their oral arguments (McAtee 259). Attorneys understand that Supreme Court justices need a variety of information in determining which way to vote. At the same time however, using wisdom does not mean that an attorney is securing a justice's vote, but rather they are creating a way for the justice to understand this issue in a different light (McAtee 262).

In another view of attorney effectiveness, McGuire argues that "the justices are ultimately concerned with uniformity in federal law, the ramifications of their decisions for public policy" but "in the dialogue over such issues it is lawyers who help give them voice" (189). The purpose of oral arguments is for justices to be able to learn about facts that they do not know. Most of the time, justices have a deep understanding of the law being used, but not as much is known about the facts (Jackson 802). The way these facts are presented determine if an attorney will have a greater impact on the ruling.

Specifically looking at cases dealing with partisan issues, we see that scholars take different views on the subject. If a justice's ideology was taken into account, then we would see an attorney's oral arguments only plays a small role; that impact would be mainly from the attorney's previous experience in the court and based off merit (Wahlbeck 106). Literature has shown that when a justice is supportive of an issue that aligns with their ideology, it is possible for them to be influenced by an attorney's oral argument (Wahlbeck 107). If the attorney provides a higher quality oral argument than their opposing side, then there is an increased probability that that attorney could sway a justice's vote (Wahlbeck 107). In this sense, an attorney would have an effect, even though the cases may be partisanly divided.

Looking at all the literature presented above, an attorney would have the potential to change various case outcomes in the Supreme Court through their oral argumentation.

The Ineffectiveness of Attorneys on Partisan Issues

Literature has conversely argued that attorneys do not have an effect on a Supreme Court case outcome. We have seen throughout time that changes have occurred in the Supreme Court and one of those changes is the shortening of the amount of time an attorney gets for an oral argument. Scholars have assessed this and found that this does not have a dramatic effect on the outcome of a case (Kearney 746).

Scholars believe that lawyers do not have an effect because in order for an attorney to be effective, they must possess specific qualities. For example, lawyers must be able to argue cases off memory, avoiding nervousness or stumbling upon their sentences (Jackson 801). This is difficult to accomplish with the justices constantly asking questions that the attorney may not have anticipated and thus the attorney may not be able to play a significant role in deciding the outcome of the case. Attorneys also complain about the line of questioning they receive from the justices (Jackson 801). All this combined reinforces the ineffectiveness of attorneys in the Supreme Court.

Justices also select what cases they want to hear and therefore tentative opinions or inquiries about how they feel about the case will present themselves before an oral argument has taken place (Jackson 801). Most of the time, the justices stick with their original instinct, meaning that the attorney does not hold any persuasive power over the decision (Jackson 801). The justice can however, use the language in the oral argument to formulate their written opinions.

Justices do not give lawyers a lot of time to argue and the fact that lawyers are not given enough time is a representation of “justices growing disdain for oral arguments” (Wrightsmann 14). Some justices no longer find these oral arguments useful but rather they see them as an unnecessary step in the Supreme Court proceedings (Wolfson 452). Wolfson did a test and found that about 0-20% of the time, oral arguments can influence a justice to change their mind (452). The problem is that this change occurs on a performance base, and not so much on the basis of the argument itself (Wolfson 452). For example, “oral arguments performed effectively are of crucial significance—that they positively contribute to the decision-making process” (Mosk 62). Wikstorm agrees, believing that lawyers are underfunded (360). It is argued further that lawyers are therefore ineffective, and cannot satisfy what is expected of them in the Supreme Court level (Wikstorm 360).

Valerie Hoekstra argues that the Supreme Court is focused on lower court decisions rather than what the attorney says in their oral argument (320). The Supreme Court makes an opinion before the oral argument even occurs, as they are given all the facts and legal issues beforehand (Hoekstra 321). Most of the time, the lower court is concerned about being overturned by the Supreme Court (Hoekstra 321). Some courts try to write very detailed records, where they try to include all necessary arguments for the Supreme Court (Hoekstra 321). By doing this, the Supreme Court is able to use these written arguments to come to a decision before hearing an attorney’s oral argument, thereby making them ineffective (Hoekstra 321). According to Lucas, counsel is extremely ineffective in the Supreme Court (220). It was found that attorneys are not able to anticipate what is going to be asked of them, their nervousness kicks in, and they are unable to grab the justice’s attention (Lucas 220). Furthermore, the attorneys who get sent up to the Supreme Court are supposed to be some of the best attorneys. Our standard of an attorney is extremely low because we expect attorneys to use notes and to not be as prepared as they should be (Lucas 221). But because our expectation of attorneys is so low, the attorneys before the Supreme Court are not as good as they should be (Lucas 221).

The way an attorney presents their oral arguments is frequently attacked. Frost found that “the justices today are more likely to speak harshly, as well as make more jokes than they did in the past, and the justices are better prepared in terms of questioning the oral arguments” (1). Furthermore, justices indicate in their questions what side they stand on and whether or not they disagree with the majority and this shows that the justices have already formulated an opinion on the case before even hearing the attorney’s oral argument (Frost 1). This further supports the idea that the attorney does not have an impact. It is also argued that “oral arguments are less about addressing the legal merits and more about feeding DC journalists’ needs for sound bites and quotes for their daily articles” (Frost 1).

In terms of partisan issues, it has to be admitted that even when a justice bases their decision on their ideology or their preference for a policy, they often do so while taking in other information to support their beliefs (McAtee 260). The literature in this sense shows that an attorney has a very minimal to no effect on the justices (George 323). A justice also determines what side they will most likely be on based on what decision most closely aligns with their ideological beliefs. This is, more often than not, decided before any evidence is heard (McAtee 279). In this sense, an attorney would lack effectiveness, particularly in partisan issues. Examining the literature in this section, we see a different view. The literature indicates that an attorney has limited to no effect in influencing the Supreme Court case outcomes.

In conclusion, there are many potential impacts on the Supreme Court's decision making, as well as different reasons as to why an attorney can be effective or ineffective in impacting a justice's decision on a case. Partisan issues also come into play here because we have seen that when justices decide their own docket, they do so based upon their ideological beliefs. Through this study, we hope to find that the attitudinal model is widely used in justice decision-making and that when a partisan case is placed in front of the Supreme Court, attorneys will have minimal to no effect on the outcome.

Methodology

This thesis uses a quantitative research design to determine whether or not an attorney's oral argument has an effect on Supreme Court decision-making. Specifically, this study utilizes a content analysis. A content analysis is the process of collecting quantitative data derived from a written source or text. This content analysis uses oral arguments and the written decisions of the Court as the written source or text. This methodology, however, is not able to account for everything the justices review in coming to a decision. Despite that, it does adequately assess an attorney's effectiveness before the Supreme Court. In order to conduct this analysis, several variables had to be accounted for and these variables will be discussed below.

This study examined one hundred Supreme Court cases that took place between 2006-2016. These cases were selected on the basis of which attorneys had most frequently argued in front of the Supreme Court. It has been noted in the literature review that attorneys who argue frequently in front of the Court have more credibility and more experience. These attorneys are thought to have the most effect in the Supreme Court. Knowing this, I collected cases from the three attorneys that have most frequently appeared in the Supreme Court during the 21st century. The three attorneys I looked at were: Paul D. Clement, Edwin S. Kneeder, and Michael R. Dreeben. Ultimately, the analysis includes 47 cases argued by Clement, 35 by Kneeder, and 16 by Dreben.

The 100 cases were then coded on a variety of different dimensions. The analysis first explores how the justices had voted on a specific case. The justice's votes are separated into several variables: ConservativeYES (how many conservative justices voted in favor of the decision), ConservativeNO (how many conservative justices voted against the decision), ConservativeTOTAL (the total number of conservative justices on the Court at that point in time). Similarly, the analysis codes the same information for the liberal justices of the court

through the variables LiberalYES, LiberalNO, and LiberalTOTAL. The ideology of the justice was determined from the classification developed on a webpage called “InsideGov” and the way they voted was accounted for by looking at the case on “OYEZ.”

The next variable collected examines what side the Court had favored in each individual case. In each case, the Supreme Court could side with either the appellant/respondent or appellee/petitioner. For this variable, a “1” was assigned to the appellee and a “0” was assigned to the appellant. This variable was coded in order to aid in coding the polarization of the issue.

The next group of variables collected in the data set were the similarities between the oral argumentation given by the attorneys and the opinions written by the Court. This variable is relevant in the analysis of this thesis, because the more ideas a justice’s ends up adopting from an oral argument, the more effect an attorney will have. The data for this variable is divided into three sections: the similarity between the oral argument and the majority opinion, the similarity between the oral argument and the concurring opinion(s), and the similarity between the oral arguments and the dissenting opinion(s). This data was collected by running a similarity test on the oral argument and each individual opinion, using a website known as “copyleaks.com.” This comparison produced two numbers, the percentage of text copied, and how many chunks of text appeared to be similar. These were coded as MajorityWord and MajorityPercent, ConcurringWord and ConcurringPercent, and DissentingWord and DissentingPercent. Again, this variable is designed this way because if the attorney had an effect on the Court then that effect should be evident in the similarity between the oral argument and opinion. Therefore, if these three attorneys are indeed successful in the manner we believe them to be, the attorney’s argument should show up in the Court’s opinions more frequently than not.

The fourth set of variables collected for this study involves the questions that the Supreme Court justices asked the attorneys while they were presenting their oral arguments. The questions were specifically coded to determine how many questions had an implied answer. A question with an implied answer has a truth value already in the question. Usually, the person asking a question with an implied answer already has a defined perspective on the issue at hand. Therefore, no matter what the attorney responds, the justice would already have a defined point of view on the issue. These questions involve questions that end in “isn’t that right?” or “you would agree with me when I say...” Again, the idea behind recording the frequency in which these questions appear is that if the attorney is consistently asked questions of this nature, then their effect is likely to be low. This is because the justices would already have a developed opinion on the issue being presented. In this light, we expect that cases that are partisanly divided would have a higher number of implied questions. This data was coded as the following variables: AppellantQuestions (the total number of questions that were asked the appellant attorney), AppellantImplied (the number of implied questions asked to the appellant attorney), AppellantNotImplied (the number of questions asked that did not have an implied answer to the appellant attorney), AppelleeQuestions, AppelleeImplied, AppelleeNotImplied. This data was collected by looking at transcripts of the oral arguments online and assessing how justices responded to both the appellee and appellant. I did a search to find every single question asked by the justices during both attorneys argument. Once I had a complete list of the questions asked during the

argument, I read through each question and determined if the question seemed to have an implied answer or not. This variable is slightly subjective, as I tried to use my rational based opinion in selecting what was considered implied and not, but there is no set standard for how to determine something of that nature.

The fifth and final variable I collected is the IssuePerspective. This variable codes what ideological side the majority of the Court was more likely to lean towards. For example, one issue presented in front of the Court, in *District of Columbia v. Heller*, was if being required to have only nonfunctional guns in your home is a violation of the 2nd amendment. Now this case seems to have an issue that if you vote 'yes' this is a violation of the 2nd amendment. This would be a perspective that many conservatives might hold, therefore it would be classified as a conservative issue. The way the data is coded, a liberal issue receives a '0', a non-partisan issue receives a '1', and a conservative issue receives a '2'. An example of a non-partisan issue includes issues that the majority did not share ideological consistency on, such as attorney fees or if a case fell under the correct law when it was argued in the lower courts. This test, is also slightly subjective, as I used existing knowledge on the two party's beliefs, as well as the two party's platforms that I found online. However, there is a possibility for disagreement on certain issues.

The measurement of an attorney's effectiveness in the Supreme Court is extremely hard to measure. In order to gain accurate results, the data tried to account for the main factors that would demonstrate an attorney's effectiveness. While this study does not take into account every possible thing that the Court may consider, it still takes many variables into consideration. These variables and their influences are discussed in the results section below.

