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The St. Mary's University
McNair Scholars Program

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Fall 2018 Volume XI

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McNair Scholars Program

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Research is the product of creativity, ingenuity, study, and very hard work. The results of our scholars' work with their mentors are in this journal. As students continue to explore their fields, each will expand academic skills to contribute to the larger work of scholarly research. Thanks are due to the mentors and staff, as well as families, who work with our scholars and encourage them to excel. All of us are grateful for your support and time spent with our McNair Scholars.

Dr. Jennifer Zwahr-Castro, Director
Dr. Samadhi Metta Bexar, Asst. Dir.
St. Mary's University
Fall 2018

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“Use Your Words”: The Role of Emotional Security on Parent-Adolescent Communication

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The emotional security theory (EST; Davies & Cummings, 1994) has empirically established that a child possesses a higher-order desire for safety within the family and that exposure to interparental conflict affects such security (Davies & Cummings, 1994). During adolescence, the normative tendency to separate from the family is vital for healthy development (Freud, 1958), but oftentimes results in reduced disclosure to parents (Steinberg & Silverberg, 1986). Preserving family communication is essential during adolescence (Barnes & Olson, 1985), as it is the medium through which parents and adolescents re-establish and negotiate their roles and relationships (Lanz, Iafrate, Rosnati, & Scabini, 1999). Thus, this study examined if emotional security would serve as a mediator to explain the relation between interparental conflict and parent-adolescent communication. The variables analyzed in this study were emotional security (Davies, Forman, Rasi, & Stevens, 2002), parent-adolescent communication (Barnes & Olson, 2003), and interparental conflict (Porter & O'Leary, 1980). The participants involved adolescents ($N = 225$) aged 11 to 17 years of age ($M = 13.2$, $SD = 1.7$) and their parents ($N = 450$), whose ages ranged from 27 to 62 years ($M = 42.7$, $SD = 6.7$). After conducting a Baron & Kenny (1986) regression-based approach to analyze the

mediation model, the hypothesis was found to be statistically significant. The findings provide significant information about the consequences of interparental conflict on adolescents that can be promulgated among researchers and implemented towards intervention programs.

Role of Emotional Security on Interparental Conflict

Emotional security in the family system has cascading effects in youth across various developmental contexts (Cummings & Miller-Graff, 2015). The emotional security theory (EST) proposes that exposure to negative experiences (e.g., interparental and family conflict, negative quality of parent-child relationship) may result in consequences affecting the child's overall emotional security (Davies & Cummings, 1994). Moreover, contrary to extant beliefs among parents, the EST explains that children are adept at recognizing concern regarding the quality of the marital relationship (Davies & Cummings, 1994).

EST stems from the attachment theory (Bowlby, 1969), which describes attachment as the emotional connectedness between a child and the caregiver. EST—aligning with the attachment theory—emphasizes the critical role of the parent-child relationship, while also introducing interparental relationship quality as an influencing factor of a child's emotional security. As elucidated in Maslow's Hierarchy of Needs (Maslow, 1943), safety and security are within the most critical and essential human needs. Supporting this argument, the EST has also empirically established that a child possesses a higher-order desire of safety and security within the family (Davies & Cummings, 1994).

Although interparental conflict is often unavoidable and generally may fare non-threatening to the child's sense of security in the family, some consequences could jeopardize it (McCoy, Cummings, & Davies, 2009). Specifically, interparental conflict may undermine the sense of security in the family, which could then affect the parent-child relationship and lead to increased emotional problems in children (Cummings & Davies, 2002).

For example, destructive marital conflict is characterized by hostile and angry behaviors, insults, and physical and verbal aggression (McCoy, Cummings, & Davies, 2009). Destructive conflict threatens the child's goals to maintain a sense of security within the family, resulting in elevated levels of emotional distress in the child (McCoy, Cummings, & Davies, 2009). Further, the continuous hopelessness, anxiety, and worry resulting from destructive conflict may increase the child's risk of developing internalizing or externalizing disorders (Cummings & Davies, 1994; Grych & Fincham, 1993). Specifically, competitive co-parenting (e.g., undermining and/or contradicting each other, competing for attention and favoritism of the child) predicts later externalizing behaviors of the child (Murphy, Boyd-Soisson, Jacobvitz, & Hazen, 2017). Destructive conflict is also a threat to child adjustment outcomes, as exposure to this type of conflict also increases the child's probability of developing adjustment disorders (McCoy, Cummings, & Davies, 2009).

Parent-Adolescent Communication

Adolescence is a period of multiple transformations in relationships and communication (Hill, 1988; Steinberg, 1989, as cited in Laursen & Collins, 2004), especially regarding parent-adolescent relationships (Silverberg & Gondoli 1996). Separation-individuation is the normative process when adolescents isolate from their parents to establish their own sense of identity. The tendency to separate—physically and emotionally—during adolescence results from evolutionary pressures on the individual to leave the family and find a sexual partner, cultivating a desire for individuation and autonomy (Laursen & Collins, 2004). These normative separation tendencies are vital for healthy development in adolescence, given that they allow for healthy independence, emotional adjustment, and later attachment to extrafamilial objects (Freud, 1958). Increased separation is generally accompanied by lessened adolescent disclosure of information (Steinberg & Silverberg, 1986), in the form of reduced intensity and frequency of communication with parents (Keijsers & Poulin, 2013).

Although there is a biological need during adolescence to separate from the family, open parent-adolescent communication has been found to play a critical role during this transitioning process (Barnes & Olson, 1985). Bowlby (1969) initially developed his theory on attachment, emphasizing the human tendency to engage in proximity-seeking behaviors to gain contact with trusted individuals during times of vulnerability, like fear. Additionally, his theory construed that individuals who are most well-adjusted possess a strong conviction about the responsiveness and accessibility of those whom they trust. Supporting Bowlby's findings, Lamborn & Steinberg (1993) found that adolescents with a stronger emotional autonomy and higher levels of perceived support and parental availability (e.g., with open communication) were found to display greater competence and better adjustment. Moreover, family communication is the medium through which parents and adolescents re-establish and negotiate their roles and relationships (Lanz, Iafrate, Rosnati, & Scabini, 1999). Specifically, open communication creates an environment that enables adolescents to find constructive methods to resolve conflicts and adequately manage interpersonal situations (Noller, 1995). Families with open communication are also more likely to engage in constructive conflict (i.e., positive strategies) and have equal control within the family, allowing adolescents to develop positive self-perceptions to then handle everyday conflicts and challenges (Lanz, Iafrate, Rosnati, & Scabini, 1999).

Purpose of the Study

The purpose of this study is to further understand the relation between overt interparental conflict and quality of parent-adolescent communication through a mediation model. The EST has continuously served as a mediating mechanism, explaining the relation between interparental conflict and respective outcomes relating to the child's adjustment (Davies & Cummings, 1994). However, there is limited literature on emotional security specifically predicting the quality of parent-adolescent communication. Thus, this study is the first of its kind to analyze

this relation by also setting emotional security as a mediator, rather than solely a predictor.

Hypothesis

The following hypothesis is derived from the empirically established role of interparental conflict on child adjustment outcomes and the significance of open communication during adolescence.

1. Emotional security will operate as a mediator of the relation between interparental conflict and quality of parent-adolescent communication (see Figure 1).

Method

Participants

The recruitment strategies for participants included distribution of flyers with specific information about the program throughout community and public centers (i.e., grocery stores, libraries), participating in community events and setting up informational booths, referrals from other participants, among others. The participants of the current study involved adolescents ($N = 225$) of 11 to 17 years of age ($M = 13.2$, $SD = 1.7$) and their parents, whose ages ranged from 27 to 62 years ($M = 42.7$, $SD = 6.7$). The adolescents' ethnicities varied, with 5.8 % being Hispanic or Latino, 1.8 % being American Indian or Alaska Native, 2.2 % being Asian, 12.4 % being Black or African American, .4 % being Native Hawaiian or other Pacific Islander, 78.8 % being White, and 4.4 % being another ethnicity. The reported family income varied from \$6,000 or less to \$125,000 or more. In this study, 34 % of participants reported earning between \$6,000 and \$54,999, and 65.5 % reported earning \$55,000 or more.

The dataset used in this current study included families that met previously-specified criteria for the Family Communication Project (FCP), an intervention program intended to improve communication and family relationships. To be eligible for participation in the FCP, parents were required to be married or cohabitating for at least three years and have a child between the ages of 11 and 17 years of age. The Institutional

Review Board (IRB) at the University of Notre Dame approved the project and concluded that the treatment of participants was on accordance with ethical requirements. Additionally, participants were compensated monetarily for their participation and time invested in the research study.

Procedure

The original data set was collected across four time periods, one per visit to the research center. In FCP, families were randomly assigned into one of the following conditions: parent and adolescent (PA), parent only (PO), self-study control (SS), and no treatment condition (NT). In the PA condition, both, the parents and the adolescents, received psychoeducation and skills training. The PO condition involved only the parents receiving psychoeducation and skills training. In the SS condition, the families did not actively participate in the psychoeducation component, but they received reading materials that aligned with the content in the sessions. Lastly, in the NT condition, the families attended the research center to complete assessments (i.e., questionnaire packets and problem-solving task), but did not receive reading materials.

Upon criteria approval, the treatment conditions (i.e., PA and PO) were asked to return to the intervention center four times, in total. In select visits, the family engaged in triadic (i.e., involving the entire family) and dyadic (i.e., interparental only) seven-minute problem-solving tasks for the researcher to assess specific components of conflict that may be present during the interactions. In detail, all four condition groups completed these problem-solving tasks on visits 1 and 4. However, the treatment groups attended additional psychoeducational sessions and participated in communication skills training exercises with a project staff member, whereas the control groups did not participate in this portion of the intervention. To comply with psychometric procedures, a project staff member maintained communication with these families through phone calls for visits 2 and 3, the designated visits in which treatment groups attended the psychoeducational sessions.

Measures

The participants completed the following assessments before and after completing the intervention program (i.e., pre and post assessments). Though the intervention program involved multiple periods of data collection, this study solely uses the baseline data. Furthermore, because research has found adolescents to be more accurate reporters of emotional security, the current study focused mainly on adolescents' self-reports of emotional security and communication. Interparental conflict was assessed through a self-report that was completed by the adolescents' parents.

Emotional Security

The Security in the Interparental Subsystem (SIS) scale (Davies, Forman, Rasi, & Stevens, 2002) assessed adolescents' preservation of emotional security in the presence of parental conflict. The measure consists of 50 items scored on a four-point Likert scale, ranging from "not at all true of me" (1) to "very true of me" (4). The measure is comprised of three major subscales relating to emotional reactivity, regulation of exposure to parent affect, and internal representations of the interparental relationship. The total scores of the scale range from 50 to 200, with high scores indicating greater emotional insecurity. The majority of the items display negative statements about security in the subsystem. Therefore, items stating positive statements were reverse coded, which allowed for a final cumulative score of emotional security. Davies et al., (2002) assessed the psychometric properties of the SIS. Test-retest reliability of the scale was calculated with a sample of 90 children and resulted within the accepted range for reliability. Almost all subscales exceeded the alpha coefficient of .70, with the exception of the Behavioral Dysregulation Scale, which resulted in alpha coefficients of .65 and .52. Further, the correlations between all scales fell within psychometric expectations, resulting in moderate strength ($r = .35$). An internal consistency analysis was conducted for the sample used in the current study and the alpha coefficient was found to be .92.

Parent-Adolescent Communication

The Parent-Adolescent Communication Scale (PACS; Barnes & Olson, 2003) assessed adolescents' perspectives of their verbal exchanges with each parent. The measure consists of 20 items scored on a five-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). The measure is composed of two major subscales related to the extent of openness in communication and problems in communication. The total scores of the scale range from 20 to 100, with high scores indicating good communication quality. The items pertaining to problems in communication were reverse coded, allowing for an additive value measuring the overall quality of communication. Barnes & Olson (2003) used Cronbach's alpha to assess the internal consistency of the PACS. The alpha coefficient was .87 for the Open Family Communication subscale, .78 for the Problems in Family Communication subscale, and .88 for the total scale—the additive value of both subscales. Internal consistency analyses were conducted for the sample used in the current study. The alpha coefficient was found to be .36 for the scale pertaining to father-adolescent communication and .32 for the scale pertaining to mother-adolescent communication.

Interparental Conflict

The O'Leary-Porter Scale (OPS; Porter & O'Leary, 1980) assessed the frequency of overt interparental conflict, or marital hostility, taking place in the presence of the adolescence. The measure consists of 10 items scored on a five-point Likert scale, ranging from "never" (0) to "very often" (4). The measure contains items asking how often certain forms of interparental conflict are observed by the adolescent. The total scores of the scale range from 0 to 40, with high scores indicating more interparental conflict. The majority of the items mention hostile behaviors. Therefore, the last item—stating a positive behavior—was reverse coded, allowing for a summative value of overall frequency of overt interparental conflict. Test-retest reliability of the scale was found to be .96 after being calculated by analyzing 14 of the original participating families throughout a two-week

period (Porter & O’Leary, 1980). Internal consistency analyses were conducted for the sample used in this study. The alpha coefficient was found to be .79 for the scale pertaining to the fathers’ self-report of interparental conflict and .77 for the scale pertaining to the mothers’ self-report of interparental conflict.

Results

Descriptive Statistics

The descriptive statistics of the participants’ scores on the scales used in this study are displayed on Table 1, including mean scores and standard deviation values.

Analyses of Hypothesis

Mediation Model

A Baron & Kenny (1986) regression-based approach was employed to analyze the research model through the Baron & Kenny four steps for mediation. The model requires four different levels of analysis: (1) a simple regression analysis with the predictor variable predicting the outcome variable; (2) a simple regression analysis with the predictor variable predicting the mediator variable; (3) one multiple regression analysis with the predictor and mediator variables predicting the outcome variable; (4) an overall interpretation of the information gathered to determine whether or not the model is performing as a mediation model.

The variables of the study were interparental conflict (i.e., predictor variable) emotional security (i.e., mediator variable) and parent-adolescent communication (i.e., outcome variable). The mediation analysis was conducted to understand if emotional security would serve as a mediator to explain the relation between interparental conflict and quality of parent-adolescent communication. The research hypothesis was supported, given that significance was found in the mediation model (see Figure 2), including all direct relations within the model. Interparental conflict was found to significantly predict the quality of parent-adolescent communication ($\beta = -.596, p < .001$) and level of emotional security ($\beta = 1.048, p < .01$), and emotional security was found to significantly predict the quality of parent-adolescent

communication ($\beta = -.262, p < .001$). Further, the model found partial mediation, rather than complete mediation.

Discussion

The normative tendencies for adolescents to separate from the family are initially driven by biological mechanisms that develop a desire for individuation and autonomy (Laursen & Collins, 2004). However, despite the need for separation from the family during adolescence, open parent-adolescent communication plays a critical role (Barnes & Olson, 1985) and is the medium through which adolescents re-establish their roles and relationships in the family (Lanz, Iafrate, Rosnati, & Scabini, 1999). The need for connectedness derives from the human tendency to gain contact with trusted individuals during vulnerable times (Bowlby, 1969). Thus, the current study sought to further understand the relation between overt interparental conflict in the presence of the adolescent and resulting parent-adolescent communication quality, as explained through emotional security.

In this study, emotional security served as a significant mediator (i.e., explanatory variable) of the relation between overt interparental conflict behaviors and quality of parent-adolescent communication. Moreover, the mediation model was found to be partially mediated, given that, after including emotional security as a mediator, the c' value—displaying unstandardized β coefficient of the relation between the predictor and outcome variables, while including the mediator—was significant. If complete mediation would have occurred, the c' value would have resulted non-significant. The model's partial mediation could potentially represent a more realistic perception of human nature, given that specific outcomes may be influenced by multiple contributing factors. Additionally, significance was found on all direct relations within the model (see Figure 2). This means that interparental conflict directly influences quality of parent-adolescent communication ($\beta = -.596, p < .001$). Further, interparental conflict increases emotional security ($\beta = 1.048, p < .01$) and this stronger sense of security leads to improved parent-

adolescent communication ($\beta = -.262, p < .001$). Thus, couples that engage in less conflict—specifically when their adolescent is present—increase the sense of security in the family and, as a result, improve parent-adolescent communication. Moreover, although former research elucidates the importance of connectedness (e.g., attachment) during infancy, the current research highlights its significance throughout adolescence. Further, research has found that an optimal balance between connectedness and autonomy can be established through open communication (Grotevant & Cooper, 1983, as cited on Barnes & Olson, 1985).

As previously stated, higher values on the SIS indicate more insecurity; higher values on the PACS indicate better quality of parent-adolescent communication; and higher values on the OPS indicate more interparental conflict. That being stated, emotional security and interparental conflict were expected to be positively related to each other, but inversely related to parent-adolescent communication. Therefore, the three relations within the mediation model displayed effects in the expected direction. For example, the interparental conflict variable (i.e., higher values indicate more conflict) was positively related to the emotional security variable (i.e., higher values indicate more insecurity); the emotional security variable was inversely related to the parent-adolescent communication variable (i.e., higher values indicate a better communication quality); and the interparental conflict variable was inversely related to the parent-adolescent communication variable.

Although, the study contains various strengths, there are also a few limitations. The first relates to the demographic distributions of the sample. The sample was predominantly White and representative of the South Bend community. However, the demographic properties of this sample may raise questions about its generalizability in settings serving greater minority populations. Moreover, common measurement complications (e.g., reporting biases, participants' individual differences) could also affect the scores on the measures and final analyses. Lastly,

the current study is solely cross-sectional and, therefore, causal conclusions cannot be drawn from the findings.

Further, understanding the quality of the conflict—rather than focusing solely on the frequency of the disputes—could also fare significant when analyzing the impact of interparental conflict. For example, constructive marital conflict is characterized by support, problem solving, and verbal and physical affection (Goeke-Morey, Cummings, Harold, & Shelton, 2003). It enhances emotional security by assuring that interparental challenges will be handled effectively and carefully, to preserve family concordance (McCoy, Cummings, & Davies, 2009). Thus, limited exposure to conflict may not necessarily increase a child's emotional security. Rather, conflict resolution and constructive approaches to handling interparental disputes may assist children in their own cultivation of problem-solving, conflict resolution, and coping skills (Grych & Fincham, 1990).

That being said, future analyses could focus on identifying the specific roles of destructive and constructive conflict behaviors on parent-adolescent communication. In addition, the reliability of the findings could be verified by continuing the assessment of interparental conflict behaviors with different scales, like the Short Marital Adjustment Test (SMAT), which discriminates between distressed and non-distressed marriages, or the Conflict and Problem Solving (CPS) Scale, which measures interparental conflict behaviors. Additionally, because emotional security is a determining factor of positive parent-adolescent communication, analyses could focus on further understanding these significant findings by examining underlying mechanisms of emotional security or specified processes of adolescence, like separation tendencies. Further, using additional advanced statistical analyses to examine the mediation model could provide new insights about the methodology and findings. As mentioned above, the current study is cross-sectional. Thus, future studies could also longitudinally test the relations found in this study to better understand long-term outcomes. Lastly, implementation of the current findings in academic settings and intervention

programs is strongly encouraged to promulgate effective strategies that preserve emotional security and communication during vulnerable times of emotional and biological changes.

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Table 1

Descriptive statistics of the scales and observational data

Instrument	Range (min - max)	<i>M</i>	<i>SD</i>
SIS	50 - 200	96.16	24.80
PACS	20 - 100	69.41	13.31
OPS	0 - 40	21.57	5.29

Note: Higher values on the SIS indicate more emotional insecurity; higher values of the PACS indicate better family communication; and higher values on the OPS indicate more conflict; SIS = Security in the Interparental Subsystem Scale;

PACS = Parent-Adolescent Communication Scale;"

OPS = O’Leary-Porter Scale

Table 2

Correlation matrix of the scales and observational data

Variable	1	2	3
1. SIS	1.000		
2. PACS	-.516**	1.000	
3. OPS	.223**	-.236**	1.000

Note: ** $p < .01$; SIS = Security in the Interparental Subsystem Scale; PACS = Parent-Adolescent Communication Scale; OPS = O’Leary-Porter Scale

Figure 1. Emotional security will serve as a significant mediator of the relationship between interparental conflict and parent-adolescent communication.

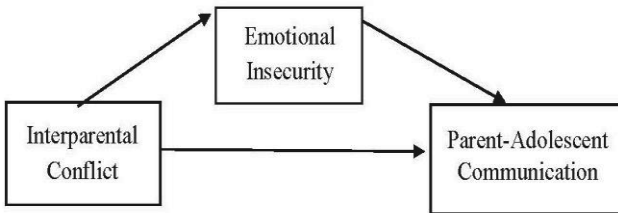
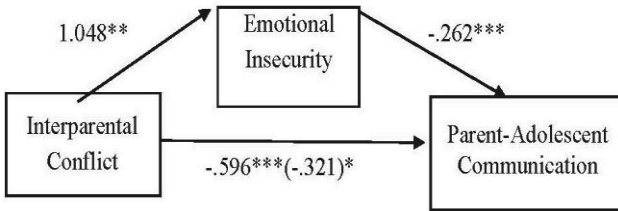


Figure 2. Emotional security serves as a significant mediator of the relationship between interparental conflict and parent-adolescent communication.



Note: * $p < .05$, ** $p < .01$, *** $p < .001$; unstandardized beta coefficients were used for data interpretation; parenthesis indicates c' value

Constructal-based Heatsink Optimization for Multiscale Enhanced Electronics Cooling

Cristian Buelna
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Heat generation in electronic devices is an inevitable consequence of operation. The progression towards increasingly smaller microscale devices necessitates the use of conduction heatsinks for effective thermal management. Heatsink design optimization and enhanced heat removal methods are critical to sustaining the mechanical integrity of next generation electromechanical systems. Constructal theory is a geometric optimization method proposed by Adrian Bejan that has shown great promise in a number of biological and physical applications for minimizing flow resistance, and prior work has indicated the potential for enhanced heat transfer in multiscale thermal-fluids systems using Constructal configurations. This research adapts the Constructal optimization scheme to the conduction heatsink problem to produce candidate geometries for thermal evaluation. The influence of a geometric factors were considered, and thermal transport and cooling effectiveness of the Constructal conduction heatsink geometries for multiscale electronics cooling was evaluated using computational methods. Additionally, materials fabrication methods for producing the multiscale Constructal heatsink patterns were evaluated. Careful consideration of the influence on the thermal and mechanical properties of the Constructal conducting pathways was given. Test sections comprising semi-conductive PCB laminate

substrates and thermally conductive Constructal geometries were created using an LPKF Protomat S103. The results of the computational analysis show a substantial nonlinear increase in thermal effectiveness with increasing Constructal complexity, and fabrication tolerances of less than 500 nm for conducting pathway widths were achieved while maintaining bulk material properties of the Copper Alloy 101 conductive pathways and FR4 fiber glass.

1. Introduction

Over the past decades, the cooling of electronics has heavily relied on convection or coupled convection and conduction methods [1-4]. Heat transfer via convection is optimized by creating fins, ducts, and channels to maximize the convection surface area. However, with the continuing trend towards smaller electronic components, with sizes approaching the microscale, convection-based heat transfer becomes impractical due to the requirement of fluid carrying ducts, and the loss of heat transfer effectiveness on increasingly smaller scales approaching mean free path length scales [1]. Therefore utilization of conduction heat transfer via high thermal conductivity heatsinks as the primary mode of heat removal becomes necessary. In addition, Moore's Law predicts design challenges that include space limitations on circuit boards [5-6]. Therefore, the challenge is to determine whether there is an optimal distribution of a finite-sized volume of thermally conductive material to maximize heat removal.

An optimization method known as Constructal theory was proposed and discussed in previous literature [1-12]. The bifurcation optimization model emerged from natural flow systems, which have increasingly come to dictate constraints in electronic engineering applications [7]. The Constructal model has been adapted in a number of convective channel designs for increased heat transfer in a system [8-14]. These previous studies have provided insight to the benefits of using complex patterns for convective heat transfer, and ultimately conductive heat transfer in microscale applications.

Although a substantial amount of theoretical and numerical work has been done to predict the performance of the geometric Constructal patterns, to the knowledge of the authors there is much less experimental data available. Experimental work is needed to provide more comprehensive and conclusive data for Constructal theory. A major factor contributing to the lack of experimental work in this area is

thought to be due in large part to fabrication challenges to create increasingly small geometric features common to microscale Constructal conduction pathways, while maintaining bulk mechanical properties, and these challenges have persisted for decades. The minimal experimental data available focuses on convective heat transfer in complex flow structures, such as the work of Hart and da Silva [15]. Their investigation considered important constraints including the area being cooled and the effective heat transfer area to directly compare performance between complex flow arrangements. Additionally, Hart and da Silva sought to develop a technique to measure only the thermal effectiveness of Constructal geometries for convection-based cooling, while minimizing experimental uncertainty and decreasing entropic heat losses [15]. They did not seek to maximize the heat transfer performance by balancing thermal and thermo-mechanical material response, which is critical to prevent thermally-induced stresses from causing mechanical failure of electronics [16]. Effective thermal management of microelectronics, including thin-film batteries and biomedical technology, requires the use of optimized heatsinks to prevent mechanical failure, which is critical to sustaining mechanical integrity of the electromechanical and electrochemical systems.

The approach of this work is to adapt the Constructal optimization scheme to the conduction heatsink problem to produce candidate Constructal geometries for further evaluation. A total of four geometries were obtained using the Constructal optimization scheme, each one with increasing geometric complexity. A fully coupled temperature-displacement analysis was carried out using the finite element methods to evaluate the thermal-effectiveness of the increasing Constructal complexity. One of the principal objective of this study is to further understanding of Constructal theory to yield greater insight into thermal conduction heat transport of complex geometric patterns.

Additionally, potential fabrication methods were explored to produce multiscale Constructal patterns consisting of a high thermal conductivity conducting path network (Constructal geometries) and a semi-conductive substrate. Particular emphasis was placed on methods for creating multiscale Constructal heatsinks which produced material properties approaching those of bulk properties. A key feature of this research is the methods used to create the macro- and microscale models. The test sections created were identical in size, which is important when considering the heat transfer surface area of the substrate. The fabrication method used is unique in that the technology

did not exist 20 years ago, at least not at the accuracy and precision, when the Constructal method was proposed. Methods considered for creating these geometric patterns include polymerization, photolithographic methods, thin metal deposition processes, and electroplating [17-23]. While important to thin film applications, those methods have not shown to be viable for creating conductive microscale patterns that are of sufficient thickness with material properties approaching the bulk material. In this work, test sections containing the four candidate geometries comprised of semi-conductive PCB laminate substrates and thermally conductive Copper Alloy 101 Constructal geometries were created using an LPKF Protomat S103.

2. Methodology

Previously conducted numerical and analytical work was employed to calculate the necessary dimensions for the tree-like patterns [1]. The following details the procedure of applying the optimization scheme and the computational analysis.

2.1. Geometrically optimizing heatsink patterns

The Constructal configurations used in the computational analysis and in the test sections consisted of a series of geometric bifurcations with rectangular cross-sections and branching angles of 90° [1-4, 15]. Four different complexities were created using the geometric optimization scheme. The dimensions were generated using fixed ratios of length and width with increasing tree-complexity as suggested in literature [1]. The lengths are defined using the relationship $L_i/L_{i+1}=2^{1/2}$, where i refers to the increasing tree complexity level. Similarly, the width dimensions are defined using the relationship $W_i/W_{i+1}=2^{1/3}$. The height H was held constant through all Constructal branches to ensure constant volume material distribution to further constrain computational and experimental work. This allowed for direct evaluation of each geometry for cooling effectiveness considering the distribution of material, as previously suggested [1]. The top face of the first tree-pattern was constrained at half the length of the substrate. The same face was constrained for the proceeding complexities. The width midpoint of $i=1$ was constrained at half the width of the substrate through all i complexities. The macro and micro dimensions for the test sections with complexity levels are summarized in Table 1 and Table 2, respectively.

Table 1

Dimensions for macroscale test sections with respective complexity levels.

Constructal Tree	i	L (mm)	W (mm)	H (mm)	Volume (mm ³)
1	1	17.5	12.225	5	1069.68
2	1	17.5	6.96	5	1071.21
	2	12.375	3.735		
3	1	17.5	3.63	5	1073.03
	2	12.375	2.88		
	3	8.75	2.28		
4	1	17.5	3.27	5	1068.59
	2	12.375	2.115		
	3	8.75	1.47		
	4	6.185	1.065		

Table 2

Dimensions for microscale test sections with respective complexity levels.