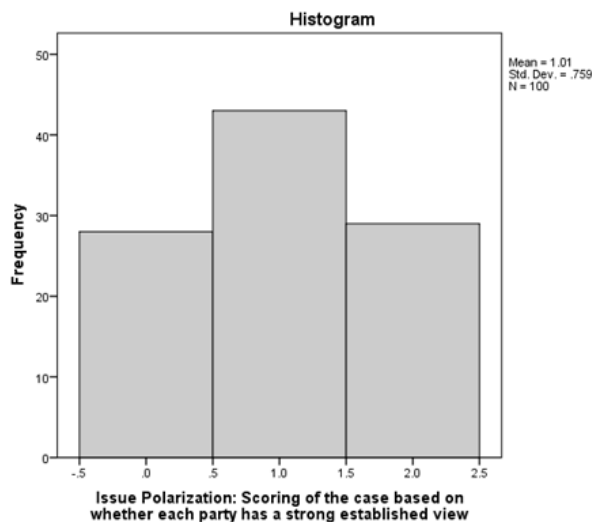
Results

This section supports the argument posed in this paper, which is, that an attorney will not have an effect on Supreme Court decision-making when the issue is partisanly divided. In order to see if this argument has standing, I ran several tests on the variables collected in my data set. One of my most important variables used was issue polarization. Issue polarization when tested against another variable allows us to determine whether or not that variable is being influenced by the partisan divides of a case. The results were broken down by first looking at characteristics about individual variables. The first issue I wanted to examine was how the justices were voting on any given case. I decided to run a one-way ANOVA between issue polarization and the way the justices were voting. The second test that I ran was a chi-square test between issue polarization and whether or not the case yielded a unanimous decision. The last test that I ran that examined the justices votes was a chi-square test between issue polarization and what side the justices favored, whether it be the appellant or appellee attorney. The next issue I wanted to tackle was the attorney's role in effecting the justices. In order to do this, I ran a one-way ANOVA between issue polarization and the percentages/ words that appeared to be copied between the oral argumentation and Court opinions. The last variable I looked at was the questions that were being asked of the attorney during the oral argumentation. The charts and graphs I created are referenced and explored deeper below.

	Frequency	Percent
Liberal	28	28%
Neutral	43	43%
Conservative	29	29%
Total	100	100%

Chart 1.1: Issue Polarization Frequency Table

Issue polarization is the variable that I used in all of my tests. I first wanted to see how many cases out of the hundred that I found were either a liberal, neutral or conservative issue. Above, in chart 1.1, we can see a frequency table which depicts the number/percentage of cases that were either liberal or neutral or conservative. Looking at this frequency table, we can see that most of the cases that were collected were neutral or non-partisan cases. Specifically, 43% of cases in my complete data set were neutral, while only 28% were liberal and 29% were conservative cases. I also created a histogram to better illustrate these findings.



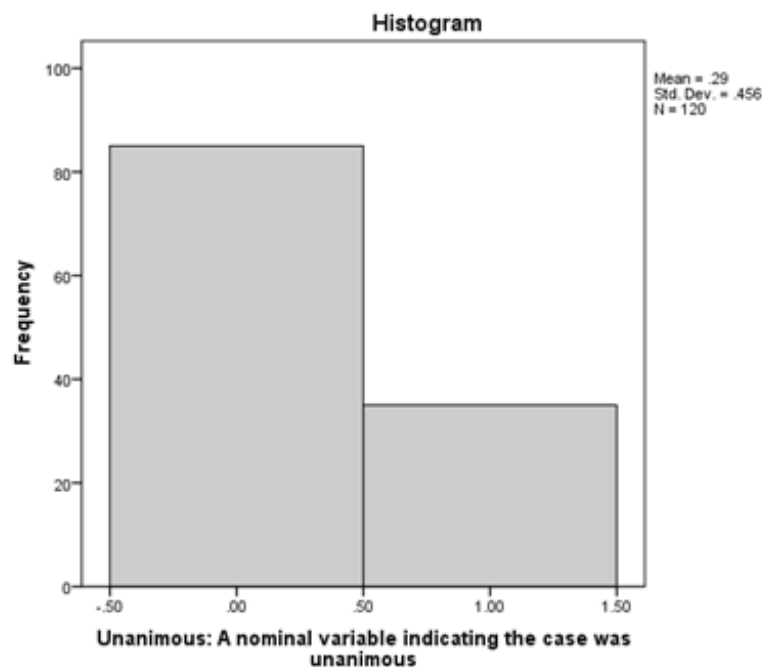
Graph 1.1: Histogram of Issue Polarization

This histogram represents the amount of cases that were liberal, the amount that were neutral/non-partisan and the amount of cases that were conservative. Looking at this histogram, we can see the same finding as above. Most of the cases that were selected were classified as neutral/non-partisan case, while there were less liberal and conservative cases picked. The importance behind this histogram is that if an attorney is having a limited effect, then we should expect to see the liberal and conservative cases result in split decisions while the neutral cases result in unanimous decisions.

	Frequency	Percent
Split Decision	71	71%
Unanimous Decision	29	29%
Total	100	100%

Chart 1.2: Unanimous v. Split Decision Frequency Table

Before going into specific tests, I also wanted to look at how many of the cases I looked at had a split decision versus a unanimous decision. If the cases are likely to be influenced by the justices already held political beliefs, then we should expect to see less split decisions because a majority of the cases collected were neutral cases. Looking at chart 1.2, we can actually see that most decisions are split decisions. Specifically, 70.8% of the cases that I used in my data set were split decisions, while 29.2% were unanimous decisions. We could once again look at a histogram for a better understanding.



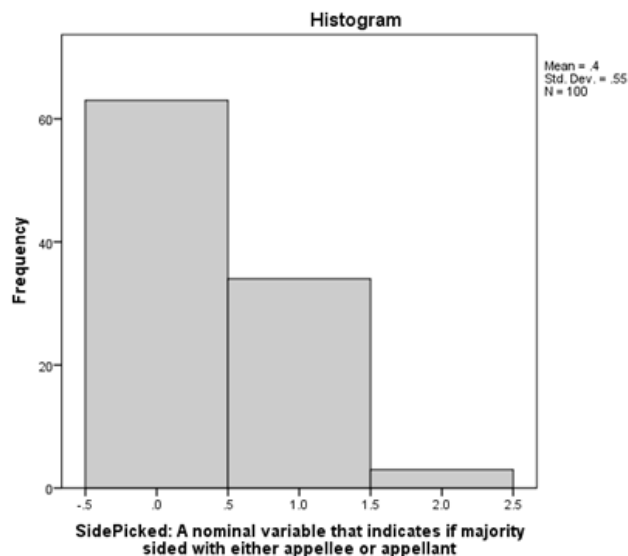
Graph 1.2: Histogram of whether or not decision was unanimous

Above we can see a histogram of whether or not the decision was unanimous or split in a case. We can see similar findings to those listed above, that is, that we are more likely to run into a case that is a split decision as oppose to a case that is unanimous. This is very interesting considering a lot of our cases were non-partisan. This histogram could indicate that the justices might be voting based on another influence and not just their political identifications.

	Frequency	Percent
Appellant	63	63%
Appellee	34	34%
Per Curiam	3	3%
Total	100	100%

Chart 1.3: Side Picked Frequency Table

Above we can see a frequency table which depicts the amount of cases that the justices had voted for either the appellant or appellee attorney. Some cases however were per curiam opinions which means that no justice signed the opinion and the opinion was made by the court. No side is specified in these opinions. Looking at chart 1.3, we can see that 63% of the cases were in favor of the appellant attorney, therefore over half the cases that were decided were decided for a specific side. Also, we can see that 34% of the cases were in favor of the appellee attorney while only 3% of the cases were per curiam opinions. The importance behind this is to see if any side is more partisan than the other side as well as to see if a specific attorney is having more of an influence. This can once again be demonstrated more visually in a histogram graph.



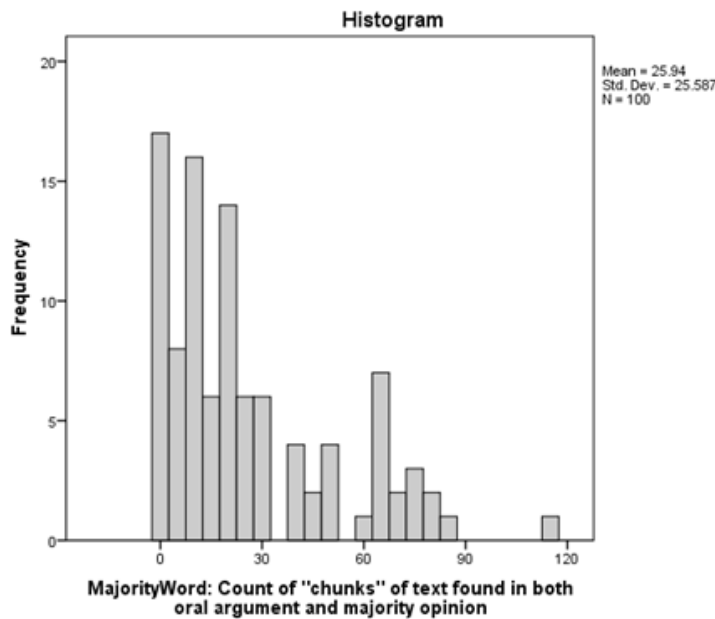
Graph 1.3: Histogram of Side Picked

Looking above, we can see a histogram of the side that was picked by the justices in each case they heard. This histogram is just a demonstration of the frequency table that was depicted above. It shows, once again, that most of the decisions made by the courts were in favor of the appellant attorney, while not as many were made in favor of the appellee.

	Majority Word	Majority Percent	Concurring Word	Concurring Percent	Dissenting Word	Dissenting Percent
Mean	25.94	.241	11.20	.088	26.50	.279
Median	18.00	.100	7.00	.000	16.00	.100
Std. Deviation	25.587	.3118	15.551	.2669	30.844	.5509
Range	117	1.0	98	2.0	195	4.0

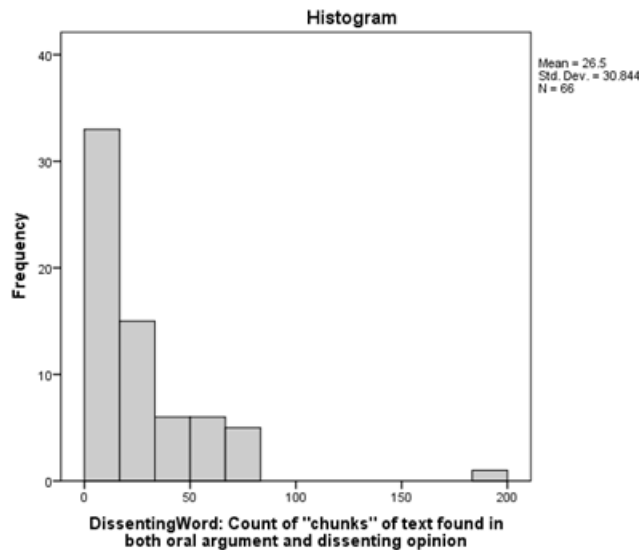
Chart 1.4: Descriptive Statistics of Argument v. Opinion

Next, we can look at characteristics of the variables where an attorney's oral argumentation was deeply examined. First, we can look at a descriptive statistics of how much of the attorneys oral argument was used in the majority, concurring and dissenting opinions. In chart 1.4 we can see a standard descriptive statistics table, which accounts for several variables. These variables include the words that were the same between the oral argument and opinion, as well as the percentage of text that was copied. This table, indicates the mean, median, standard deviation and the range for all of these variables. Looking first at the amount of the oral argument that was used in the majority opinion, we can see that the mean for the amount a text that was copied is 25.94. This means that the average amount of text being copied is about 26 chunks of text. Looking at the percentage for the majority opinion as well, we can see that the mean is .241, meaning that the average percent is only .241% of copied text between the two documents. Next, we can looking at how much of the oral argumentation matched with the concurring opinion. One thing to note is that the concurring and dissenting opinions are missing some numbers because there are times where the justices do not concur, or times where there is no dissenting opinion, such as in the case of a unanimous decision. When looking at the concurring opinion, we can see through the mean that the average number of words being copied is 11.20 words, while the percentage is .088%. This is interesting because these numbers are much lower than that recorded by the majority opinion. I assume that the reason for the decline in the amount of similarities between the oral argument and concurring opinion is due to the fact that justices write a concurring opinion because they agree with the majority vote but have a different reason for agreeing. I assume that this different reason, is based upon something the justice had previously encountered and knew, and was therefore not as affected by the attorney's oral argumentation. The last thing to note is the dissenting opinion. We can see in chart 1.6 that the average amount of chunks of text that were copied were 26.50. The percent that was copied was .279. This is more expected as the dissenting opinion has similar numbers to the majority opinion. The spread in all these variables can better be illustrated using graphs.



Graph 1.4: Histogram of Majority Word

The graph above shows the distribution of the amount of text that was copied between the oral argumentation and the majority opinion. Specifically, it looks at word and not the percentage count. Looking at this graph, we can see that the cases are concentrated between 0-30 chunks of text copied. We can also see that there is an outlier that is close to 120 words copied.



Graph 1.5: Histogram of Dissenting Word

This histogram graph above is similar to graph 1.4, but this is taking the dissenting opinion into account instead of the majority. Looking at chart 1.8 we can see a completely different distribution, with almost all of the cases concentrated from zero to 70 words. We can also see the outlier that exists here as well, this one is almost up to 200 words being the same between the opinion and the attorney’s argumentation.

	Appellant Question:	Appellant Implied	Appellant Not Implied	Appellee Question:	Appellee Implied	Appellee Not Implied
Mean	39.96	8.960	31.00	38.83	7.65	31.38
Median	36.00	8.000	28.00	37.00	7.00	29.00
Std. Deviation	18.797	5.7681	15.220	21.713	6.061	16.803
Range	128	46.0	88	207	55	153

Chart 1.5: Descriptive Statistics of Questions Asked to Attorney

Above we can see a standard descriptive statistics that shows the mean, median, standard deviation, and range of the questions that were asked to both the appellant and appellee attorneys. First, looking at the appellant attorneys we can determine that the average number of questions the appellant attorney is asked is 39.96, or 40, if we round it. Out of those 40, the average number of implied questions that the appellant attorney is asked is 8.96, or 9 questions. Looking at the average number of not implied questions that the appellant attorney is asked, we can see that that number is 31. Next, we can look at the total number of questions that are asked to the appellee attorney. Based upon the mean, we can determine that the total number of questions the appellee attorney is asked are 38.83, or 39. Out of those 39 questions, on average 7.65 of them are questions that have an implied answer and are being asked to the appellee attorney. In terms of the average of not implied questions, we can see that there were 31.38 questions. This is interesting because if the justices are voting on party lines then we should expect to see more implied questions being asked of the attorney.

	F-Value	Significance
The number of conservative justices who voted YES	11.390	.000
The number of conservative justices who voted NO	13.087	.000
The number of liberal justices who voted YES	40.122	.000
The number of liberal justices who voted NO	41.144	.000

Chart 1.6: One-way ANOVA between issue polarization and justice votes

When I started comparing variables, I first conducted a one-way ANOVA between issue polarization and the way that the justices are voting. The purpose of this, was that if the justices are voting on their party lines, then we should expect to see a significance between the way they vote and the polarization of the case that is being heard before the Courts. In conducting this ANOVA, we can see that in chart 1.6, there is a significance between all of the variables. If we look at chart 1.6, then we can note that the significance value for all these variables is .000. This indicates that there is a 0% probability that this relationship is due to chance. Since the significance value is lower than .05, we are able to say that there is a significance that exists between these two variables. Meaning there is a significance between ConservativeYES, ConservativeNO, LiberalYES and LiberalNo, when put against the issue polarization in each case.

	Value	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.687	.005

Chart 1.7: Chi-square between Issue Polarization and Unanimous Variable

The next test that was conducted was a Chi-Square test. This test is used to measure two nominal or ordinal variables. In this case, we are comparing issue polarization and

whether or not an issue will yield a unanimous vote or not. The idea behind this test is that if the justices are likely to vote on party lines, then we should expect to see that most polarized issues are split decisions, whereas most neutral or non-polarized issues are unanimous decisions. The first thing I did was run a chi-square test. Looking at chart 1.7, we can see that the value yielded by this test indicated that the significance value was .005. This means that there was a .5% probability that this relationship was due to chance. Therefore, there was a significance between issue polarization and whether or not the decision was unanimous or not.

	Liberal	Neutral	Conservative
Split-decision	18 (25.7%)	25 (35.7%)	27 (38.6%)
Unanimous decision	10 (33.3%)	18 (60%)	2 (6.7%)

Chart 1.8: Cross Tabulation of Issue Polarization and Unanimous Variable

The next thing I did was create a cross tabulation to actually see how many cases fell into each category: liberal, neutral, and conservative, when analyzed with whether or not the decision was split. Looking at the chart up above, we can see that most split decisions are likely to be conservative. The chart indicates that 38.6% of split decisions are conservative issues. In terms of unanimous decisions, we can see that 60% of unanimous cases are likely to be a neutral or non-partisan issue. This chart is important because it makes it more likely that justices are voting on party lines since the split decision are polarized issues, whereas the unanimous are likely to be non-polarized.

	Value	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.349	.119

Chart 1.9: Chi-square between Issue Polarization and Side Picked

I wanted to look at whether or not the side that the attorney voted for was changed at all by the polarization of the case. In order to do this, I ran a chi-square test between issue polarization and the side that was picked. As we can see in chart 3.1, the asymptotic significance is .119. This means that there is an 11.9% probability that this relationship is due to chance. This is enough for us to conclude that there is no significance between issue polarization and the side picked.

	F-Value	Significance
Majority Word	.453	.637
Concurring Word	1.629	.205
Dissenting Word	.327	.722

Chart 2: One-way ANOVA between Issue Polarization and Word similarities in Opinions

After running those two tests, I started looking at the variables that were meant to show whether or not an attorney had an impact on Supreme Court decision-making. The first variable that I looked at was the comparison between the opinions made by the Courts in terms of word count. The idea behind this test was that if an attorney is not going to have an influence then we should expect to see that less of an attorney's oral argumentation is used in the Court's opinion, especially when the case is polarized. Looking at chart 4, we can see that there is no significance between the MajorityWord, ConcurringWord and DissentingWord, when looking at it against issue polarization.

	F-Value	Significance
Majority Word	.469	.627
Concurring Word	1.335	.271
Dissenting Word	.443	.644

Chart 2.1: One-way ANOVA with Issue Polarization and percent similarities in Opinions

When collecting my data, I noticed there was a big difference between the percentages of texts being copied versus the word count. Due to this factor, I wanted to also run a test between the percentages and the issue polarization of the cases. I ran a one-way ANOVA which indicated similar findings as above. If we look at chart 2.1 we can see that none of these values are significant. In terms of the Majority Percent, we can see that the significance value is .627. This means that there is a 62.7% probability that the relationship between the majority percent and issue polarization is due to chance. This is an extremely high percentage and therefore, we can conclude that this relationship is not significant. Similarly, we can see a reoccurring trend with the other values. In terms of Concurring Percent, we see a significance value of .271. While this number is substantially lower than the one above, it is still not within our .05 threshold of being significant. Lastly, looking at the significance value between the Dissenting Percent and the issue polarization we can see that this value is .644, thereby demonstrating that a significance does not exist here either. This goes to show that there is no significance between the amounts of text being copied from the oral argument to the opinion when placed against issue polarization.

	F-Value	Significance
Questions that were asked to the appellee that were NOT implied	1.019	.464

Chart 2.2: One-way ANOVA between Issue Polarization and Appellee Not Implied

The next set of variables I examined, were the questions that were being asked of the attorneys. In chart 2.2, we see a one-way ANOVA between the questions that were asked to the appellee attorney that were not implied versus issue polarization. Looking at the significance value here we can see that there is a 46.4% that this probability is due to chance. Based upon this, we can say there is no significance. Issue polarization does not have an effect on the amount of questions that are not implied and asked to the appellee attorney.

	F-Value	Significance
Questions that were asked to the appellee that were implied	1.033	.434

Chart 2.3: One-way ANOVA between Issue Polarization and Appellee Implied

The next variable is the questions that were asked to the appellee attorney that were implied questions. Looking at chart 2.3, we can see that we have a significance value of .434, this once again demonstrates that no significance exists between these two variables. There is a 43.4% probability that this relationship is due to chance. Due to this high probability, we must then conclude that there is no significance between issue polarization and the amount of implied questions that the appellee attorney is being asked.

	F-Value	Significance
Questions that were asked to the appellant that were implied	.875	.634

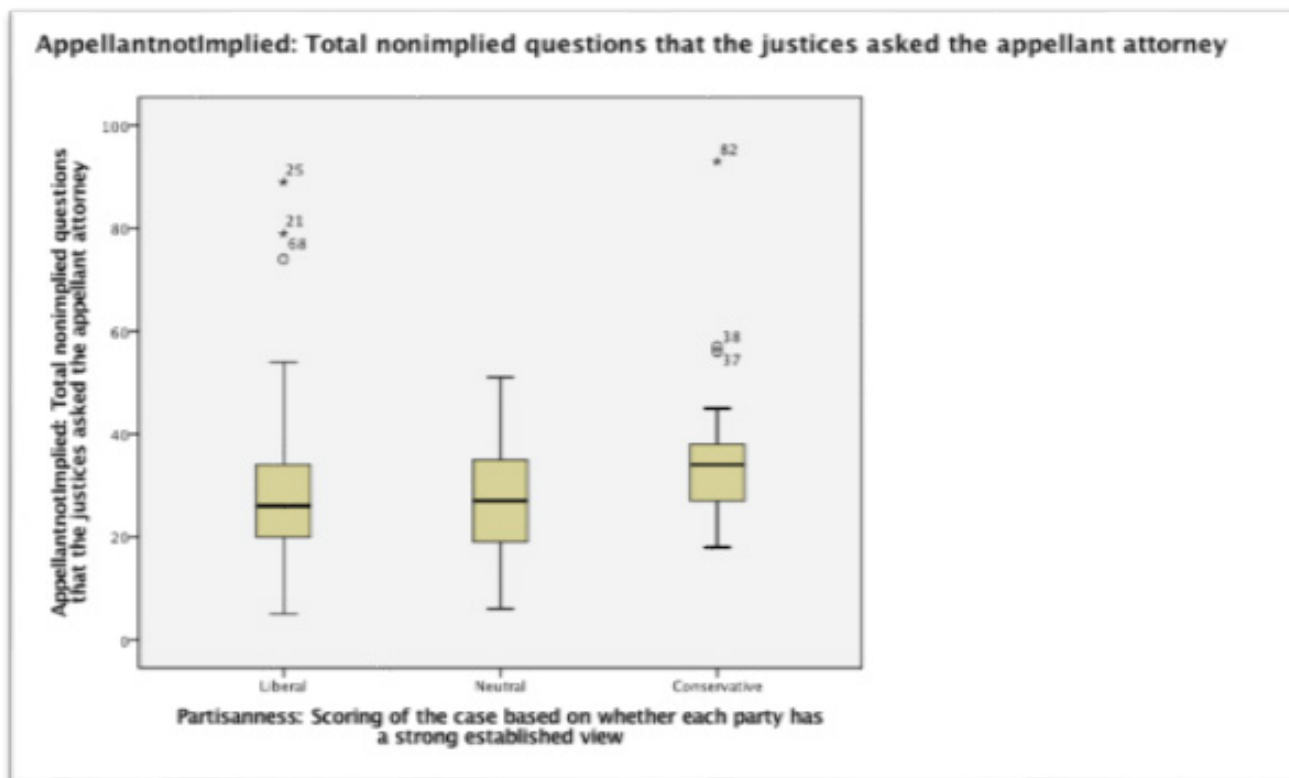
(Insert Chart 2.4 here)

Next, I looked at the questions that were asked to the appellant attorney. The first one-way ANOVA I ran was between issue polarization and the total amount of questions that the appellant attorney was being asked that were implied. Looking at chart 8, we can see that the significance value is .634. Therefore, there is no significance here either meaning that issue polarization does not affect the amount of implied questions that are being asked of the appellant attorney.

	F-Value	Significance
Questions that were asked to the appellant that were NOT implied	1.714	.029

(Insert Chart 2.5 here)

The last variable that I looked at in terms of the questions being asked during the attorney's oral argumentation was the amount of not implied questions that were being asked of the appellant attorney. This was really interesting because if we look at the significance value then we can see that it is .029, it is lower than the .05 requirement and is therefore significant. There is a 2.9% probability that this relationship is due to chance. This means that issue polarization is affecting the amount of not implied questions asked of the appellant attorney. This was interesting considering it was the only type of question that issue polarization had an effect upon and I decided to investigate further.