Constructal Tree	i	L (mm)	W (mm)	H (mm)	Volume (mm ³)
1	1	3.5	1.5	0.03556	0.187
2	1	3.5	1	0.03556	0.187
	2	1.75	0.5		
3	1	3.5	0.75	0.03556	0.187
	2	1.75	0.375		
	3	1.75	0.1875		
4	1	3.5	0.6667	0.03556	0.187
	2	1.75	0.33335		
	3	1.75	0.166675		
	4	0.875	0.083338		

2.2. Modeling on Abaqus finite element software

Table 1 was used to create four (4) Constructal geometries of the macroscale for analysis on Abaqus finite element commercial software. The dimensions in Table 2 are to be considered in future work. Abaqus was chosen as the tool for computational study using the finite element methods. Other objectives of the computational work were to simulate heat dissipation, identify important performance metrics for experimental assessment for future work.

The details to note on the Abaqus modeling are the defined boundary conditions and assumptions to fully constrain the models in order to quantify thermal performance. The substrate material was assumed to be FR-4 (fiberglass with epoxy resin) and the heat sink was assumed to be Copper Alloy 101. The selection of these two materials is based on the need for one high thermal conductivity heatsink (copper) and one low thermal conductivity substrate (FR-4). Material properties used in computation are listed in Table 3, and were taken from product specifications for copper clad PCB laminate.

Table 3
Material properties for copper and FR4 (computational)

Parameter	Cu	FR-4
Thermal Conductivity ($W \cdot m^{-1} \cdot K^{-1}$)	398	0.3

The dimensions of the substrate (FR4) were set to 50mmx50mmx5mm. The bottom surface of the FR4 was exposed to a constant surface heat flux equal to 400 W/m². The sides of the FR4 were assumed to be insulated. Additionally, a film coefficient of zero and an initial temperature of T=298K was set on all surfaces of the Constructal-trees and the top surface of the FR4. The FR4 was constrained on all sides to prevent displacement.

A cold point (T=273K) was created on the heatsink geometries to continuously flow heat out of the system during the steady-state analysis. Another important constraint is the constant volume of material used in the conductive heatsink. Table 1 numerically shows the equivalent volumes between increasing tree complexities.

The computational analysis was conducted under a coupled temperature-displacement, including the effects due to nonlinear geometry, to obtain more accurate and realistic solutions. The chosen analysis also allows for the formation of a well-formulated experiment, considered for future work.

2.3. Fabricating the test sections



Fig.1. LPKF ProtoMat S103: photograph of device used to fabricate macro- and microscale test sections

The method chosen to fabricate the experimental test sections was unique in that no previous work has used the LPKF ProtoMat S103 (Figure 1) circuit board miller to create test sections [1-4, 11-15, 17-23]. The technical specifications of the machine provided by LPKF Laser & Electronics gave insight to the capabilities of the printed copper board (PCB) milling machine. Some of the technical specifications of the ProtoMat are listed in Table 4.

Table 4
Technical Specifications of LPKF ProtoMat S103

Parameter	Description
Resolution (X/Y)	0.5 μm
Repeatability	± 0.001 mm
Precision of front-to-back alignment	± 0.02 mm
Milling Spindle	Max. 100,000rpm
Drilling Speed	120 strokes/min

Models of the test sections were created using Solidworks. The Solidworks part files were converted to .dxf files to be opened in the ProtoMat software, which can read .dxf files and convert them to the needed .cbf files to mill the geometric patterns.

3. Results and Discussions

3.1. Computational Analysis

The computational data from Abaqus indicates that increasing complexity improves the thermal performance of the system. Boundary conditions and assumptions placed allowed for a direct thermal performance analysis.

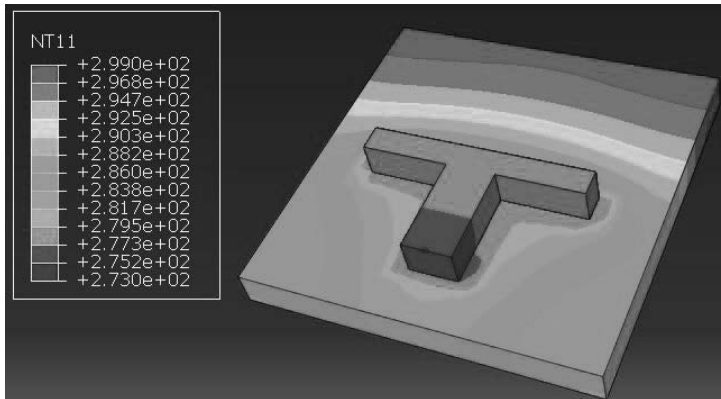


Fig.2. Complexity $i=2$, 5mm height, nodal temperature values

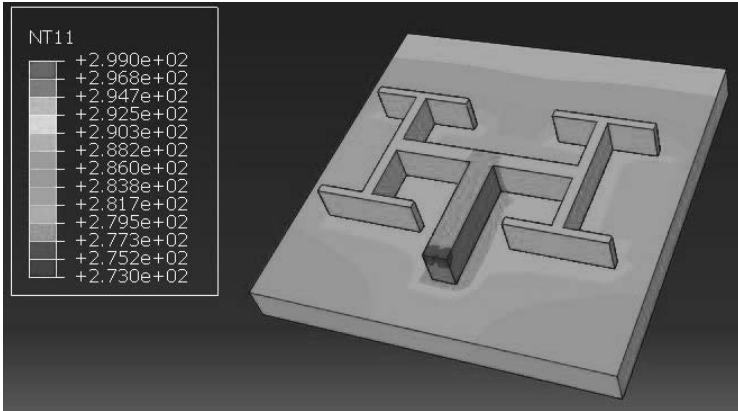


Fig.3. Complexity $i=4$, 5mm height, nodal temperature values

Figures 2-3 show the measured nodal temperature (variable NT11), and illustrate the developed thermal gradients. Temperature values to the left of the test sections are in Kelvin. The data indicates that increasing complexity has beneficial effects on the thermal performance of the system. These results are consistent with the theoretical work of Adrian Bejan and others [1-4, 8-15].

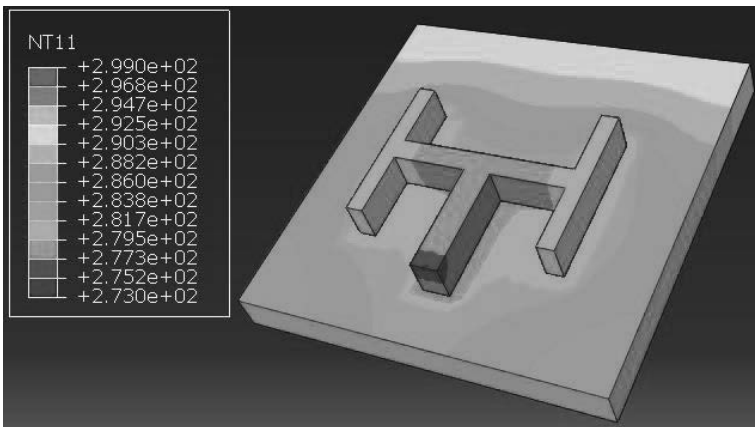


Fig.4. Complexity $i=3$, 5mm height, nodal temperature values

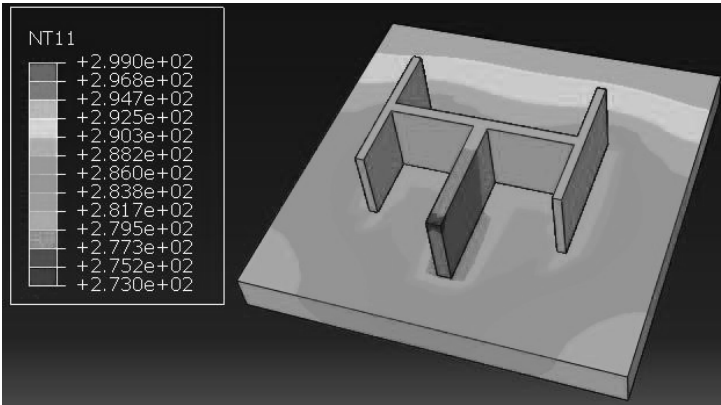


Fig.5. Complexity $i=3$, 10mm height, nodal temperature values

Figures 4-5 indicate that height may decrease the heat transfer performance. A reasonable explanation for these results is the decreased surface area of the conductive material in contact with the substrate. The investigation of height effects may show the importance of maximizing the conductive surface area in contact with the substrate to improve thermal performance. A graph showing the minimized maximum temperature gradient comparing increasing bifurcation geometries and respective heights is shown in Figure 8. The temperature gradients seem to converge with increasing bifurcation of the Constructural patterns, showing a nonlinear trend and indicating potential diminished returns with increased geometric complexity, which would be a potential problem leading to increased likelihood of mechanical failure since increasing tree complexity creates more stress concentration zones and crack substrate initiation sites.

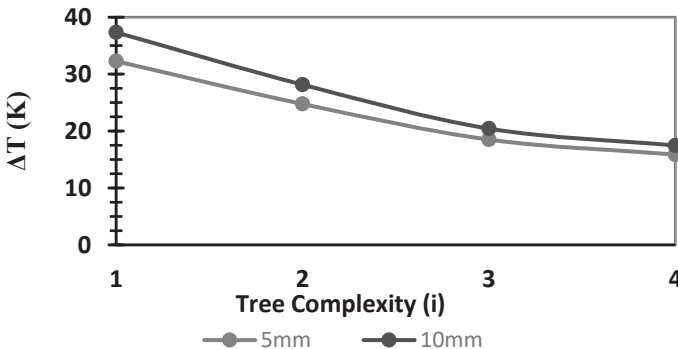


Fig.6. Comparative temperature gradients for two different heights

3.2. Test Section Fabrication

The final test sections with the Constructral geometries, as previously described, are shown in Figures 7-3. As shown, the figures were produced via etching and a milling tool. There was no substantial temperature increase due to burnishing observed during the machining process, indicating no substantial microstructural changes resulting in substantial deviation in material properties from bulk Copper Alloy 101. Additionally, the 1oz copper layer deposited onto the FR4 fiber glass substrate, a material composed of a thermoplastic resin and woven glass fibers, was a thickness of approximately 35 microns, which far exceeds the mean free path of the conduction layer. The fabrication tolerances achieved were less than 500 nm, indicating the potential of this method to be applied to even smaller scale system.

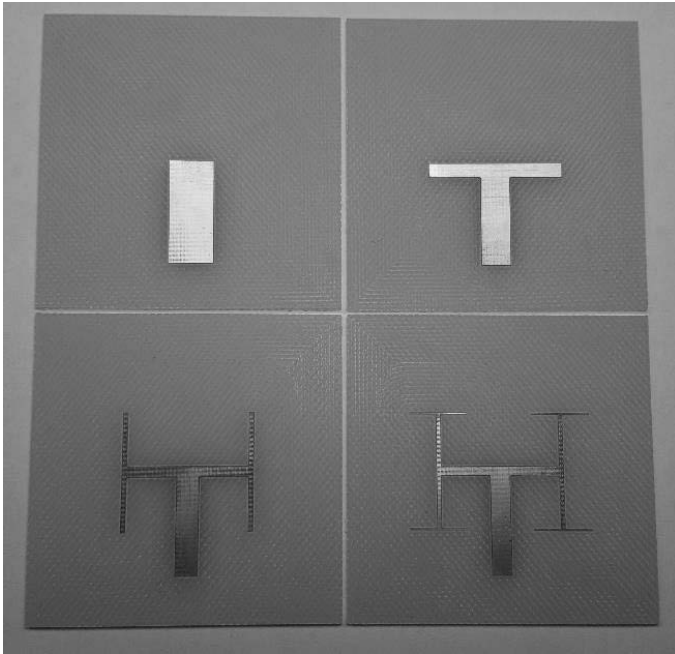


Fig.7. Fabricated macroscale test sections. Organized by increasing bifurcation complexity left to right, top to bottom.

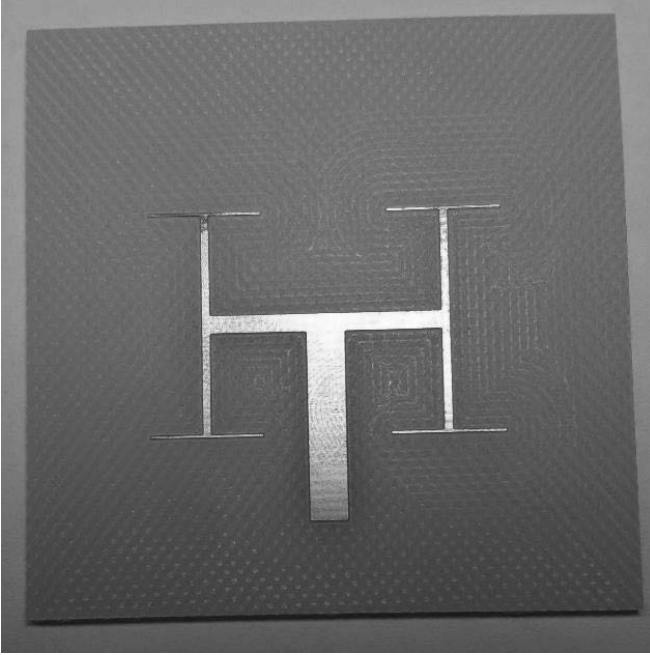


Fig.8. Proximate view of fabricated test section (complexity 4).

An experimental apparatus and methods are currently being formulated to continue the research in coming months at St. Mary's University.

4. Conclusions

The computational analysis work presented in this paper revealed the increasing thermal performance by optimizing the geometric patterns, which aligns with previous theoretical and numerical work [1-4]. While previous work suggested an increase, the results contained illustrate clearly the trend and the effect of increasing Constructural complexity on heat effectiveness, suggesting that the increase in cooling performance eventually converges. The results offer evidence that if an experiment can be formulated to mimic the conditions specified on Abaqus, more comprehensive data may be obtained.

Abaqus allowed the detailed study of a set system with specified boundary conditions and assumptions to fully constrain the analysis. The capability of the ProtoMat to produce macroscale test sections with ease suggested that the fabrication of microscale test section was possible to manufacture. The microscale test sections will have branches similar to the smallest branch in Figure 4. Future work will

include the continuation of verifying the computational results with experiment. This evaluation of geometric conductive patterns via experiment is important to this field of study because experimental techniques have not been developed to test thermo-mechanical performance of Constructal patterns.