Graph 1.6: Box Chart of Appellant Not Implied

I created a box chart that illustrates the relationship between issue polarization and the appellant not implied questions. The black lines on this chart which are not connected to the shaded area illustrate the distribution of the questions in each category, whether it be liberal, conservative or neutral. This means that the black line we see in the liberal section indicates that the lowest amount of not implied questions to the appellant attorney were around five questions, while the maximum amount were fifty-three questions, not including the outliers. The outliers are seen on this graph by the stars or circles that are located above the drawn distribution. These outliers might be one of the reasons that there is a significance between issue polarization and the total number of appellant not implied questions. Another thing that is indicated in this chart is the black lines located in the middle of the shaded in box. These lines indicate the averages of each category. If we look at chart 10 then we can see that the averages of each group is rising. The liberal cases have an average of less not implied questions, while the conservative cases have the most. This trend that shows an increase in questions based on the polarization of the issue is a clear indicator as to why there is a significance between issue polarization and questions that are asked to the appellant attorney that are not implied.

Conclusion:

The results from my data analysis demonstrate that an attorney is likely not to have an effect in the Supreme Court, especially when the case is partisanly divided. This is the result of a lack of significance between issue polarization and the similarities of the oral argumentation versus the opinions by the Court. Since there is no significance in this respect, we can make the inference that an attorney is not having an effect on the Supreme Court. The other attorney influence that we expected to see was based upon the number of implied versus not implied questions that were asked to the attorney. In terms of these variables we noticed that only one of them was significant. Since only the appellant not implied questions held any significance, there is a strong likelihood that an attorney is still not having much of an impact on the justices. Due to the lack of significance between the other variables I think it is safe to assume an attorney's influence seems to be lacking in the Supreme Court with issues that are polarized.

The results did indicate, however, that there is a likelihood that justices are voting on party lines. When looking at how many liberal justices were voting yes or no for a case and how many conservative justices were doing the same, we saw that the issue polarization of the case had an effect on these variables. There was a significance between how the justices were voting and whether or not the case was polarized. From this we can assume that the justices are voting on their party lines. Furthermore, the results also indicated that there was a relationship between issue polarization and whether or not the decision would be split or unanimous. We saw that the split decisions were more likely to be conservative issues, while the unanimous decisions were more likely to be neutral or non-partisan issues. Through this, we can see another indicator of justices voting on their party lines. These results go to solidify the fact that there is some sort of bias that exists within the Supreme Court and that an attorney is not playing as much of a role as we would expect them to be.

The reason that an attorney may not be having as much of an effect as we would have expected could be due to our political climate. Our political climate shows that our political system and society is becoming more and more polarized. With this we see an increase in polarization in all of our institutions, including the Supreme Court. Due to the polarization occurring in the Supreme Court, we can say that an attorney may appear in the Supreme Court in order to aid the justice in understanding the factual issues of a case in front of them. An attorney's appearance may also be used as an image to the public, in order to convince the public that they have an impact in Supreme Court decision-making.

There are certain factors that can be adjusted in this thesis. For example, I noticed that there was a lack of words copied from the oral argumentation and the written opinions by the Court. I think that if someone wanted to further explore this data then they should look at what part of the oral argumentation was copied and see if any of those similarities are significant chunks of the attorney's argument. If significant chunks are being copied, then there is a strong likelihood that attorneys could be having more of an impact than we are anticipating. Furthermore, I used a comparison tool to find the similarities between the argumentation and opinions written. If I had more time to work on this project then I would read the oral arguments and opinions and find the similarities myself. This is because the Court opinions might not be using the exact wording from the attorney's argumentation,

rather using a similar idea. If there are in fact more similar ideas being used, then these ideas would be ignored through an online comparison.

Another recommendation would be to create a multi-method study because this can account for variables in a qualitative sense as well. This qualitative data would be helpful because it would require an analysis of separate cases, and through this we would be able to see if there are specific instances where an attorney could be playing a role. As part of the multi-method study, we should also talk to justices to find out what they are really thinking when examining cases. It is difficult to speculate as to what is running through a justice's mind. The only adequate way to find out exactly what a justice is thinking is to get their perspective on the issue. That factor along with my data set and some qualitative analysis could create a more detailed study.

All in all, this thesis demonstrated that an attorney does lack an effect in Supreme Court decision-making. Through my study, I found it surprising that there was not more text copied between the Court's opinions and the attorney's argumentation. This though, as stated earlier, could be due to the fact that the opinions might be written using different phrases that carry the same idea that the attorney is conveying. I also did not expect to see as many implied questions when reading the oral argumentations. Reading the oral argumentation and all the questions asked really indicated that an attorney may not be as effective as they appear to be. Overall, there were surprising elements in the data set and the results indicate what we should expect as a result of our divided political system.

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"Where Do I Belong, Here or Where You Are?": A Postcolonial Feminist Reading of *Wide Sargasso Sea* and "Corpse Song"

Abstract

In this paper we discuss how opposing forces in power, race, and social status can displace the identity of an ethnic woman by examining Jean Rhys' *Wide Sargasso Sea* and Margaret Atwood's "Corpse Song." Through the application of a postcolonial feminist lens, this paper explores how both texts incorporate concepts such as "double colonization" and "othering" in order to reinforce the oppression the female protagonists face. The paper also discusses the presence of multiple identities and how they can lead to either the distortion of identity or the reclamation of it. The presence of identities is further explored through the negative effects of postcolonialism and the patriarchal culture. The two texts utilize a disruptive narrative style in order to represent the resistance against the Eurocentric and phallogocentric ideas that traditional literature is usually defined by.

Introduction

Both postcolonial and feminist theory allow one to address the various spheres of influences in society and how they cause a two-fold oppression for ethnic women. This oppression is colonial as well as patriarchal, and the two theories allow one to analyze the rampant misogyny evident in society by looking at race and how it affects a woman's power, social status, and most importantly, identity. Through the use of postcolonial feminist theory, one can see how the theme of identity is the thread which links the two texts together. Through the application of this lens, we can see that this two-fold oppression can lead to an ethnic woman being placed "in between" multiple identities and struggling to come to terms with them. In this paper, we use a combined lens of postcolonial feminist theory to analyze the language and disruptive narrative style of the two texts in order to show an ethnic woman's resistance against the defining nature of Eurocentric and phallogocentric ideals which traditional literature is usually defined by.

Literature Review

Postcolonial theory focuses on the exploitation of colonized people and their lands as well as the human consequences that result from it. By combining feminist theory with postcolonial theory, we look specifically at the effects of the exploitation of colonized women and how this affects their agency as well as the actions they take to reclaim their identity. One of our sources, Valerie P. Roper, who writes for *Caribbean Quarterly*, discusses the idea of an ethnic woman as a storyteller. This theme is important because in most Western literature, ethnic women are usually dehumanized and rendered voiceless, as seen with Bertha in *Jane Eyre*. By letting an ethnic woman have a voice to tell her own story, Antoinette is not only showing her resistance against her oppressors but it can also be seen as a coping mechanism to reclaim her identity. As Roper states, "Through her consciousness she retraces with brutal honesty her psychological journey from isolation to disintegration. She concentrates on her childhood experiences which reveal her futile search for love and understanding and the stages of her rejection, alienation and disintegration" (19). This statement shows how the dis

ruptive narrative of *Wide Sargasso Sea* helps Antoinette keep her identity alive and sustain her existence so she does not succumb to her oppressors.

A text relevant to the analysis of Margaret Atwood's "Corpse Song" is "The Only Free People in the Empire" by Bridget Orr, a professor in the English department at Vanderbilt University, whose research focuses on imperial power. In this piece, Orr touches upon the concept of dialogism, which she describes as "arguing that the sociality of linguistic exchange allows the self to open up to the other without assimilating the other" (154). This relates to the narrator in the poem who creates two narratives to discuss her suffering but continued defiance to her oppressors. The analysis of "Third World writing" relates to the speaker's reclamation of her identity that occurs in the use of dialogism. Orr acknowledges the perspective of gender in postcolonial theory which allows for better understanding of the narrator when viewed through a postcolonial feminist lens.

Methodology

Applying a combined lens of postcolonialism and feminist theory facilitates our examination in order to discuss the scope of issues which affects a specific exploited group. After deciding a theory, we chose to compare a poem and a novel from different decades to show the extent of issues that ethnic women face and how these issues need to be acknowledged. This is further expressed by choosing one text that is inherently postcolonial feminist, *Wide Sargasso Sea*, and one that is not, "Corpse Song." Next, we do a close reading of both texts and determined the postcolonial feminist elements. We look for evidence of concepts such as objectification, exoticification, and othering and analyzed how the two texts gave a voice to those who are usually voiceless in the traditional social hierarchy. In *Wide Sargasso Sea*, we perform this by looking specifically at Antoinette's point of view and examining passages where Antoinette is isolated by both the Blacks and Whites, showing how she does not fit in with either group. In "Corpse Song" it is clear that the narrator is a voiceless and oppressed figure that is rising above the corruption that can be examined in a postcolonial feminist lens. Like Antoinette, the narrator is also othered and is left in her own form of isolation created by the Eurocentric, patriarchal traditions. By finding these concepts, we are able to compare the works on the foundation of a postcolonial-feminist lens.

Findings and Discussion

By applying a postcolonial-feminist theory to these two texts, we can see the different modalities of reclaiming identity which can occur either constructively, as seen with the narrator of "Corpse Song," or destructively, as witnessed with Antoinette in *Wide Sargasso Sea*. Antoinette seems to reclaim her identity destructively because she seems to belong to both the colonized and the colonizer, but is not accepted by either. When the struggle between this power complex is fueled by forces such as poverty, hatred, and systematic oppression from colonial and patriarchal structures, these two identities become violently exacerbated (Anderson). Additionally, we find that the text's exploration of oppositions, such as Antoinette's relationship with Rochester being not just of man and woman but also of colonizer and colonized, supports how ethnic women experience a two-fold oppression that a significant amount of white women and ethnic men do not experience. Furthermore, Antoinette's destructive reclamation of identity manifests a more collective story outside of

Antoinette as an individual; a story that displays the shared humanity of Blacks and Whites and how this relationship has always been destructive due to the legacy of slavery. It is significant to see Antoinette as a symbol for this larger narrative because throughout history, ethnic women have always been voiceless and excluded from the societal narrative.

Postcolonial-feminist theory allows us to understand the struggles of an ethnic woman in “Corpse Song” while also acknowledging her power that her oppressors try to diminish. The colonizers try to condition her into submission by methods of othering and ostracism, depriving her of the abilities to think for herself and be her own person. The different perspectives in the poem represent how the narrator is able to separate who she is from how society sees her. She recognizes the cruelty that she has gone through but then chooses to overcome it rather than remain passive. Although society made an attempt to suppress her, this woman is able to reclaim her identity and regain what has been taken from her in a constructive manner. Instead of ending in destruction like Antoinette, the narrator of “Corpse Song” responds to her injustices through a triumphant return. The boat imagery is an allusion to colonizers “discovering” the new world or voyaging to “uncivilized” countries. Here it symbolizes the narrator reclaiming her power and taking that role away from those who oppressed her. The poem expresses how she is able to take control of her life and identity.

Conclusion

Although *Wide Sargasso Sea* and “Corpse Song” are products of different decades, they both illustrate the struggle that ethnic women face. The two texts express how oppression can exist in different forms. The impact that comes from this injustice is not always violent because people experience and respond to oppression in different ways but both experiences are still valid in expressing the problems ethnic women face. Examining works from a postcolonial-feminist lens allows us as readers to acknowledge the stories of those who are oppressed and find representation for their struggles where they are usually overlooked. It is important to take into account that these works just scratch the surface of issues examined by postcolonial-feminist theory in literature. These works can be seen as a starting point to join the discourses on this subject, which can be further explored in the future.

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Ternary Complexes Through Maillard Conjugation of Sodium Caseinate, Dextran, and Resveratrol to be Used as Emulsifiers

Introduction

Oil-in-water emulsions are systems in which oil is dispersed in an aqueous phase. These systems are widely used in the food industry to create products such as dairy alternative drinks, salad dressings, gravies, etc. Emulsions are thermodynamically unstable but they can be stabilized by emulsifiers to create a kinetically stable system that remains unchanged for long periods of time. Emulsifiers surround the oil droplets due to their amphiphilic nature (presence of hydrophobic and hydrophilic regions in the molecules). Proteins as amphiphilic compounds can be used as emulsifiers, nevertheless they are sensitive to pH and at the isoelectric point they lose their electrostatic repulsion and tend to coagulate and precipitate. One way to create emulsions stable at a wide range of pH, is through the attachment of high molecular weight polysaccharides to create steric hindrance¹.