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Knowledge is Power: Perceptions of Narcissism in Academia

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Narcissism and its effects have received a substantial amount of attention in the academic literature; however there has been little investigation into the potential propensity of narcissism in academia. Wallace et al. (2018) found that professors were perceived to be more narcissistic than school teachers. The current study expands on this research, examining lay perceptions of narcissistic tendencies for types of professors: professors who are primarily rewarded for scholarly productivity (i.e. publication of research) and professors who are primarily rewarded for teaching effectiveness. A sample of 237 participants responded to a survey adapted from the Narcissism Admiration and Rivalry Questionnaire Short Scale (Back et al., 2013). Effects between type of professor and type of narcissism (i.e. admiration and rivalry) were evaluated under a within-subjects design while sex of professor was evaluated between participants. The interaction between type of professor and type of narcissism provides evidence supporting that admiration narcissism, as opposed to rivalry narcissism, was perceived as more common for both types of professors based on a larger difference between rivalry narcissism and admiration narcissism in types of professors. Participant narcissism also acted as a moderator for perceived narcissism in professors: Narcissistic participants were more likely than others to view professors as narcissistic, and this

effect was particularly evident for professors rewarded for teaching. Still, professors were not perceived to be highly narcissistic overall.

Narcissism can be found in all walks of life, transcending cultures and borders, manifesting itself in the actions and values of those individuals whose self-view is enhanced. The personality effects may be found in the cognition and behavior of the affected individuals, who may subsequently believe themselves to be superior to those around them. It would seem that a selfish individual who is motivated to act in a self-bolstering and provocative manner would not lay claim to organizational success, however, studies have shown that narcissism can be advantageous for those seeking leadership positions (Campbell & Campbell, 2009, Campbell, Hoffman, Campbell, Marchisio, 2011 Hirschi & Jaensch, 2015). We are looking specifically at professors who by the nature of their job may be seen as leaders by their students. Narcissism then may play a role in both how professors act and how they are viewed.

Narcissism entails an excessive need for social admiration, lack of empathy, entitlement, and exploitative behaviors with a grandiose view of self (Derry, Ohan, & Bayliss, 2017; Miller, Gentile, Wilson, & Campbell, 2013; Russ, Shelder, Bradley, & Westen, 2008). There are two prominent subcategories of narcissism that an individual may fall into: vulnerable and grandiose. Vulnerable narcissism includes such behaviors as self-inhibition, increased anxiousness, and submissiveness (Derry et al., 2017; Russ et al., 2008; Miller et al., 2013). Grandiose narcissism can be categorized with aggressiveness, dominance, self-aggrandizement, and an overall belief that the individual is the center of the world with everything made for them (Derry et al., 2017; Russ et al., 2008; Miller et al., 2013). The present study focuses on grandiose narcissism, and all references to narcissism in this paper can be assumed to apply to grandiose narcissism specifically.

Previous research on professor narcissism conducted by Wallace et al. (2018) found that professors were perceived to be more narcissistic than school teachers, using the Narcissistic Personality Inventory (NPI; Raskin & Terry, 1988) as a measure. This indicates that school teachers are deemed to be easier to approach, less likely to act in a self-aggrandizing manner, and more likely to help others. However, it is necessary to note that while professors were perceived to be higher in narcissism than school teachers, they were not considered to be particularly high in narcissism. A separate study was conducted in which participants made judgments across six dimensions on lab created professor and elementary teacher profiles which indicated either high or low narcissism. Results for the second study were similar to the first in that professors were seen as more narcissistic. Sex differences were tested for in both studies and no significant effects were found (Wallace et al., 2018).

The present study builds upon the work conducted by Wallace et al. (2018) with some differences. First, instead of using the NPI we are using the Narcissistic Admiration and Rivalry Questionnaire Short Scale (NARQ-S; Back et al., 2013) which divides narcissism into two subcategories. The first category is admiration which entails grandiose self-views, and the second is rivalry which is comprised of antagonistic attitudes and behaviors. Secondly, we are comparing perceptions of professors at two types of colleges, one that rewards faculty for scholarly productivity and the other that rewards faculty for quality of teaching. Thirdly, we will be looking for any potential sex differences between professors.

In this study, two different types of professors are investigated. One type is the research professor, which is shorthand for professors that are employed at a university that primarily rewards its faculty for scholarly productivity. The second type is the teaching professor that is employed at a college that primarily rewards faculty for teaching. There is little research

on the stereotypes that could be attached to both types of professors, however, some inferences can be made. Teaching professors, due to the amount of time spent fostering student learning, may be seen as more approachable than a research professor whose goal is to produce publications. Research professors may seem to be entirely focused on pushing out publications and as such would be viewed as research oriented and not student oriented.

The sex of the professor in our lab has thus far shown no significant effects in perceived narcissism in comparison to the male counterpart (Wallace et al., 2018). However, the literature supports a concept of gender stereotypes that seem to be prevalent in academia. In one such study, Anderson (2010) found that students tended to perceive women as warmer than men, indicating that the women professors are viewed as more approachable, kind, friendly, and helpful. In addition, college students are more likely to consider women to be teachers and males to be professors. Miller and Chamberlin (2000) asked students to indicate the level of education each member of their majors' departmental faculty had received. Results showed that 68% of the males but only 44% of the females in the department were assumed to have a Ph.D. (Miller & Chamberlin, 2000). This indicates that the women in the department were more likely to be seen as a teacher rather than as a professor, even if they had achieved status as a full professor at that university.

There is little research on the stereotypes of professors and perceived narcissism as a whole. In a study performed in 1998 by Hill and Yousey, four occupations involving leadership were surveyed for perceived narcissism using a shortened version of the NPI. They found that politicians rated highest in narcissism, while professors, librarians, clergy were not significantly different from one another and were not perceived to be particularly high or low in narcissism (Hill & Yousey, 1998).

In the present study, participants responded to a survey which asked them to consider to what extent a given professor would agree with a narcissistic statement. The sex of the professor was manipulated between subjects, that is the participant was assigned to only a single sex, while the type of professor was manipulated within subjects--each participant received questions for both. We expected to find a difference in perceived narcissism with research professors being rated as more narcissistic than teaching professors.

Methods

Participants

Participants from the U.S were enlisted via Amazon Mechanical Turk with a payment of \$.50 USD to complete a “Judgments of Professors III” survey. The final sample ($N = 237$; 51% male; 49% female; $M_{age} = 34$). Thirty-three participants were excluded for failing the attention check portion of the survey or for failing to respond to all items. Most participants reported having earned a B.A (60%).

Materials

The questions used in the survey were adapted from the NARQ-S (Back et al., 2013) and were used as both a participant personality measure and applied to the target profile of professors. Participants were asked to first complete the short scale NARQ on a Likert scale from 1 to 6 with 1 representing not agree at all and 6 representing agree completely. The participants were then asked to consider to what extent a specific kind of faculty member would think about an item from the NARQ scale. For example, some participants were given this prompt: “*Imagine the traits of a male professor at a college that rewards faculty for scholarly productivity more than quality of teaching.*” Then they were asked to consider a specified item “*Being a very special person gives me a lot of strength.*” This sounds like something this professor would think.” The individual items were responded to on a 5 point Likert scale (Strongly Disagree to Strongly Agree).

Design

The study was a 2 x 2 x 2 mixed-design. The variables that were manipulated were the narcissism (within-subjects) and sex (between-subjects) of the professor, and whether the professor worked at a college that rewarded faculty for scholarly productivity or teaching quality (within-subjects). The dependent variable was responses to the NARQ professor questions.

Procedure

Participants took a 27 item survey on Amazon Mechanical Turk, answering questions first on gender, ethnicity, age, and level of education. Participants next answered a NARQ self-questionnaire, which preceded the professor judgment questions. The final items asked the participant to consider the narcissistic tendencies of professors in different college environments.

Results

A 2 (target narcissism) x 2 (target sex) x 2 (target job type) mixed-design ANOVA indicated several significant effects. We found a main effect for target narcissism which revealed that admiration narcissism ($M = 3.37$, $SD = 0.95$) was perceived as higher in professors than rivalry narcissism ($M = 2.59$, $SD = 0.96$), $F(1,235) = 238.2$, $p < .001$, $\eta_p^2 = .50$. The job type main effect was also significant: Narcissism was perceived more for professors who work for an institution that rewards scholarly productivity ($M = 3.29$, $SD = 0.96$) than professors who work at an institution that rewards quality of teaching ($M = 2.68$, $SD = 0.95$), $F(1, 235) = 81.98$, $p < .001$, $\eta_p^2 = .26$. We then found a significant interaction between the target type of narcissism and target job type (Figure 1). This indicated that the difference between admiration narcissism and rivalry narcissism was significantly larger at the institutions that reward for teaching ($M_{diff} = 1.03$; $\eta_p^2 = .56$) rather than the institutions that reward for scholarly productivity ($M_{diff} = .55$; $\eta_p^2 = .22$), $F(1, 235) = 21.66$, $p < .001$, $\eta_p^2 = .084$. Perceived narcissism in male professors ($M = 3.03$) was slightly higher than in female professors ($M = 2.85$),

however, the main effect was not significant $F(1, 235) = 3.28, p = .072, \eta_p^2 = .01$.

We also found that participants view professors ($M = 2.95, SD = .65$) as less narcissistic than they view themselves ($M = 3.40, SD = 1.34$). To add the participant narcissism factor to the ANOVA model, we converted participant narcissism, both admiration and rivalry, from a continuous scale to a discrete dichotomic scale using a median split, separating the bottom half at 3.4 and the top half at 3.5. To search for further effects we conducted a 2 (target narcissism) x 2 (participant narcissism) x 2 (target job type) x 2 (target sex) mixed design ANOVA¹. We found a main effect of participant narcissism, $F(1, 233) = 47.33, p < .001, \eta_p^2 = .17$, indicating that narcissistic participants were more likely to view professors as narcissistic.

Discussion

In an effort to differentiate perceived narcissism between types of professors, we found that professors at a research oriented university were considered to be more narcissistic than professors at a teaching oriented university. We also found that there were no significant differences in perceived narcissism in the sex of the professor. There were several significant effects for the dimensions of admiration and rivalry in which we found that admiration narcissism was viewed as more characteristic of professors than rivalry narcissism.

There is a lack in the literature of perceived or actual narcissism in academic faculty, which makes it difficult to relate this study to previous findings. However, Hill and Yousey (1998) had professors take the NPI through a mail in survey and found that professors in general were not particularly high or low in narcissism which seems to match the data we received. Moving forward, our findings of no significant differences between sexes is surprising. An analytical review of gender differences in narcissism confirmed that in narcissism studies men are generally perceived to be more narcissistic (Grijalva et al., 2015).

Therefore, narcissism in academia is either seen as similar between men and women or the current study's design did not allow for the differences to show.

Limitations and Future Research

Some of the limitations of our research include the fact that we were limited to the number of items in the survey to prevent participant fatigue, however by doing this we lost out on potentially useful items. Because users on Amazon Mechanical Turk were paid a relatively small amount, participants may have tried to rush through the survey. For the most part we account for this with an attention check item, however it is still possible that some participants were not fully engaged. Furthermore, the inability to add more survey items prevented us from distinguishing exactly what factors are different between research and teaching professors. Another possible limitation that was originally not considered is that by differentiating between professors by using the word teaching, the participant may automatically attribute a lower narcissism score for the teaching professor because of the possible teaching connotation as seen in a previous study where teachers received lower narcissism scores (Wallace et al., 2018). To see if results would still be representative, it may be interesting to change the language from professor rewarded for quality of teaching to professor rewarded for quality of lectures and student interactions. In this study we had found that admiration narcissism is higher than rivalry narcissism which may indicate that participants view admiration narcissism as more prevalent in professors and that it may possibly be adaptive. A future study may identify the specific job aspects of professors and identify in which narcissism is considered adaptive or maladaptive. Narcissism in many senses can be seen as adaptive or maladaptive depending on the person and the situation. Kanel, Herr, Van Vianen, and Schmidt (2016) found that in college students who took the NPI, those who were higher in Entitlement/ Exploitativeness were more likely to

burnout in college and experience higher work stress. However, those higher in Leadership/Authority were less likely to burnout in college and were associated with fewer depressive symptoms and home related stress (Kanel et al., 2016). Another possible view of narcissistic adaptiveness can be found in a study by Westerman et al., (2015), who investigated business professors' narcissism and how it affected students. Westerman et al., (2015w) found that students lower in narcissism in a class run by a professor higher in narcissism received lower grades, perceived higher class difficulty and perceived their professor as lower in status, while the exact opposite was true for students high in narcissism. This indicates that potential narcissism in the professor or in the classroom may have a direct impact in the quality of education received, warranting further research.

In summary, our findings open a novel area of narcissism and academia and allow for future research to be conducted regarding narcissism's potential adaptive or maladaptive qualities in the academic realm. Our research indicates that admiration, rather than rivalry narcissism is perceived to be higher in professors and that research professors are perceived to be higher in narcissism than teaching professors. This new knowledge may lead to a better understanding of narcissism in academia and eventually to what extent narcissism may be adaptive or maladaptive.

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Footnotes

¹A four way interaction was found between target narcissism, participant narcissism, target job type, target sex, $F(1, 233) = 5.12$ $p=.03$, $\eta_p^2 = .021$, however, it was excluded from the results section because it was not significant at $p<.01$.

Figures

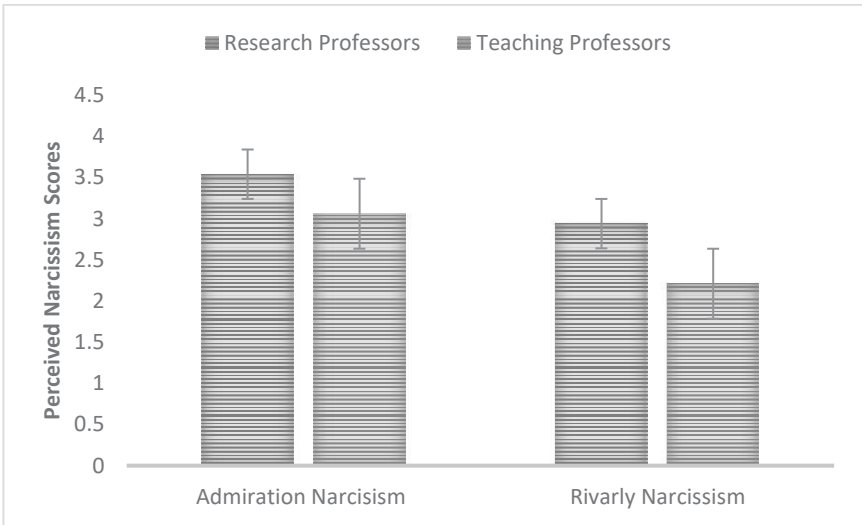


Figure 1. Values of perceived admiration and rivalry narcissism in research and teaching professors. Error bars represent standard error.