Maillard reactions have been used to covalently bind polysaccharides and protein to create steric repulsion between the droplets and to prevent flocculation and coalescence of protein stabilized emulsions at the isoelectric point of the protein. Heating proteins with saccharides causes this reaction to take place. Through intermolecular rearrangement, the saccharides and proteins join through covalent bonds in a series of steps². Stopping at the Amadori intermediate, the conjoined molecules complement each other when used for emulsification purposes³. Solubility, thermostability, and resistance to denaturation through pH see positive effects when Maillard conjugation is used in place of independent proteins for surfactants such as bovine serum albumin⁴. Conjugation of proteins and saccharides through Maillard reactions has also been shown to improve antioxidant properties of the emulsifiers when compared to simple biopolymer emulsions⁵.

The purpose of this research is to determine which dextran shows the greatest conjugation to sodium caseinate as well as the greatest concentration of resveratrol that can be added to the emulsifiers yielding the highest binding capacity.

Methods.

Maillard Conjugate Formation.

Sodium caseinate (1.00 % w/w) and dextran (1.00 % w/w) of various molecular weights (12, 40 and 250 kDa) were individually solubilized in 5 mM phosphate buffer (pH 7). The solutions were then mixed together in a 1:1 ratio, leading to a final sodium caseinate protein concentration of 0.5 % (w/w). The mixture was then placed into a freeze dryer (SP Industries, Warminster, Pennsylvania, USA) for 72 hours. Maillard conjugation reactions were performed by incubating the freeze-dried mixture in an ES 2000 Benchtop Environmental Specialties climacteric chamber (Raleigh, North Carolina, USA) at 60 °C and 77.5 % relative humidity for a period of up to 72 hours where samples will be removed periodically (every 24 hours) for analysis^{6,7}.

Maillard Conjugation Characterization.

Conjugation Efficiency. The conjugation efficiency was determined by measuring the reduction of free amino groups using the o-Phthaldialdehyde (OPA) assay⁸. Calibration curves were constructed using L-lysine (0.2-5mM). Conjugation efficiency was defined by the following equation:

Conjugation efficiency (%) = $(1 - (\text{amine groups after conjugation (M)}/\text{amine groups before conjugation(M)})) \times 100$

Conjugation yield. The samples were dissolved in a phosphate 5mM phosphate buffer solution (pH 7.0) at a concentration of 10 mg/mL and the protein concentration was determined using the Lowry assay method¹ using a standard curve (0 to 1.0 mg/mL concentrations of sodium caseinate in pH 7.0 buffer). Then the solution was acidified to a pH of 4.6 and then centrifuged at 1000 g for 10 minutes and filtered. The pH of the supernatant was then adjusted to 7.0 and a final Lowry assay was conducted. The conjugation yield was defined using the following calculation: Conjugation yield (%) = $(\text{protein in supernatant (mg/L)}/\text{protein in suspension (mg/L)}) \times 100$

Polyphenol Binding Capacity.

To determine the maximum amount of polyphenols that can be bound to the protein, a 1% (w/w) solution of sodium caseinate was mixed for 30 minutes with resveratrol at concentrations ranging from 50 to 500 $\mu\text{g/ml}$ in the final solution. The suspension sat for 5 days at 45 °C, then was centrifuged and the supernatant dissolved in dimethyl sulfoxide (DMSO). The concentration of resveratrol in the supernatant was measured using a ThermoSpectronic Genesys 10uv UV-vis spectrophotometer (ThermoFisher Scientific, Waltham, Massachusetts, USA) at 309 nm. Fabrication of Nanoemulsions.

To form the nanoemulsions, 5% (w/w) of oil was mixed with the aqueous phase containing 2% (w/w) of Maillard conjugates in 5mM phosphate buffer solution (pH 7.0). The mixture was then homogenized for 4 minutes at 20,000 rpm using a high shear homogenizer (VWR International, Radnor, Pennsylvania, USA), then finally ran through a Nano DeBee high-pressure homogenizer (Bee International, South Easton, MA, USA) for 5 passes at 30,000 psi.

Characterization of emulsions

The physical stability of the emulsions was assessed by measuring the particle size distribution using a Beckman Coulter LS 230 (Beckman Coulter, Inc., Brea, California, USA) through laser diffraction based on Mie theory.

Antioxidant activity of the emulsifiers

The ABTS test was used to determine free radical scavenging activities of the Maillard conjugates, polyphenols, sodium caseinate and dextran, and oils².

Results and Discussion.

Maillard Conjugation Characterization.

As shown in figure 1a, conjugation efficiency showed greatest results at 24 hours with dextran 12 kDa (NaC/A12) and dextran 40 kDa (NaC/A40) at 28.271% and 19.761% reduction of available amino groups, respectively. Dextran 250 kDa (NaC/A250) showed the most unfavorable results with the highest conjugation efficiency after 72 hours at 3.644%. NaC/A12 and NaC/A40 maintained conjugation efficiency throughout all time points. NaC/A250 had unfavorable results, most likely, due to the length of the saccharide as steric hindrance did not allow the terminal ends of the saccharide to have access to the amine groups on the proteins.

As shown in figure 1b, conjugation yield showed greatest results at 24 hours with NaC/A12 and NaC/A40 at ~100% stabilized protein. NaC/A250 showed a conjugation yield of 93.772% after 72 hours. NaC/A12 steadily declined in conjugation yield after the 24 hours while NaC/A40 and NaC/A250 maintained yield at ~100% throughout all time points. As shown in figure 1c, color variation remained relatively stable in NaC/A40 and NaC/A250 for all time points. NaC/A12 showed the greatest increase from the non-conjugated sample (hour 0) which suggests the Maillard reaction progressed to Strecker degradation, which can also explain the loss of conjugation yield decreasing over time. From this point further NaC/A40 was selected to continue with the study.

Polyphenol Binding Capacity.

As shown in figure 2, the addition of resveratrol at 250 and 500 $\mu\text{g/mL}$ yielded 99.6% and 98.7% respectively. This indicates that a concentration range of resveratrol between 250 to 500 $\mu\text{g/mL}$ added to NaC/A40 will bind at ~100%. Greater concentrations begin to yield lower results probably due to the crystallization and precipitation of resveratrol.

Characterization of emulsions

As shown in figure 3a, emulsions comprised of Maillard conjugates are stable at both pH 7 and 4.6 (I_p). The emulsions remained monomodal with a diameter size of 136 nanometers. Figure 3b shows emulsions using protein alone as the emulsifier. Though stable at pH 7.0, the emulsions break apart at pH 4.6 (I_p). The main reason behind the stabilization of the emulsions with Maillard conjugates could be due to the steric repulsion generated by the dextran.

Antioxidant activity of the materials

As seen in figure 4, sodium caseinate showed 24.97% radicals scavenged while dextran 40 kDa was at 0.24%. After conjugation, 27.23% of radicals were scavenged, while as expected the addition of resveratrol, a natural antioxidant, increased the results by more than three times.

Conclusions.

This study showed that NaC/A40 yielded both the highest conjugation efficiency and yield after 24 hours, showing stable results up to 72 hours. Emulsions made with sodium caseinate or NaC/A40 are stable at a neutral pH, while the Maillard conjugates are stable at all pH ranges, thus yielding a more applicable emulsifier for the food and beverage industry. The addition of resveratrol at concentrations up to 500 $\mu\text{g}/\text{mL}$ showed binding capacities of $\sim 100\%$ while increased antioxidant capacity showing potential to stabilize polyunsaturated fatty acids such as omega-3 or sensitive bioactive compounds encapsulated in the emulsions. Future research should be directed toward creation, shelf life, and digestion studies of emulsions using ternary emulsifiers.

Appendices

Acknowledgments.

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Figures

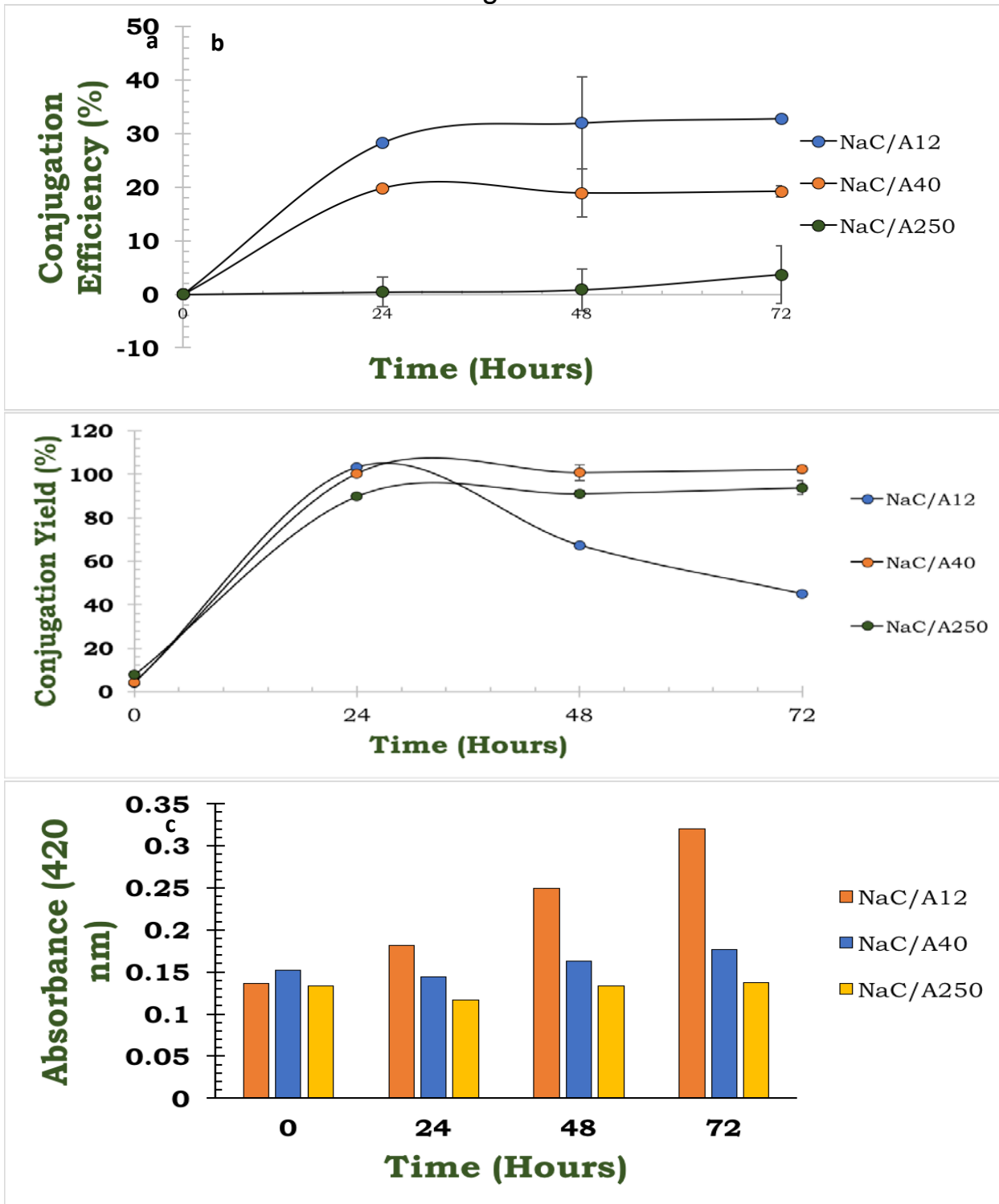


Figure 1. a) Conjugation efficiency, b) conjugation yield and c) browning of the sodium caseinate and different molecular weight dextrans over a conjugation time of 72 Hours at 60 °C and 77.5% relative humidity.