How a Change in Water Temperature Affects the Behavior of Captive Beluga Whales (*Delphinapterus leucas*)

Ashley Contreras

Melissa Karlin



Mentor: Melissa Karlin, PhD
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*In September of 2017, a beluga whale calf (*Delphinapterus leucas*) was found stranded in a mudflat in Alaska, determined non-releasable, and placed in the care of SeaWorld San Antonio in March of 2018. In preparation for this calf's arrival, the facility in San Antonio had to make adjustments to the temperature of the water of the beluga whale habitats. Many mammals, including lemurs, seals, rodents, and humans, have been found to engage in behavioral thermoregulation, and their behaviors and activity levels have been known to decrease or increase depending on the core temperature they are attempting to maintain. In this study, footage from 2016-2018 of the beluga whales held at SeaWorld San Antonio were examined to determine if the modification of the water temperature in 2018 resulted in significant changes in their behaviors compared to 2016 or 2017. Three separate behaviors were coded – solitary swims, social interactions, and play – and several tests were conducted. The report from a Friedman test concluded that there was a significant difference in solitary swim occurrences in 2017 ($p=.002$) when compared to both 2016 ($p=.001$) and 2018 ($p=.005$). A Chi Square test was also conducted, and the results indicated a significant difference ($p=0$) in the number of observations between each month for all years and all behaviors. With current recurring research themes including ocean warming, ocean acidification, and climate change, this study is*

useful in determining how a short-term change in the water temperature affects a group of captive cetaceans.

General Ecology

Beluga whales (*Delphinapterus leucas*) are native to arctic and sub-arctic waters (Ezer et al. 2013) and are circumpolar in dispersal (Huntington 1999). They are richly distributed throughout the coastal waters of Alaska, and feed on a variety of fish, shrimp, and invertebrates, including: salmon, herring, tomcod, flounder, smelt, sculpins, arctic char, whitefish, and capelin. Reproductively, belugas will usually only birth one calf at a time (though twins are possible), and the calves will usually stay with their mothers anywhere from 1 to 2 years. In order to adjust to their climate, beluga skin and blubber will be generally thicker in the spring and thinner in the fall. During the transition from spring to fall, the belugas will molt, shedding old layers of skin. This skin usually sheds easily, but the belugas may brush up against natural objects (e.g. rocks, ice) to facilitate the molting. As far as individual markings, some belugas may have scars from scraping against ice, other animals (e.g. raking), or perhaps old bullet wounds from hunters (Huntington 1999).

Previous Research

Little research has been done on beluga behavior despite the current research on cetacean physiology (Hill 2009). Since cetaceans are fast swimmers and are known to swim over large distances every day, their behavior is quite difficult to monitor. In addition, there are no standard rules for monitoring behavior. Many studies will employ *ad libitum* sampling (recording whatever behaviors are readily apparent at the time of observation) which is not only inconsistent, but also often involves bias on some level. Another issue cetacean behavior studies face is researchers do not often provide information on the equipment they used during observation nor how that equipment may have impacted the behaviors observed (Mann 1999). Finally, pseudoreplication is an issue many researchers have trouble staying clear of (Hurlbert 1984), and behavioral studies are not immune to this issue (Mann 1999). However, there are tools

researchers may use when studying cetacean behavior to minimize these issues. Being able to recognize the subjects is an immense help for researchers; in cetaceans, there are natural markings that one can use to identify subject, such as scars, fin size, etc. The downside to this is that some of these markings may not last for the subject's lifetime, making it more difficult to identify cetaceans, specifically those in the wild (Hammond et al. 1990). Using these cautions and tactics, researchers have conducted a wide array of cetacean studies concerning calf development, play, and other types of social behavior both in captivity and in the wild (Hill 2009; Recchia 1994; Hill and Ramirez 2014; Hill et al. 2011; Hill et al. 2015; Delfoura and Aulagnierb 1997; Dudzinski 2010; Dudzinski et al. 2012; Hill et al. 2007; Samuels and Gifford 1997; Greene et al. 2011).

Young Belugas and Their Effect on Adult Beluga Behavior

Growing evidence suggests that play is distributed across many species, and even found occurring among adults that do not often participate in play behaviors (Hill et al. 2015). The play behavior of one animal can have an impact on the behavior of others, creating a domino effect within the population; some adult animals will even mimic the younger animals in the population. In a study done by H. Hill, S. Guarino, S. Crandell, E. Lenhart, and S. Dietrich, it was found that adult belugas display play behaviors when younger belugas are present, with overall higher levels of behavioral activity when there was a mixture of ages in the population (Hill et al. 2015).

Behavioral Thermoregulation

When exposed to a change in ambient temperatures, many mammals (marine or otherwise) will engage in behavioral thermoregulation in order to reach normothermia (a core temperature within their physiological range). When exposed to low ambient temperatures, mammals will engage in behaviors that either conserve or acquire energy. In order to conserve energy and body heat, some mammals will form into a ball-like posture, or some will be sitting in a hunched over position. Some

mammals will also bask in the sun or find shelter to increase their core temperature. In order to produce body heat, some mammals will engage in higher levels of locomotor activity. However, although locomotor activity may often constitute a large source of body heat, it is also quite costly in terms of energy, and in turn needs to be fueled through a higher caloric intake. In many mammals, a specific endocrine signal will increase the amount of orexigenic hormones in order to increase caloric intake (Terrien et al. 2011).

A beluga whale calf, now known as Tyonek, was found stranded in a mudflat in Cook Inlet, Alaska in late September of 2017. Several members of the Alaska SeaLife Center attempted to push Tyonek back into the water, but he kept re-stranding back onto the beach (SeaWorld 2018b). Since it is vital that beluga calves stay with their mothers for up to two years, they knew Tyonek had no chance of surviving on his own in his natural habitat (Brogan and Speegle 2018). Less than a year old, Tyonek now calls SeaWorld San Antonio home (SeaWorld 2018a). In order to assist in Tyonek's transition, the Alaska SeaLife Center and SeaWorld worked together to guarantee that his new environment would have conditions similar to what he experienced in the wild. The Alaskan waters Tyonek was found near are, on average, negative 3 to 8 degrees Celsius. For the captive beluga whales in San Antonio, the water in their tanks is favorably kept at a routine 17 to 18 degrees Celsius. In order to properly acclimate Tyonek to his new environment, the water temperature in the facilities at SeaWorld had to be altered (SeaWorld 2018a).

The purpose of this study was to observe behaviors of belugas in captivity at Sea World San Antonio from 2016-2018 to determine if changes in water temperature in 2018, associated with the arrival of Tyonek, significantly affected the types or frequencies of commonly observed beluga behavior. I hypothesized that, since the controlled change in temperature was not very significant, the change in play activity during the months of 2018 when compared to 2017 and 2016 would be insignificant.

I also hypothesized no significant change in solitary swims nor social interactions.

"

I coded archived video footage of the beluga whales for the months of March, April, and May of 2016, 2017, and 2018, for a total of 18.83 hours of video data. The specific behaviors coded included: solitary swims, social interactions, and play (defined in Table 1).

Method

I employed scan sampling, meaning at each minute (on the minute) of each video, I recorded what behaviors were observed and by which beluga, by coding a “1” next to their name, under the behavior in which they were engaged. After all the videos

Table 1. Specific Beluga behaviors coded for from SeaWorld San Antonio video footage

Behavior	Operational Definition	Examples
Solitary Swim	Animal swims or floats independently, or engages in independent behaviors	Spy hops, vocalizations, chin slaps, wall rubbing, object rubbing
Social Interactions	When one animal engages in a pair swim, affiliative swim, sexual interactions, socio-sexual interactions, or agonistic interactions with one or more other animals	Displacement calls, chasing, pectoral fin rubbing, presentations
Play	When an animal, either independently or with one or more other animals, interacts with its environment	Manipulating EEDs, objects found in nature (e.g. leaves, sticks), and/or the water (e.g. bubble bursts, water spits, etc.); engaging in social interactions that are displayed atypically (e.g. predatory behaviors that do not receive aggressive or evasive responses)

were coded, a Friedman’s test was used to determine if there was a significant difference ($\alpha = .05$) in number of behaviors, combining all animals, comparing the different behavioral events for each session of 2016, 2017 and 2018. I also conducted a Spearman’s Rho correlation test ($\alpha = .05$) in order to determine if there was a correlation between the number of behavioral events recorded and the temperature of the water. Finally, I used a Chi

Square test ($\alpha = .05$) to determine if there was a difference in the number of observed behaviors between the years.

Results

Based on the observations made from all of the video data coded, I found that the category of behaviors observed the most throughout all three years was solitary swims, as seen in Figure 1. Over all three years, 2016 had the highest number of total behaviors observed.

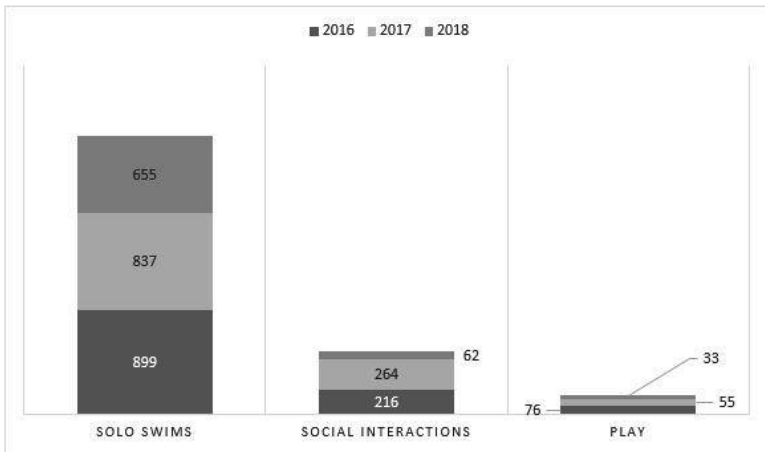


Figure 1. Total number of behaviors observed for captive beluga whales at SeaWorld, San Antonio, TX for March-May of 2016-2018.

The water temperature on days of observation across all three years can be seen in Figure 2. Data on the water temperature for 2016 was unavailable, but since the water temperatures of the tanks at SeaWorld San Antonio are normally controlled with little variation, the water temperatures for 2017 were used for the corresponding dates for the 2016 video data. Also notable, the data line for 2017 goes much further than 2016 and 2018, and this was because the highest number of recordings were conducted in 2017.

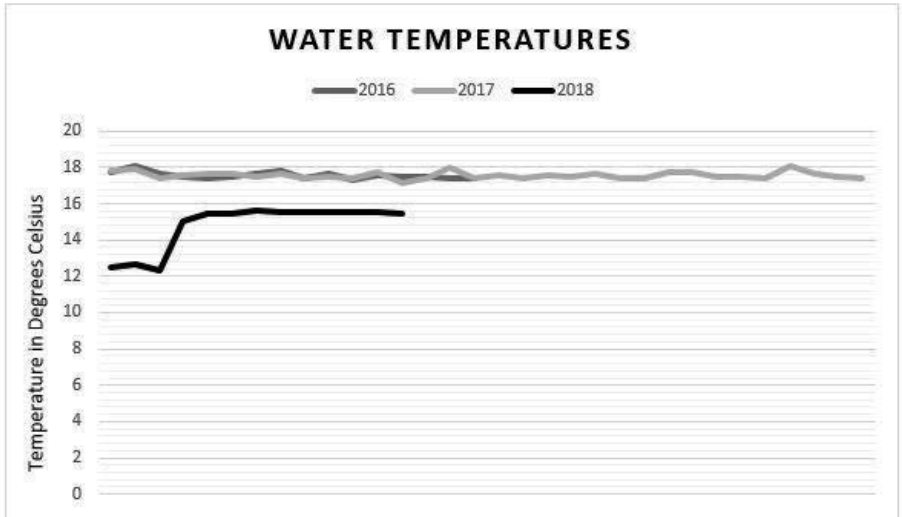


Figure 2. Water temperatures in the captive beluga tanks at SeaWorld, San Antonio, TX on the days of video sessions, March-May of 2016-2018.

In Figure 2 you can see the water temperatures for 2016 and 2017 were fairly similar, while the change in water temperature for 2018 is quite different, including what appears to be a sudden spike in temperature, but what was really a change of approximately 3 degrees Celsius over the course of four days. This was due to the modifications made to the water temperature; as mentioned earlier, the water temperatures of Alaska range annually from negative 3 to 8 degrees Celsius while SeaWorld San Antonio's average water temperatures range from 17 to 18 degrees Celsius. When Tyonek was brought down to SeaWorld San Antonio, the biologists at SeaWorld tried to find a temperature that was in the middle of what their belugas and Tyonek were used to, resulting in water temperatures averaging from 12 to 15 degrees Celsius.

Based on the results from the Friedman’s test, there was a significant difference in solitary swim occurrences in 2017 ($p=.002$) when compared to both 2016 ($p=.001$) and 2018 ($p=.005$), with no significant difference reported for social interactions nor play. There were no significant correlations reported for any behaviors in the Spearman’s Rho test results. However, in both 2017 and 2018, there was a slight positive correlation between water temperature and play activities, and in both 2016 and 2017, there was a slight negative correlation between water temperature and social interactions, as seen in Table 2.

Table 2. Spearman’s Rho Test Results for number of behavioral observations and water temperature

Year	2016			2017			2018		
Behavior	Play	Social	Solitary	Play	Social	Solitary	Play	Social	Solitary
rho	0.026	-0.184	0.26	0.309	-0.224	0.045	0.424	0.018	0.119
p-value	0.925	0.494	0.332	0.085	0.219	0.809	0.149	0.953	0.7

The results from the Chi Square test indicated there was a significant difference ($p=0$) in the number of observations between each month across all three years (Figures 3 - 5). There were more solitary swims recorded throughout the months of 2016 when compared to 2017 and 2018, however, there was a peak in solitary swims during May of 2017. There were more social interactions recorded in 2017 when compared to 2016 and 2018, and a peak of social interaction occurrences in May of 2017. Lastly, there were more observations of play recorded in 2016 when compared to 2017 and 2018, with a peak of play observations in April of 2016.

Figure 3. Percentage of observed solitary swim behaviors for captive beluga whales at SeaWorld San Antonio for all years.