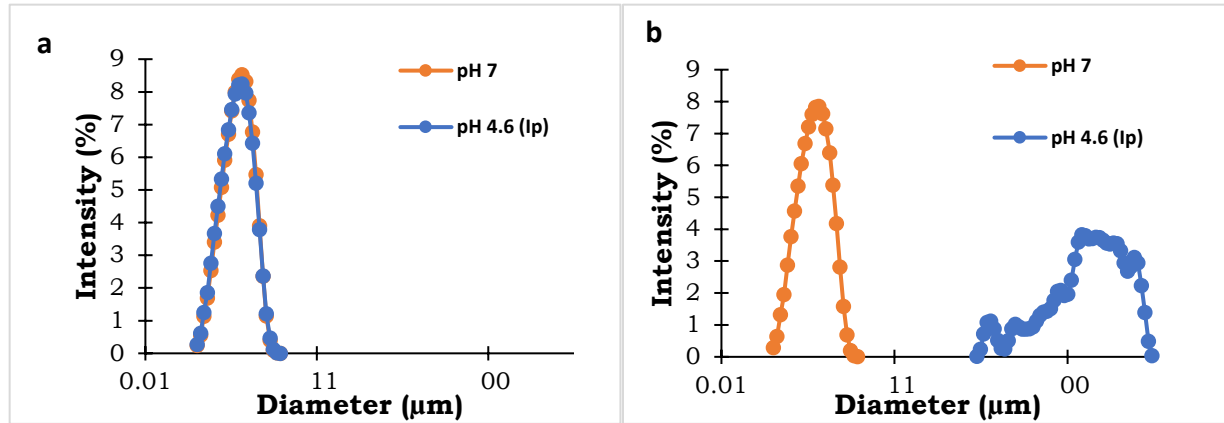


Figure 3. Particle size distribution at pH 7 and pH 4.6 of nanoemulsion made a) Maillard conjugates (NaC/A40) and b) sodium caseinate alone.

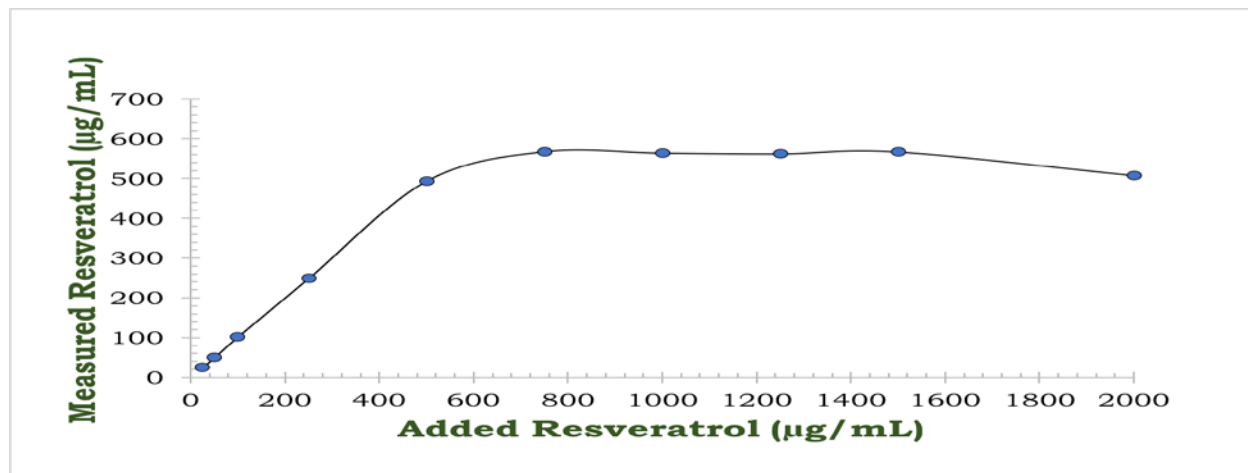


Figure 2. Dependence of added and measured resveratrol in 1% (w/w) sodium caseinate solutions.

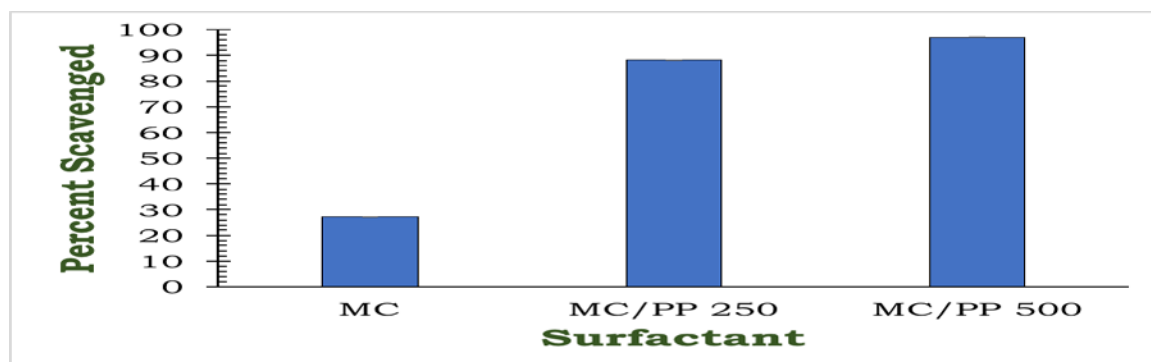


Figure 4. Antioxidant activity of the different potential emulsifiers (Sodium caseinate (NaC), dextran 40 kDa (A40), Maillard conjugates (MC), Maillard conjugates with 250 µg/ml of resveratrol (MC/R 250) and Maillard conjugates with 500 µg/ml of resveratrol (MC/R 500) as measured by ABTS and expressed as radical activity scavenging.

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Design and Testing of A Solar-Driven Wastewater Treatment Unit for Off-Grid Applications

Abstract

The decline of surface water sources along with periodic droughts has introduced new challenges for the state of California. In order to keep up with the increasing demand for water, the state is heavily relying on imported water from the north to Southern California as well as importing water from the Colorado River. The imported water has a large carbon footprint due to using grid power for water transport. Water reuse (reclaimed) is considered as one of the solutions to reduce the dependency of state on imported water. The research team at Cal Poly Pomona, is developing an off-grid solar-powered greywater treatment system for non-potable use in single households. Greywater is the drained water from bathroom sinks, showers, tubs, and washing machines; not including wastewater from toilets or kitchen sinks. Treating greywater on-site can provide significant water savings, and can reduce the carbon footprint of desalination using solar panels. The developed system is comprised of a three-stage treatment train: micro-filtration, solar-driven reverse osmosis, and ultraviolet disinfection. The end product of the project is capable of reclaiming 90-100 gallons of water per day which is about 60% of residential greywater waste. The system removes large suspended particles (particles of dirt, food, etc.) as well as organic and inorganic dissolved contaminants. It is demonstrated that the system can provide a permeate flow that agrees with recommended guidelines for reclaimed water. The system has a recovery rate of up to 62%.

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Introduction

Having access to clean water is a basic human need and right. According to United Nation's Human Development Report, about one in five people living in developing world do not have access to clean water [1]. Water crisis has been identified as one of the major challenges, facing human race in 21st century by World Economic Forum [2]. Many communities around the globe are experiencing new levels of water shortage. Cape Town (second most populous urban area in South Africa) is counting the days to reach "Day Zero" in which municipal water will stop flowing due to extreme drought condition and insufficient sources of fresh water [3]. The water crisis is not limited to the developing world. In the wake the most severe drought conditions in the history of California, as of April 2018, more than 58% of the Californians are living in water-stressed areas under drought condition [4].

Water reuse is one of the options available for the governments to reduce the need for fresh water. In California, water reuse has been utilized to reduce over-drafted ground and surface water supplies [5]. More than 37% of the reclaimed water is used for agricultural irrigation and about 12% of the reclaimed water is pumped to the aquifers for groundwater recharge. Although centralized wastewater treatment plants have been in operation for decades, decentralized and point-of-use water and wastewater treatment has not received enough attention.

Many of the decentralized membrane-based water treatment systems that are currently in operation are large scale and targeted at treating brackish water and seawater. Elsaad et al. [6] presented a decentralized water treatment system based on Reverse Osmosis to produce potable water for a village in Mexico. Elsaad's system treated groundwater and rainwater at a flow rate of 1.9 gpm. In a similar project, Qiblawey et al. [7] developed a photovoltaic-driven Reverse Osmosis (PV-RO) system that produces about 132 gallons per day of treated water. A softener unit is considered before the RO system as a pre-treatment step to eliminate mineral ions that cause scale problems. In addition to the softener, a 5-micron sediment filter, a granular activated carbon filter, and a 1-micron sidemen filter were used.

In a different and more recent effort, Gökçeks [8] developed a wind-driven RO system for remote locations in Turkey to desalinate seawater. They tested the RO system in conjunction with a variety of wind turbines, ranging from 6 to 30 kW. The excess power generated by wind turbines were exported to the local power grid. They demonstrated that their wind-driven system produces water at a rate of 4.4 gpm and at a slightly higher cost compared to a grid-tied desalination unit.

In a more recent study, Karavas et al [9], developed a decentralized and solar driven seawater desalination unit that was capable of producing up to 0.44 gpm of permeate flow at pressures as high as 740 psi. Unlike most PV-RO studies Karavas' system does not include a battery and employed DC micro grid concept along with mechanical and electrical energy storage methods such as hybrid capacitors and pressure vessels to remedy the intermittency of solar energy.

The current team previously designed, fabricated, and tested Decentralized Renewable Off-grid Water Treatment (DROWT) technology [10]. DROWT 1.0 was a solar driven RO filtration system that is designed to operate independent of the power grid. DROWT 1.0 was run by a DC pump and had a relatively large footprint. In this paper the second generation of DROWT products is presented. DROWT 2.0 has revolutionary differences with its predecessor including shorter footprint, ability to operate on- or off-grid, and more robust design and components. This paper discusses the design, fabrication, and testing of DROWT 2.0. The ultimate goal of the DROWT project is developing a water reuse technology for single-unit dwellings, remote areas, and disaster management.

REVERSE OSMOSIS THEORY

Reverse Osmosis is a membrane-based technology that is widely used for water and wastewater treatment. Raw water that may include suspended particles and dissolved contaminants, is pushed through a semi-permeable membrane. The membrane is only permeable to water molecules due to its small molecular size and impermeable to dissolved and suspended contaminants. The flowrate of the RO process product (permeate) is found by Eq. (1)

$$Q_w = (\Delta P_{\text{Hyd}} - \Delta P_{\text{Osm}}) \times K_w \times S \quad (1)$$

where Q_w is the permeate flow rate, ΔP_{Hyd} is the hydrostatic pressure across the membrane, ΔP_{Osm} is the osmotic pressure of the feed water, K_w is the water permeability coefficient, and S is the wetted surface area of the membrane [11]. The hydrostatic pressure across the membrane must overcome the osmotic pressure of the feed water. The osmotic pressure of the feed water is found by Eq. (2)

$$\Delta P_{\text{Osm}} \approx RT (C_{\text{feed}} - C_{\text{per}}) \quad (2)$$

where R is the ideal gas constant ($8.3144598 \text{ kg m}^2 \text{ s}^{-2} \text{ K}^{-1} \text{ mol}^{-1}$), T is the temperature of feed water (K), and C_{feed} , C_{per} are molar concentration of dissolved species (mol m^{-3}) in feed and permeate flows, respectively. Since the concentration of the dissolved solids in the permeate flow is smaller than that of feed water (i.e., $C_{\text{feed}} \gg C_{\text{per}}$), the osmotic pressure of the feed water is almost linearly related to the concentration of dissolved solids in the feed water. The molar concentration of dissolved solids is commonly represented by Total Dissolved Solids (TDS) and the electrical conductivity of the feed water. The energy consumption of any RO system is directly proportional to the required feed pressure. Conclusively, desalinating water streams with high TDS (e.g., sea water) is much more energy intensive when compared to treating wastewater.

CONFIGURATION OF THE SYSTEM

DROWT 2.0 is designed and tested employing lessons learned from DROWT 1.0. The most significant difference between two versions is the addition of a third RO membrane in series and a third microfilter in the pretreatment step. The new design features a recycle loop that protects the RO membranes, enables higher recovery rates [7], and reduces the number of pumps from two in DROWT 1.0 to one in DROWT 2.0. Another major difference between the previous and new designs is the installation of a DC to AC inverter to power the pump and ultraviolet disinfection unit.