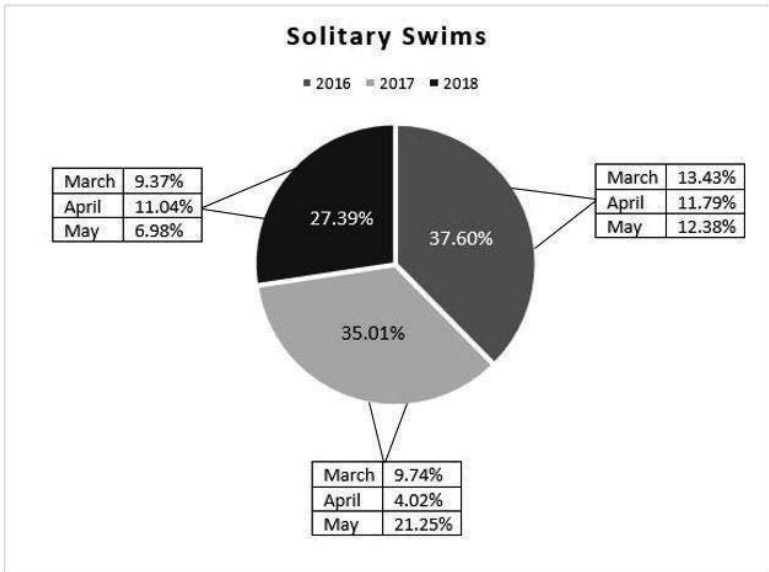


Figure 4. Percentage of observed social interactions for captive beluga whales at SeaWorld San Antonio for all years.

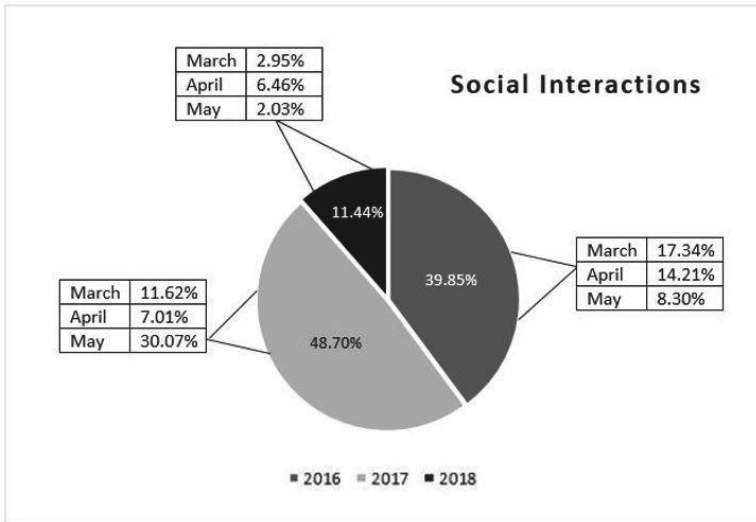
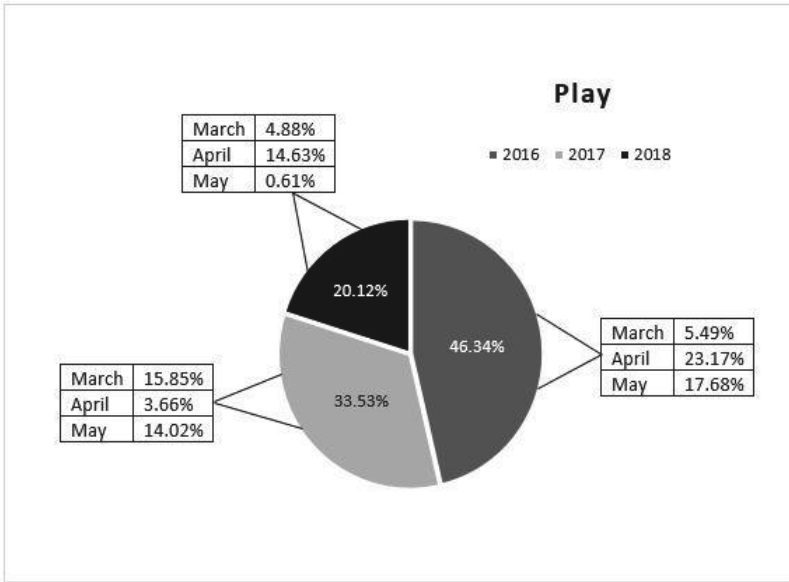


Figure 5. Percentage of observed play behaviors for captive beluga whales at SeaWorld San Antonio for all years.



Discussion

The purpose of this study was to observe the behavior of the belugas in captivity at Sea World San Antonio to determine if changes in water temperature in 2018, associated with the arrival of Tyonek, significantly affected the types or frequencies of commonly observed beluga behavior. I hypothesized that, since the controlled change in temperature was not very significant, the change in play activity, solitary swims, or social interactions during the months of 2018 when compared to 2017 and 2016 would be insignificant. If there was a change in behavior, I suspected that it may be due to a behavioral thermoregulation reaction in the belugas. Based on the p -value of the Friedman’s test results for play ($p=.517$) and for social interactions ($p=.165$), my hypothesis was correct. However, based on the p -value of the Friedman’s test results regarding solitary swims ($p=.002$), my hypothesis that there would be no significant change to solitary swims was incorrect. There are a number of factors that could have caused this change to be identified. During 2017, there was

an abnormal amount of scan sample recordings of the beluga whales taken. There was an average of five scan sample videos recorded per month during March, April, and May of 2016, an average of four videos recorded for 2018, and an average of ten videos recorded for 2017, with a peak of sixteen videos recorded in May. Also, the demographics of the belugas varied video-to-video. In some videos, the group consisted of only adults, while in others there was a mixture. Along with this, the demographics found within the beluga whale groups changed each year, with one of the females birthing a new calf in 2018. All of these factors may have been what caused the amount of solitary swims in 2017 to differ from 2016 to 2018.

In conclusion, based on the tests that were ran, there was no change in the behavior of the beluga whales – as far as solitary swims, play, and social interactions – that was attributed to the temperature change in the water of the tanks in 2018. While this may have been expected, since the temperature change only varied slightly, this data is still relevant in terms of climate change and ocean warming. The ocean is a key component in many environmental processes (Martin and Windom 1991; Broecker and Denton 1989; Betts and Holland 1991) – even in warning us of natural disasters (Zheng and Zhu 2015) – and the health of the ocean is vital; because of this, it is important that we know how ocean warming affects oceanic species, since these species can often tell us quite a bit about how our oceans are being affected (Widdicombe and Spicer 2008). Many critics of climate change and ocean warming argue that a temperature change of a few degrees is harmless, and this may be accurate based on the results of this study. However, the results of this study are based on a short-term change in the water’s temperature, meaning this study is inconclusive in terms of how a long-term change in water temperature would affect the behavior of beluga whales. Future behavioral studies should focus on how a long-term change in the ambient temperature of an organism’s environment may affect that organism’s behavior, as well as whether or not short-term changes in the ambient temperature

may, or may not, affect other organisms. Future studies should do their best to include steady observations and demographics as to ensure the data are not effected by environmental factors other than warming.

Acknowledgments

We would first like to thank Dr. Heather Hill for connecting us to SeaWorld San Antonio, and especially for personally contributing to Ashley Contreras' knowledge on behavioral studies. We would also like to thank SeaWorld San Antonio for allowing us the opportunity to study their beluga population, and we wish them the best with their newest addition, Tyonek. Lastly, we would like to thank the McNair Scholars Program at St. Mary's University for funding this research.

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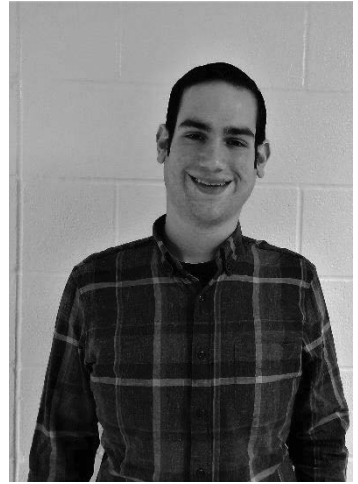
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Creating Creative Dolphins (*Tursiops truncatus*): Assessing Creativity Under Stimulus Control

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*Cetaceans, like bottlenose dolphins, are well known for their complex and highly developed cognitive capacities. One of the first constructs tested for dolphin cognition was creativity in the late-60s. Several dolphins demonstrated their ability to perform novel behaviors when asked by a trainer, under stimulus control. While novel, the degree of creativity for the behaviors produced was not assessed. In humans, creativity is measured commonly with The Torrance Tests of Creative Thinking (TTCT). For this study, we adapted two of the constructs utilized by the measure (i.e., fluency & originality) to investigate creativity in eight bottlenose dolphins (*Tursiops truncatus*) in managed care. After five test sessions, the results indicated that the dolphins performed different behaviors for 52-72% of reinforced trials. On average, the dolphins performed between 19 and 20 different behaviors whether they received reinforcement or not during a session and tended to perform more behaviors in a row before repeating behaviors as sessions progressed. For originality, several behaviors were performed one time across sessions by a specific animal and 89 out of 217 behaviors occurred once across all animals across all conducted trials. Taken together, these results suggest that dolphins seem to show fluency and limited originality in their creativity when under stimulus control. The training and testing procedures used may have influenced the*

degree of originality, and future studies must consider these factors.

Introduction

In psychology, creativity is often described as a problem-solving task in which individuals move from an initial problematic state to a state of goal completion (Matlin, 2013). Extensive literature on creativity exists, but a standard approach to its definition has not been met. Fundamentally, creativity has been outlined as the capacity for individuals to produce *novel* and *useful* solutions. The number of creative and useful solutions produced is called divergent thinking Guilford (1967) while convergent thinking includes deriving one novel solution that is functional (Zmigrod, Colzato, & Hommel, 2015). These definitions, although functional, do not address the motivation behind creativity.

Intrinsic Innovation in Humans and Animals

Intrinsic motivation is regarded as innately motivating and pleasurable (e.g., hunger, procreation; Repovich, 2013). Creativity or innovation that occurs intrinsically may include solving naturally occurring problems or creating aesthetically pleasing works simply for the one's pleasure. For example, the use of adornments (e.g., fashion in humans) may be used as a means to solve a species' biological duty of attracting a mate for procreation (Spivey, 2005) or it may simply reflect an individual's aesthetic preference.

Innovative behaviors can be found in technology, architecture, science, and education. Across all of these contexts creativity is recognized easily by others despite the difficulties in measuring it. An example of this intuitive recognition occurred during a study on perceived intrinsic creativity with 204 primary and secondary school teachers from Hong Kong (Chan & Chan, 1999). These teachers were asked to discriminate creative students from uncreative students and to ascribe overall attributes to them. The teachers implicitly identified creative students as "more imaginative", "active", and "always questioning" (Chan & Chan, 1999). The assessments on the student's degree of intrinsic

creativity revealed findings that indicated implicit attributes for categorizing behavior as creative or not.

Intrinsic creativity may be more easily attributed to humans than to non-human animals. Given the difficulty with understanding intrinsic creativity in non-human animals, a limited body of research on this topic currently exists. One possible illustration of intrinsic creativity may be represented by Bornean orangutans (*Pongo pygmaeus wurmbii*) and their nest-making behavior (van Schaick, van Noordwijk, & Wich, 2006). Specifically, one group built fewer nests with less complexity than the other group. The researchers hypothesized that these variations in nest-building behavior may have been driven by internal needs such as distributing energy more efficiently in the less frequent nest-building group (van Schaick et al., 2006). Adaptations to specific environmental constraints, as observed in the orangutans, may reflect intrinsic innovation as a problem-solving task rather than an aesthetic endeavor.

Extrinsic Motivations for Innovation in Humans ('Animals

Like the intrinsic creativity described above, the current literature also provides evidence for creativity under extrinsic motivation. Extrinsic motivation produces repeated responses that are driven by external stimuli, such as rewards or reinforcements (Repovich, 2013). These repeated behaviors may also produce variations that provide foundations for reconstructing and creating novel solutions to different problems, which may be facilitated by neurological pathways (L. Vygotsky, 1904).

Elicited creativity in humans and animals.

Extrinsic rewards vary by individuals: (1) some individuals value opportunities to socialize whereas other individuals value their independence, or (2) some individuals value high-energy activities while others prefer to relax. It is well-known that working together in groups to achieve a common goal serves as a reinforcer to successfully complete difficult tasks (e.g., "Robbers Cave Experiment", Sherif, Harvey, White, Hood, & Sherif, 1961). Similarly, children who were observed during language play that

included improvisation, innovation, and repetition showed collaboration with other children while also displaying creativity (Cekaite, 2018). These students served as extrinsic motivators for each other during the language play. In an adult context, many of 267 Italian employees from 60 different organizations increased their creative self-efficacy under newly implemented managerial strategies (Ng & Lucianetti, 2016). Extrinsic motivation from management induced the increase of creative self-efficacy, which in turn, generated creativity in employees. These examples emphasize the importance of social networks as extrinsic reinforcements for novel behaviors.

Extrinsic motivators for creativity are often inferred for animals in wild settings. For example, a study performed with 18 color-ringed male Southern masked weavers (*Ploceus velatus*) showed that these birds built elaborate nests for various mates during breeding season. Unexpectedly, the male birds continued to tidy and weave leaves into their nests after interacting with females inhabiting their current nests (Walsh, Hansell, Borello, & Healy, 2013). Although many birds build nests in preparation for breeding season as a mate selection strategy, this study suggests that the male birds may have been extrinsically motivated to refine or elaborate their nests by their mates rather than driven by innate behaviors (Walsh et al., 2013). Foraging behaviors in novel contexts have been observed anecdotally for many birds, primates, rodents, and other animals (Griffin, 1992).

Eliciting creativity under controlled circumstances. ""

In stimulus control (i.e., contingency learning) studies, subjects are presented a discriminant stimulus – a hand gesture, a verbal cue, a sound, etc. – to indicate the beginning of a trial in which the subjects are expected to produce a response. Desired responses produce reinforcements. When behavioral innovation is being trained initially, novel behaviors or behaviors that are different from previous behaviors are rewarded. Repeated behaviors, therefore, are not rewarded. Rewarded behaviors are often repeated in future trials, which poses a problem for the subjects and results in repeated failures and frustration while the subject learns what behavior is being rewarded, creative behavior in this

case. Eventually, a reinforcement history of extrinsically rewarded, creative behavior will be accrued by the subjects, and creativity is now under stimulus control.

Limited research has investigated creativity in animals under controlled contexts. In one study with two Pacific walrus (*Odobenus rosmarus divergens*), trainers administered vocal cues and fish as rewards (i.e., extrinsic motivation for creativity) for the production of qualitatively different vocalizations across a session (Schusterman & Reichmuth, 2008). After 10 sessions, the animals successfully produced a number of novel vocalizations under stimulus control. Novelty in vocalizations was defined as variability in sounds or the “modification of learned responses, [which] facilitates the solving of never before encountered problems, and generates diverse or surprising behaviors that may have functional significance.” (Schusterman & Reichmuth, 2008, p. 320). This study demonstrated that creativity could be instrumentally conditioned through extrinsic rewards in a non-human animal.