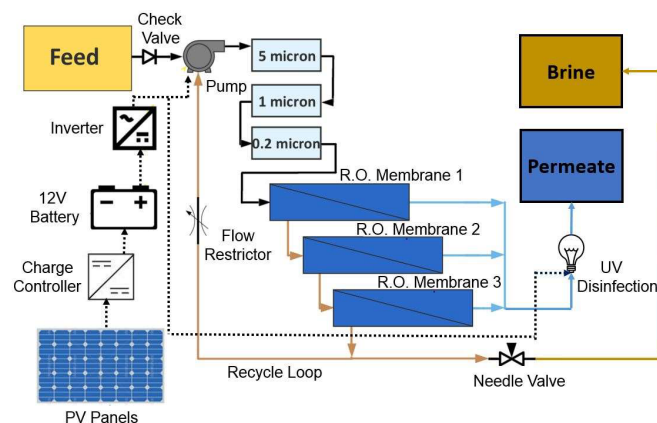


Figure 1 - Hydraulic Flow-diagram and Electric Circuit Schematic

Figure 1 shows the hydraulic and electrical circuit schematic for DROWT 2.0. Unlike DROWT 1.0, a plunger pump is no longer used on DROWT 2.0 and instead a vane pump is used due to its compactness and robust performance characteristics. Feed water is drawn from the feed tank by a positive displacement Procon Series 2 pump (Model No. 142A110S) rated at 112 gallons per hour. The pump is powered by a Marathon $\frac{1}{2}$ hp split-phase

carbonator pump motor (Model No. 871 YP). Feed water is conveyed in ½” outside diameter (O.D.) polyethylene tube and is mixed with flow from an integrated brine recycle loop before entering the suction side of the pump. A standard 304 stainless steel spring check valve is installed on the feedwater line upstream of the junction between the recycle line and feed before it is introduced to the suction side of the pump. A second spring check valve is installed downstream of the pump to eliminate potential backflow of water. An Ashcroft analog pressure gauge and a Kavlico pressure transducer, Model No. 1009 and P255, respectively were installed downstream of the second check valve to determine system pressure before the pretreatment stage in microfilters. In the pretreatment stage, water is passed through a series of microfilters with a successive reduction in porosity to reduce the filter maintenance expenses, i.e., 5-microns, 1-micron, and 0.2-micron. The pretreatment micro filters are Neo Pure Model No. PH-27097-05, PH-27097-1A, and HP-PESG-26100-0.2-B, respectively. The addition of a third microfilter was made to strategically step down the filtration in order to extend the life of the 0.2 micron filter; whereas, version 1 had similarly sized microfilters connected in series.

Service racks for both the microfilters and RO membranes were incorporated to better access the components when needed. Analog pressure gauges and pressure transducers were installed upstream and downstream of the 0.2-micron microfilter to monitor pressure drop across it for maintenance purposes, per manufacturer's specifications. After the pretreatment stage, feedwater is then directed through three Axeon 2.5” D x 21” L spiral wound reverse osmosis membranes (Model No. HF5-2521) connected in series. Permeate from each membrane is collected and directed to a Viqua Sterilight Ultraviolet Unit (Model No. SC1) for post treatment. The concentrate of the first and second RO membranes is passed through the subsequent membrane in series to enhance recovery rate. The concentrate of the third membrane is directed through a 3/8” Superlok needle valve (Model No. SINV4-F-6N-RS-S316) before disposal. The needle valve is used to regulate pressure in the system to desired test pressures. A tee fitting is installed upstream of the needle valve and a Neo-Pure one gallon per minute flow restrictor (Model No. FRSS-1-038FF) is connected to the branch side of the 3/8” O.D. Tee. The flow restrictor is used to allow a controlled portion of the 3rd membrane’s concentrate to be recycled and mixed with feedwater and cycled through the system for treatment. Recycling the concentrate is necessary to increase the feed water that passes through RO membranes. Reduced feedwater flow rate in the RO membranes may cause excessive fouling and system failure.

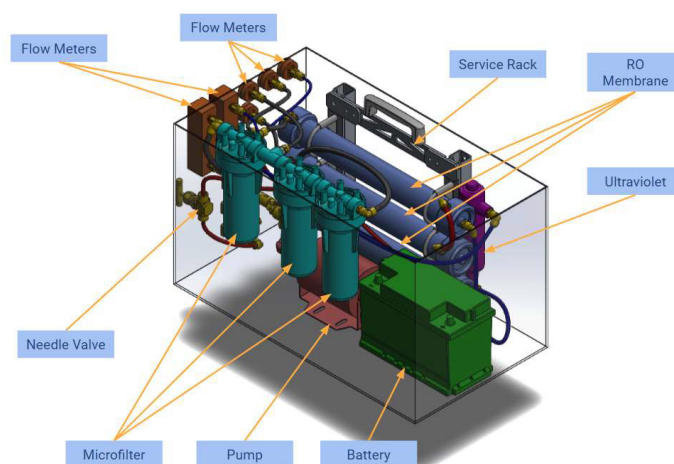


Figure 2 - SolidWorks Rendering of System Packaging and Hydraulic Circuit Configuration

The location of the components inside the enclosure was determined by developing a 3D CAD model in SolidWorks as illustrated in Fig. 2. Redundant flow meters were installed on the permeate and brine lines consisting of analog and digital meters. Digital flow meters are Uxcell ¼" hall effect water flow meters (Model No. A16042200UX0966) while the analog flowmeters are Hydronix panel mount (Model No. PMF-0202). A single digital flow meter was installed on the raw feed water so as to minimize head loss on the suction side of the pump. All fittings used were push-to-fit fittings compatible to the outside diameter of polyethylene tubing used for necessary changes in direction. Sizes in tubing and fittings varied to maintain a fluid flow velocity between 4 - 7 ft/s as recommended by [13] for schedule 40 pipe. Figure 3 shows the packaging and location of different parts of DROWT 2.0. The entire system was mounted and secured to a DeWalt portable tool chest (Model No. DWST38000) which has dimensions of 23" D x 24" H x 38" W.

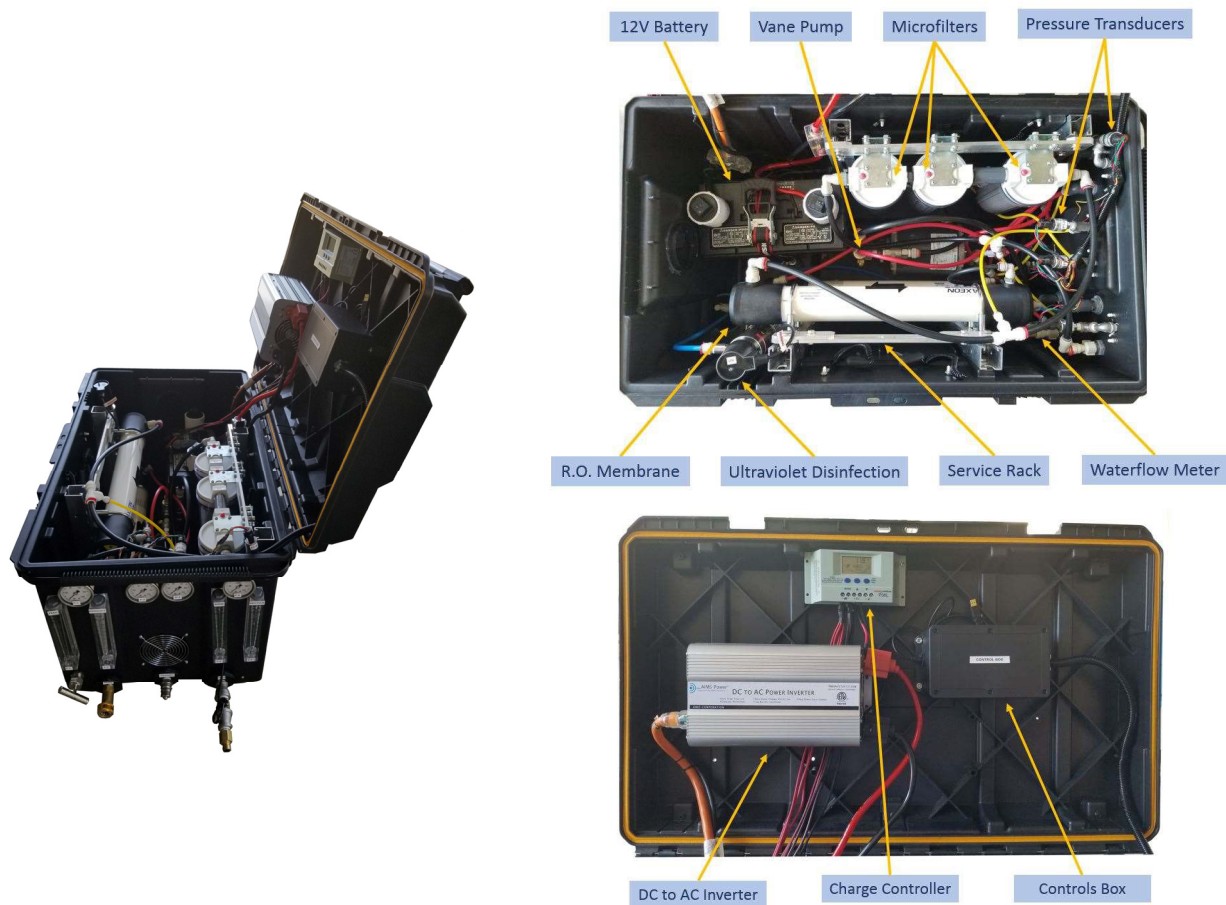


Figure 3 – DROWT 2.0 product packaging

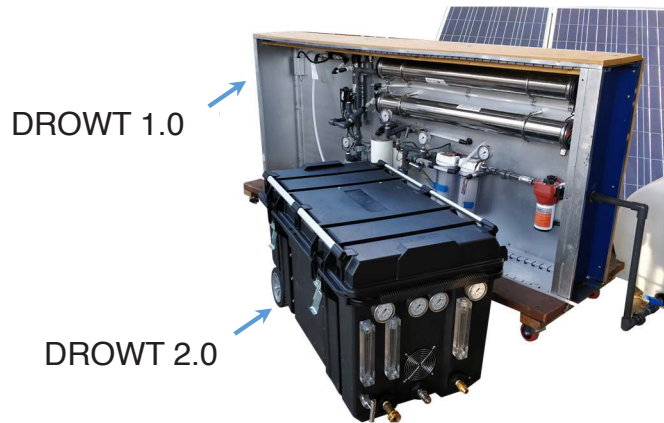


Figure 4 – Comparison of DROWT 1.0 & 2.0 size and footprint

As shown in Figure 4 DROWT 2.0 has significantly smaller size and footprint compared to DROWT 1.0 presented in [10].

All electrical components are powered by a single 12V wet-cell lead acid battery with a 115 amp-hr rating. For off-grid purposes, two 115 Whr NewPowa solar panels in conjunction with a Windynation solar charge controller (Model No. P30L) are used to charge the battery. Power is passed through an Aims DC to AC power inverter (Model No. PWRINV20001212W) before distributing power to the pump and UV disinfection unit. The inclusion of an inverter allows for a wider variety of pump types and style readily available for AC applications at cost effective prices compared to those of DC circuits. This change was considered in designing DROWT 2.0 to allow for on- or off-grid functionality of the system. The inverter enables the user to plug the system into the grid in the event that it is desired to run the system beyond the capacities of battery and solar panels. Data acquisition from the flow meters and pressure transducers is accomplished via an Arduino Mega (Model No. 2560). Energy consumption of the pump and UV disinfection unit is evaluated by measuring the individual AC current withdrawn downstream from inverter via Extech AC line splitters (Model No. 480172) and recorded using and Extech Amp-meter (Model No. MA445).

EXPERIMENTAL PROCEDURE

Before testing, feed water was generated by dissolving sodium chloride (NaCl, 99% purity) into 20 gallons of DI water until the conductivity of the solution was 2000 $\mu\text{S}/\text{cm}$. Flow meters, pressure transducers, current sensors and conductivity probes were all calibrated before the beginning of testing. Pressure was varied by partially closing the needle valve located downstream of the reverse osmosis membranes (as shown on Figure 1) until the desired pressure was achieved. The performance of the system was tested at feedwater pressures in the range of 60-140 psi. The lowest operating pressure corresponds to a fully open needle and maximum pressure is dictated by the rating of the microfiltration housing. The system can be run by the power grid or entirely decentralized by utilizing solar panels. In order to perform more consistent data accusation and ensure a constant voltage output, data reduction was conducted while the system was run by the power grid.