Measures of Creativity

Human studies on creativity have used adaptations of several constructs to measure the number of creative and useful solutions produced (i.e., divergent creativity), and the individual’s ability to produce one, novel solution that is functional (i.e., convergent creativity). To account for both the divergent and convergent definitions of creativity, researchers have utilized The Torrance Tests of Creative Thinking (TTCT) for evaluating creative thinking (Torrance, 1974). In this measure, responses to thought-provoking scenario items are weighed under four constructs: fluency, originality, elaboration, and flexibility. Fluency is measured by the amount of distinct, novel, and useful solutions produced when prompted with a thought-provoking scenario. Originality, considers single and novel solutions that are functional. Statistically rare solutions across participants are assessed as original. Elaboration is assessed qualitatively by summarizing the level of detail or development of the responses, much like the variability construct assessed in Schusterman and Reichmuth’s (2008) study. Flexibility pertains to whether

answers by participants can be categorized using themes that were established previously or that emerged.

Most studies focus on fluency and originality. Less research has attempted to quantify elaboration and flexibility. However, as illustrated in Table 1, many different operational definitions have been used to examine each of the constructs above. Using a variety of demographics and age ranges, each study approached creativity slightly differently. For example, one study investigated creativity by presenting children and parents mailed questionnaires that asked about their creative use of technology, including videogames and computers (Jackson, Witt, Games, Fitzgerald, von Eye, & Zhao, 2012). This survey was coded for all four aspects of creativity, which are defined further in Table 1. Another study, which examined the genetic basis for creativity in 147 university students (Runco, Noble, Reiter-Palmon, Acar, Ritchie, & Yurkovich, 2011) evaluated fluency from a productivity perspective, the originality of the solutions that were proposed less than 5% of all solutions, and elaboration and flexibility, which were measured by overall variation in responses (Table 1). The final example explored the validity of TTCT with a sample of 204 Korean elementary students. The researchers examined all four factors within the creative performance of this sample using definitions that were similar to previous research (Yoon, 2017; Table 1).

Table 1

Operational Definitions of Fluency, Originality, Elaboration, and Flexibility

Study	Fluency	Originality	Elaboration	Flexibility
“Creativity in Children & Technology Use” (Jackson, et al., 2012)	Measured as the number of interpretable, meaningful, & relevant responses elicited by the stimulus.	Measured on a Likert Scale: The unusualness or rarity of responses.	Measured on a Likert Scale: The degree of detail for item responses.	Measured as the number of different categories with relevant responses.
“The Genetic Basis of Creativity & Ideational Fluency” (Runco, et al. 2011)	Measured by number of responses produced.	Only solutions that were proposed less than 5% of the time were considered original.	Measured as number of responses being aesthetically or functionally fitting, in some level.	Measured as the variety of responses presented by the sample.
“A Validation Study of the Torrance Tests of Creative Thinking with a Sample of Korean Elementary School Students” (Yoon, 2017)	Measured by the number of relevant ideas produced by an individual.	Measured by the number of ideas statistically rare: The unconventionality of the proposed ideas.	Measured by the ability to develop ideas. The simplicity or complexity of a response.	Measured by the abstractness of responses. Looking at whether the responses can be labeled or not.

Dolphins and Innovation

Bottlenose dolphins (*Tursiops truncatus*) have been studied extensively, which has illustrated complex societies with considerable differences between groups and many different individual personalities (Highfill & Kuczaj, 2007; Kuczaj,

Highfill, & Byerly, 2012). To keep track of their complex societies these animals have evolved an intricate but individually recognizable communication system. These animals produce distinctive whistles (i.e., signature whistles) that are typically learned within the first year of life and used to signal individuals in the group (Caldwell, Caldwell, & Tyack, 1990; Janik & Sayigh, 2013; Kuczaj, 2014; Tyack & Sayigh, 1997). This communication process indicates high and complex levels of cognition. Other examples of their complex cognition include specialized foraging strategies. Some populations of wild bottlenose dolphins carry sponges on their beaks to protect them from wounds while foraging (Smolker, Richards, Connor, Mann, & Berggren, 1997), while others use conch shells (Allen, Bejder, & Krützen, 2011).

In controlled settings, bottlenose dolphins have demonstrated a variety of cognitive skills under stimulus control. One early study demonstrated that two bottlenose dolphins showed the ability to remember their previously performed behaviors based on different rules. Both dolphins performed increasingly complex behaviors following an abstract rule on 104 out of 120 trials and 86 out of 138, respectively (Mercado, Murray, Uyeyama, Pack, & Herman, 1998). Research has also supported that these bottlenose dolphins can self-monitor. When paired with their controlled breathing, the ability to self-monitor was reflected in the dolphins' display of systematic and innovative types of bubble play (McCowan, Marino, Vance, Walke, & Reiss, 2000). These animals' abilities combined with others suggest dolphins may have a unique combination of cognitive skills compared to other non-human animals (Simmonds, 2006).

“The Creative Porpoise,” published in 1969, was one of the first studies to assess the ability of cetaceans to present novel behaviors under stimulus control. This study consisted of 33 sessions in which novel behaviors, or behaviors that were not present in the animal's repertoire, were reinforced. The session began with the ring of a bell and the appearance of a trainer. The session concluded with the same bell ring and the trainer leaving.

In earlier sessions (i.e., 1 to 14) there was a focus on shaping behaviors through approximation and reinforcement. In these sessions, the animal produced novel behaviors like laying its head on the edge of the pool (“beaching”) or inverted swimming right side up (“corkscrew”). By sessions 15 and 16, the animal was already producing more novel behaviors (i.e., “double tail slap”, “upside down tail slap”, “side swipe with tail”, and “aerial spin”). These were continuously reinforced in sessions despite repetition, so that the animal could assimilate the new behaviors into her repertoire. In the final sessions (28-33), the animal was only reinforced for novel behaviors in the session. This corresponded with an increase in previously unseen behaviors: “one porpoise and one flip”, “upside down porpoise”, “tail stand”, “jaw claps”, and “spitting water towards trainer”. Results indicated that the display of novel behaviors increased (Pryor, Haag, & O’Reilly, 1969).

Building on the literature of innovation in cetaceans, a more recent study examined varying behavior in three male captive bottlenose dolphins (Kuczaj & Eskelinen, 2014a). This study assessed the frequency of behaviors that the dolphins used without repetition and number of components used to construct the behavior, using criteria associated with fluency and elaboration. Under stimulus control with a clear discriminative stimulus (i.e., hand signal that indicated “vary”), repeating behaviors was unacceptable and not reinforced. This contingency required that each subject had to remember behaviors previously produced. These animals were almost perfect in their performance by producing correct responses in over 90% of the test trials: 51 out of 54 trials showed variation for the first animal, 45 out of 48 trials for the second, and 56 out of 59 trials for the third. Although the dolphins did not have to produce completely novel behaviors, they were able to combine multiple behaviors into one complex response, which produced some truly original behaviors (Kuczaj & Eskelinen, 2014a).

Since Pryor’s original study in 1969, only seven papers have reported findings of innovation for dolphins under stimulus control (Dudzinski, Yeater, Bolton, Eskelinen, & Hill, in press).

Out of these seven publications, only three studies have collected quantitative data on innovation for seven dolphins – two rough-tooth dolphins, (*Steno braedenesis*), (Pryor et al., 1969; Pryor, 1975; Pryor & Chase, 2014) and five bottlenose dolphins, (Braslau-Schneck, 1994; Mercado et al., 1998; Herman, 2006; Kuczaj & Eskelinen, 2014a; Lawrence, Borger-Turner, Turner, & Eskelinen, 2016). The current study doubles this sample while extending our knowledge of how to create creative dolphins.

Purpose

For the current study, the creativity of the behaviors produced by bottlenose dolphins under stimulus control with reinforcement was assessed. Eight subjects, previously trained on a discriminant stimulus associated with creativity (i.e., the concept of innovate), were tested over five contiguous days. The behaviors produced by each dolphin were analyzed using several definitions of fluency and originality that had been alluded to in the previous studies (Kuczaj & Eskelinen, 2014a; Pryor et al., 1969). Several hypotheses, presented below, were evaluated at both the group and individual levels

Hypotheses

H1: Dolphins demonstrate *fluency* in their innovativeness under stimulus control.

- H1: As a group, dolphins should demonstrate increased fluency over sessions.
 - H1a: Dolphins will increase the proportion of rewarded behaviors per session.
 - H1b: Dolphins will increase the number of new behaviors across trials prior to repetition.
 - H1c: Dolphins will increase the amount of new behaviors across trials per session.
- H1: Dolphins should demonstrate increased fluency across sessions at the individual level.
 - H1d: Dolphins will increase the proportion of rewarded behaviors per session.
 - H1e: Dolphins will increase the number of new behaviors across trials prior to repetition.

- H1f: Dolphins will increase the amount of new behaviors across trials per session.

H2: Dolphins demonstrate *originality* in their innovativeness under stimulus control.

- H2a: As a group, dolphins will display original behavior across sessions.
- H2b: Dolphins will display original behavior across sessions at the individual level.

Method

Subjects

Subjects for this study were housed at the Roatán Institute for Marine Sciences (RIMS), a facility located in Roatán, Honduras, Central America. A total of eight bottlenose dolphins (*Tursiops truncatus*) were tested for their responses to the innovate discriminant stimulus, in five sessions. The sample consisted of two female dolphins, Maury and Poli, and six male dolphins, Bill, Mr. French, Han Solo, Champ, Ritchie, and Ronnie. Intermittent training on this concept has occurred for an average of four years across all subjects. However, training ranged between less than a year to over seven years. Ages (years) for these animals were as follows: Maury 16, Poli 7, Bill 17, Mr. French 14, Han Solo 16, Champ 6, Ritchie 15, and Ronnie 16. This sample had a wide array of experience with training, in general, and the innovate concept, specifically.

Measures

Two constructs of the Torrance Tests for Creative Thinking (TTCT) were adapted for animal behavior to assess creative displays of behavior under the innovate stimulus (Torrance, 1974). Several definitions were employed for both the fluency and originality constructs (Table 2). The first definition of fluency (F_1) measures the proportion of trials that were reinforced in each session per animal. The second definition of fluency (F_2) measures the amount of behaviors performed in a session before the animal repeated any behavior. The third definition of fluency (F_3) accounts for the average number of novel behaviors in a session given the number of trials. For the first definition of originality (O_1) we measured which behaviors

only occurred once throughout the whole study, across all animals and all sessions. The second definition of originality (O₂) includes behaviors produced a single time across all trials experienced each specific animal.

Table 2

Definitions of Fluency and Originality

Fluency	Originality
F ₁ – Proportion of rewards per session.	O ₁ – Behaviors presented once within the span of this study
F ₂ – New behaviors across trials prior to repetition.	O ₂ – Behaviors presented one time by animal.
F ₃ – New behaviors across trials per session.	

Procedure

On-site collection. Data were recorded on site at RIMS from January 8, 2018 to January 12, 2018. Two photographers recorded footage: one person on dockside (Figure 1a) with a Go-Pro Hero 4 and one photographer in the water with two Go-Pro Hero 3 cameras positioned at the surface and underwater (Figure 1b). Each camera continuously recorded the entire session to ensure that all behaviors were captured regardless of where the subject performed the behavior (e.g., dockside, underwater, at the surface).



Figure 1. a. Dockside camera with trainer sitting on the left and dolphin in front. b. Surface and underwater cameras.

A total of five sessions were performed for each animal across a five-day period, each session produced a different number of trials for each animal. The first two sessions occurred during the morning feeds prior to any guest presentations. The latter three sessions were divided into morning (9:00-11:00am) and afternoon (1:00-2:00pm) as the sessions increased in length and not all the animals could be tested in the morning. The male dolphins were randomly split between the morning and afternoon sessions each day. Both female dolphins were tested in the afternoon.

One trainer administered the innovate SD, primary reinforcer, secondary reinforcer, a bridge, and a least reinforcing scenario (LRS) when needed. The administration of the innovate discriminant stimulus marked the beginning of a trial within a session. Behaviors in trials were evaluated as novel – never happened before in the session – or repeated within the session. Novel behaviors were automatically bridged with a whistle; the bridging process is to let the animal know what they did was what was asked from them and they should expect a reward now. The trainer varied between rewards. Fish, the primary reinforcer, was administered every time the behavior was correct, except on a few occasions when there was a shortage of fish. Secondary reinforcer, praise, was ultimately used every time primary reinforcers were administered. When behaviors seemed ambiguously novel (i.e., a variation of previously performed behavior) the trainer only administered secondary reinforcers with no bridge or primary reinforcers. Finally, an LRS was administered when a dolphin presented a repeated behavior. While administering an LRS the trainer ignores the behavior performed indicating no reinforcement will follow and the behavior was incorrect. However, an animal may receive reinforcement for sitting quietly in front of the trainer after a 3-sec pause (Scarpuzzi, Lacinak, Turner, Tompkins, & Force, 1991).

Coding video data. Two research assistants, naive to the purpose of the study, viewed all trials recorded with the dockside camera together to initially document the behavior reinforced as

identified by the trainer. If dolphins went out of the dockside view (i.e., performed behavior underwater) or there was a recording error with the dockside camera, underwater footage was assessed. Once all the videos were indexed by the two coders, half of the trials were randomly assigned to each coder. These trials were coded independently of one another and then compared to their original coding. Ultimately, every trial was examined two times. Behaviors then dummy coded for originality analyses (Appendix A).

Analysis. The resulting data were summarized on an excel datasheet and then coded for fluency and originality as described above. Each measure was coded by G. Guerra and verified by H. Hill. Dichotomous coding (i.e., 0, 1) for F_1 was employed to the behaviors recorded in each trial. A one was ascribed to reinforced trials, whereas, a zero was ascribed to LRS trials. A simple count of how many behaviors were reinforced (i.e., total number of ones) before a repetition was performed defined the F_2 variable. Dichotomous coding was used for F_3 , measuring how many behaviors were truly novel within the session. This definition allows the inclusion of behaviors performed by the dolphins during trials that were not reinforced. Behaviors new to the session were ascribed the value of one, and repeated behaviors were not counted. For O_1 , each dummy coded behavior that occurred only one time across *all* animal across *all* trials was identified. Finally, for O_2 dichotomous coding was used, a value of one was ascribed to the dummy-coded behaviors that only occurred once across sessions in a single animal. Data were analyzed using a repeated-measures ANOVA (RMA) and Chi-Square (X^2) goodness of fit tests for each animal and across all animals.