Each test was characterized by turning on the pump and UV disinfection units and adjusting the needle valve to the desired feed pressure. Once the desired pressure had been achieved, the system was allowed to run for approximately two minutes to ensure steady state of all readings. After the stabilization period, data was collected for three minutes at each pressure setting. Pressure remained constant throughout each test. Flow rates of the feed, concentrate, and permeate lines were collected every second from digital flowmeters. Power consumption of the pump and UV disinfection unit was measured three times for each pressure setting. Three samples of permeate water were collected and the conductivity of the permeate was measured. Averages and standard deviation of all readings were calculated and plotted to describe the performance of the system and the random error associated with measurements.

RESULTS AND DISCUSSION

Feedwater and permeate flow rate as well as system recovery rate are plotted as a function of feed pressure in Figure 5. Feed flow rate decreases slightly with increased pressure due to the recovery loop. As predicted by Eq. (1) an increase in the hydrostatic pressure (ΔP_{Hyd}) across the RO membrane linearly increases the permeate flow rate. The results confirm the linear increase of permeate flow rate as a function of feedwater pressure. Unlike the permeate flow rate, the feedwater flow rate remains relatively constant at 1.2 gpm corresponding to 864 gpd which exceeds the generation of wastewater per household (i.e., 80-100 gpd/person). Figure 5 also shows that DROWT 2.0 is capable of recovering more than 62% of the feedwater at the maximum pressure setting. It should be noted that the achieved recovery rates exceed the recovery rate of available under-the-sink RO systems in the market (15% to 25%).

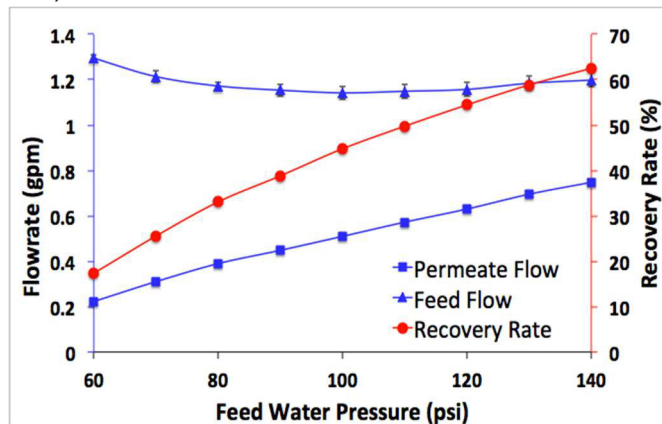


Figure 5 - Feed and permeate flow rates and recovery rate as a function of feed water pressure

The attention is now turned to the conductivity of the permeate flow and the salt rejection rate of the system as one of the most important characteristics of RO systems. Figure 6 shows the conductivity of the permeate flow at different pressure settings of the system. The conductivity of the permeate flow ranges from 154.6 $\mu\text{S}/\text{cm}$ at 90 psi to 230 $\mu\text{S}/\text{cm}$ at 140 psi. Taking the feed water conductivity of 2000 $\mu\text{S}/\text{cm}$ into account, the salt rejection (i.e. TDS removal) rate for the system is between 88.5-92.3% for the tested pressures. The conductivity of the generated permeate agrees with the ideal conductivity of potable water ($< 250 \mu\text{S}/\text{cm}$).

The membranes used in designing the system are made of polyamide thin-film composite which is a hydrophobic material. The trend of the conductivity plot can be explained by the chemistry of hydrophobic material paired with the physics of membranes operating at high pressure. At low pressures the polyamide thin-film composite material provides a force that repels water from traveling through the membrane contributing to a low permeate flow rate. At low pressures, salt molecules are able to diffuse through the membrane which results in higher conductivities when combined with the small amount of permeate water. As feedwater pressure is increased, the water carries a larger force to pass through the membrane leading to more permeate water to be generated. The greater quantity of permeate water is able to dilute the salt particles passing through the membrane contributing to a decrease in conductivity. This trend only applies to a certain range of pressures because eventually at high enough pressures, salt molecules will start to be forced through the membrane with along with water. Increasing the pressure to these levels will cause an increase in conductivity from the membrane failing to filter out the particles. With the specific membrane used in this study being rated for 80 psi, we can see in Figure 6 that the best quality water produced happened at this pressure.

The specific energy consumption of the system at different operating pressures is illustrated in Figure 6. The factors that affect the specific energy consumption are total energy consumption of the system and the amount of permeate water generated. The pump and the UV disinfection unit are the major energy consuming components of the system. The pump contributed to approximately 96% of the amount of total energy consumed. As shown in Figure 7, the total energy consumption of the system increases at higher feedwater pressures. The increase in permeate flow rate at higher pressures has a greater impact on the specific energy consumption, leading to a decreasing trend of specific energy consumption. The slope of the specific energy consumption plot in Figure 6 decreased with feedwater pressure. This behavior suggests that there is a minimum value for specific energy consumption of the system; however, this minimum value was not reached due to the limitations on the system pressure. In the study of DROWT 1.0, the minimum value of specific energy consumption was achieved and reported in [10].

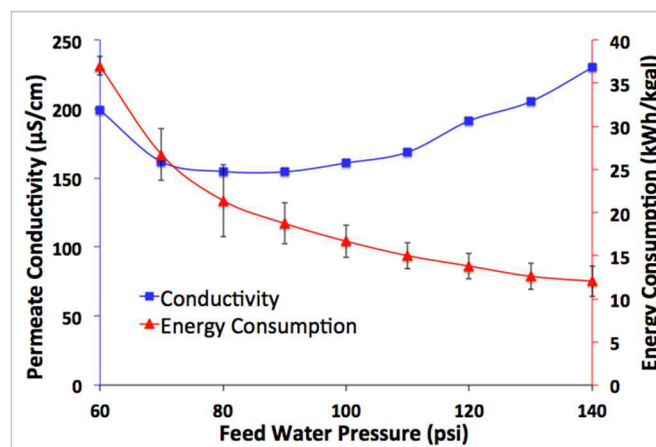


Figure 6 - Energy consumption per unit volume of product and conductivity of permeate flow as a function of feed water pressure. The feed conductivity is ~2000 µS/cm)

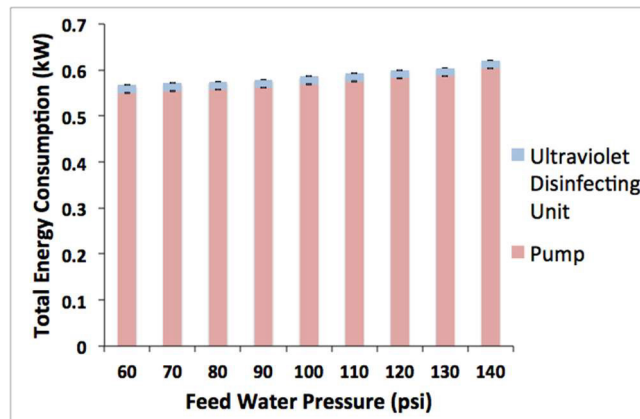


Figure 7 - Energy consumption of each component as a function of feed water pressure

Table 1 - Performance comparison between the two iterations of the system

	Version 1	Version 2
Optimal Pressure	120 psi	110 psi
At optimal pressure		
Recovery Rate	80 %	50 %
Conductivity	32 μ S/cm	169 μ S/cm
Specific Energy Consumption	3.5 kWh/kgal	17.2 kWh/kgal

As tabulated in Table 1, hydraulics and electrical upgrades implemented in DROWT 2.0 affect the performance of the system compared to DROWT 1.0. In order to simplify the hydraulic configuration as well as extend the lifespan of the RO membranes, the concentrate recycle loop has been introduced to the system at the expense of gaining lower recovery rates and having higher specific energy consumption. Moreover, due to blending of the feed with the recycled concentrate stream, the average feed conductivity before going into the first membrane is increased, thus the conductivity of permeate is also increased. The higher specific energy consumption in DROWT 2.0 is attributed to the reduced size of membranes and additional pretreatment steps.

THERMAL ASSESSMENT TEST

Since DROWT 2.0 is a highly compact design with major components working in a relatively small enclosure, overheating the electric motor and other electrical components of the system is a possibility. In order to assess the thermal characteristics of the design, the system was tested continuously on-sun with the lid closed. Infrared images of the components were taken at 10-minute intervals using a FLIR Thermal Camera (Model No. E8). Ambient temperature during the test was 70 °F in a fairly clear sky. Figures 8-1 and 8-2 show the initial and final thermal state of the system after 1.5 hours of continues operation. It was observed that the hottest component of the system after the test is the electric motor that runs the pump. The maximum temperature of the system is about 115 °F which is in the acceptable range of operation for all components of the system.

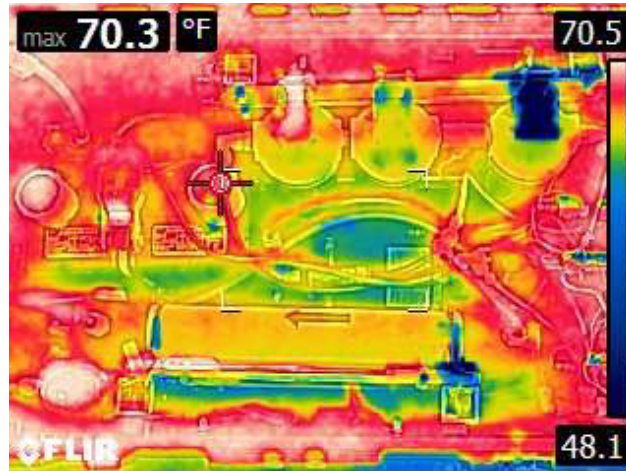


Figure 8-1 - Infrared image of unit before testing

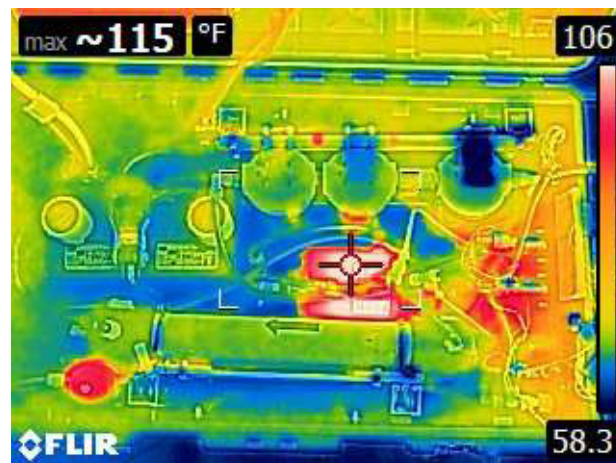


Figure 8-2 - Infrared image of unit after 1.5 hours of testing

CONCLUDING REMARKS

A solar-driven water treatment unit for off-grid applications was successfully designed and tested. The filtration process includes a pretreatment stage consisting of a three-stage micro-filtration, followed by a three-stage reverse osmosis and an ultra violet disinfection post-treatment. The designed system can be run on- or off-grid. In the off-grid operation, the system has zero operational carbon-footprint.

Tests of the system with a feed water conductivity of 2000 $\mu\text{S}/\text{cm}$ yielded a recovery rates of 17-62% when tested at pressures ranging from 60-140 psi. The permeate flow rate during these tests ranged from 0.22-0.75gpm. Salt rejection at these pressures ranged from 88.5-92.3%. Specific energy consumption of the system ranged between 12-37 kWh/kgal of permeate water. The overall trend of energy consumption appears to approach a minimum value that is not achieved in the operating pressures of this study.

The performance of the two versions of DROWT system is compared and it was observed that DROWT 2.0 exhibits lower recovery rates and higher specific energy consumption due to its conservative design to reach higher lifetime of components.

FUTURE WORK

The Decentralized Renewable Off-grid Water Treatment (DROWT) team has its sights on developing a technology to be commercially available for consumers with a need for a decentralized, portable water filtration machine. In the next step, the performance of the system in treating synthetic graywater will be assessed. A user interface system will be developed to provide the user an easy way to operate and monitor the system remotely.

ACKNOWLEDGEMENTS

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