Results

Three one-way repeated measures ANOVA tests were performed to evaluate the effects of session on the three definitions of fluency in dolphin behaviors. For the first hypothesis, it was expected that the proportion of behaviors reinforced across animals would increase as sessions progressed (H_{1a} , F_1). However, the results showed that there was no

significant change across sessions, $F(4, 28) = 2.00, p = .12$ (Figure 2). Dolphin behaviors that were reinforced remained relatively stable between 52% and 72% throughout the study, even with the apparent drop over the sessions. Further analysis revealed that when session one is removed, the decrease in reinforced responses significantly correlated more between sessions, $r(30) = -.43, p = .014$.

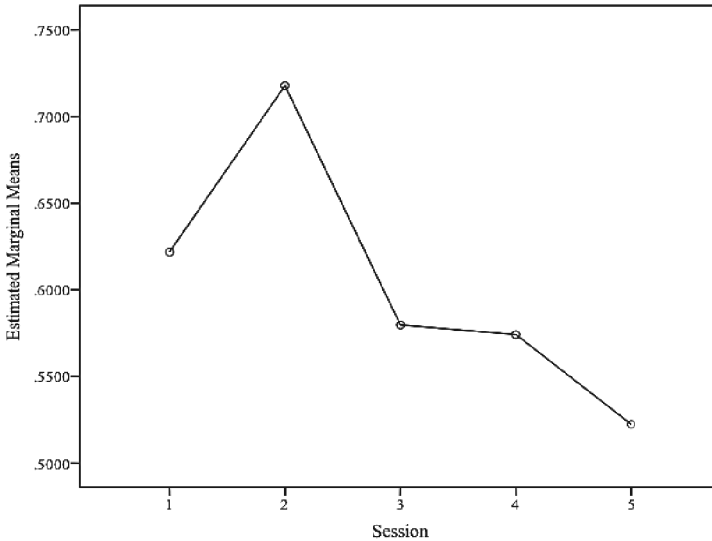


Figure 2. Proportion of behaviors reinforced across animals across sessions.

As demonstrated in Figure 3 individual performance across sessions was highly variable (H_{1d}, F_1). For example, Ronnie’s first session was reinforced at a rate of 100%. As sessions progressed, his reinforcement began decreasing until session five where he received reinforcement at a higher proportion than in the previous session. Contrasted to Ronnie, Champ produced a different trend. In his first session, Champ was scarcely reinforced. Yet, by the second session, his fluency of reinforced behaviors rose above 60%, until it dropped and remained relatively constant for the last two sessions.

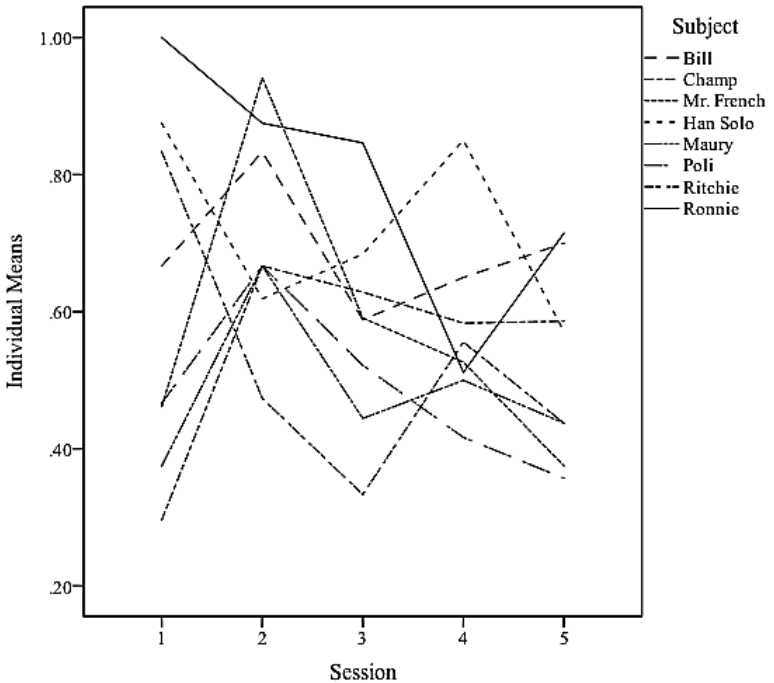


Figure 3. Proportion of behaviors reinforced per animal across sessions.

For the second classification of fluency, it was expected that the amount of new behaviors across trials prior to repetition would increase as sessions progressed (H1b, F₂). Results failed to support this expectation on the never examined measure of fluency, as no significant change occurred across sessions, $F(4, 28) = 1.91, p = .14$. Novel behaviors before repetition in dolphins remained relatively stable across the five sessions. Across the eight animals, three to seven different behaviors were displayed prior to the first repetition when all sessions were examined. Figure 4 shows a constant rise of novel behaviors before repetition, on average, from 2.50 to 6.25 between the first three sessions. In the fourth session, peak performance dropped to 3.25

behaviors, although the behaviors across animals remained at an average of 3.44 for the last two sessions.¹

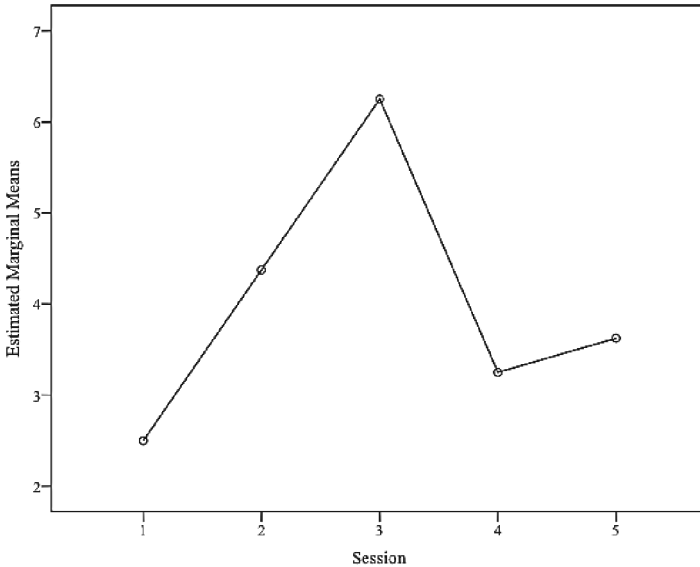


Figure 4. Number of new behaviors across animals across trials prior to repetition.

As illustrated in Figure 5, the animals varied in their individual performances across sessions although it was not significantly different (H_{1e} , F_2). Ritchie produced a pattern of two to four behaviors while progressing in sessions (i.e., two, then four, then two, and so on). Comparatively, Mr. French showed constant irregularity across sessions. This animal produced one behavior before repetition in the first session, 12 behaviors in the second, seven in the third, two in the fourth, and one in the fifth. The contrast between Ritchie and Mr. French demonstrates individual variability across sessions. Interestingly, Poli, Maury, and Ritchie seemed to perform consistently low on this measure throughout the study.

¹ Decimals in amount of behaviors are present because these statistics are the average of behavioral performance of eight animals across five sessions.

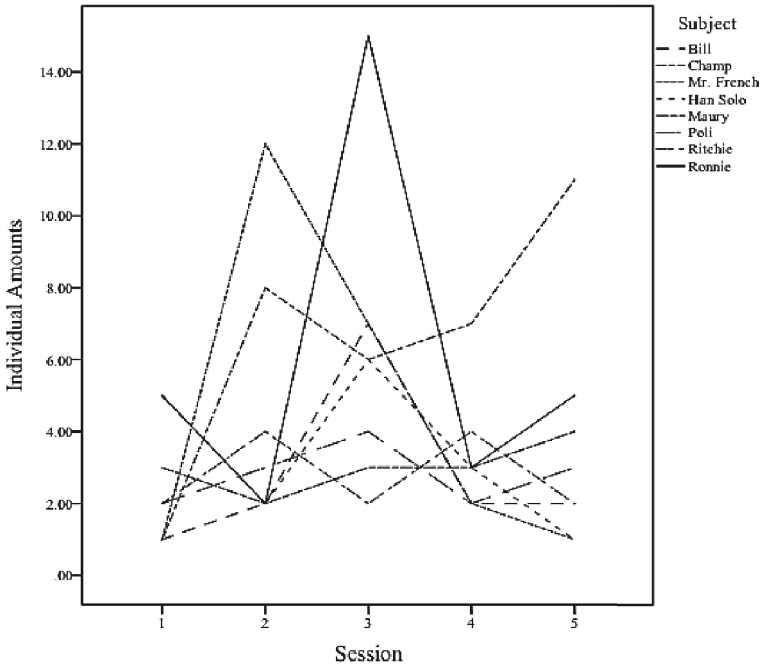


Figure 5. Number of new behaviors per animal across trials prior to repetition.

For the third definition of fluency, it was expected that the number of new behaviors across trials per session would increase as sessions progressed ($H1c$, F_3). Results partially supported this hypothesis, $F(4,28) = 6.68$, $p = .001$ (Figure 6). Post hoc analyses revealed that the number of new behaviors exhibited by dolphins across trials increased from 11.50 to 26.50 through the first three sessions (Table 3). However, this increase dropped at session four to 25.00 and session five to 19.13.

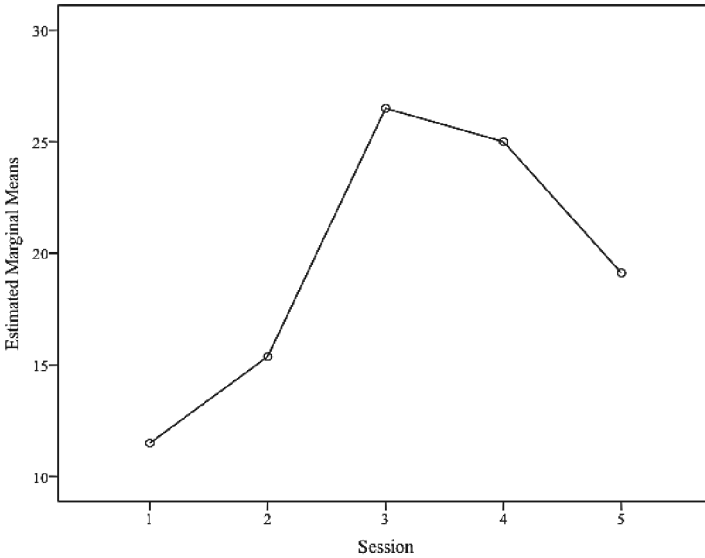


Figure 6. Number of new behaviors across animals across trials per session.

Table 3

Group Performance Across Definitions of Fluency

Session	Fluency 1		Fluency 2		Fluency 3	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
1	.62	.26	2.50	1.69	11.50	3.70
2	.72	.15	4.38	3.70	15.38	4.17
3	.58	.15	6.25	3.99	26.50	6.63
4	.57	.13	3.25	1.67	25.00	9.86
5	.52	.14	3.63	3.29	19.13	6.58

Figure 7 shows all animals tended to individually perform more behaviors as sessions progressed up until session three (H1f, F2). Further analysis of session three reveals that Bill, Champ, Han Solo, and Poli reached their individual peaks of novel behavior performance during this session dropping off in the next two sessions. Similarly, Ronnie, Maury, Mr. French, and Ritchie reached their peak at session four dropped off at session five.

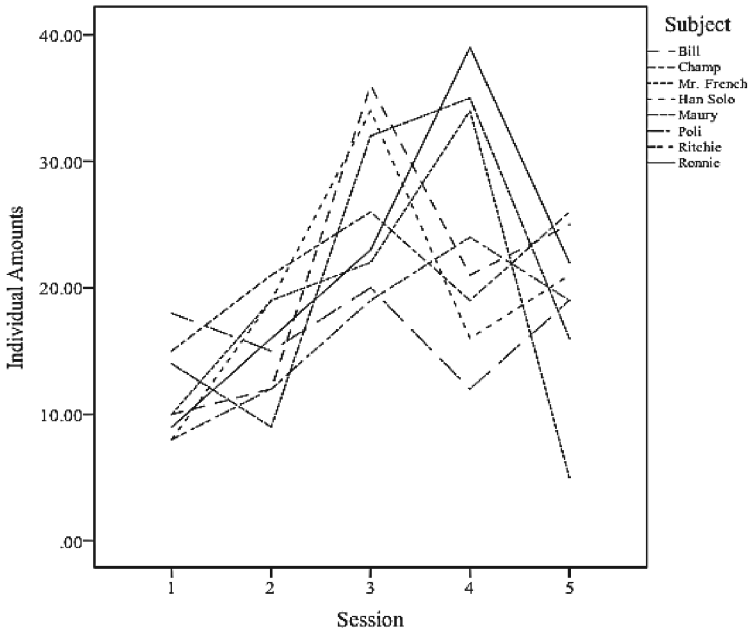


Figure 7. Number of new behaviors per animal across trials per session.

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for all animals across all sessions (H2a, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(214, N = 1,599) = 6,176.90, p < .001$. There were 89 behaviors across all animals and sessions that were performed only one time and significantly below chance, and four behaviors that were performed more than 70 times, which was significantly above chance. Table 4 summarizes these behaviors.

Table 4

Original and Preferred Behaviors for All Dolphins Across All Sessions

Original Behavior		Preferred Behaviors			
Backwards Bow	Flip Over to Ventral	Hula x2	Laid to Right	Partial UW Tail Lob	Bubbles
Barrel Rollx2	Vertical Flip	Starting Back Dive	UW Left Swim	Big Bubble Burst	Left turn
Three Bubbles	Horizontal Ventral Layout	Barrel Roll into Bow	Rollover to Left	Sink Vertical Right	Open mouth
Feces	Backwards Hula	UW Barrel Roll + Open Mouth	Rollover to Left + Bubbles	Stationary sink	Sink
Come Up	Pec & Tail Wave	UW Barrel Roll + Bubbles	Fake Pop up, Sink	Swim Like Shark	
Lateral Layback	Head Back + Open Mouth	UW Whistle Stream	Turn Left + Come Back	Turn Left + Right Eye Stare	
Lateral Swim	Head Up + Open Mouth	Dorsal Layout + Spit	Turn left + Swim Around	UW Ventral Up + Circle in Opposite Direction	
Left Pec Flare	Layback + Open Mouth	Dorsal Speed Run + Beach on Platform	UW Backwards Tail Walk	Barrel Roll - Variation	
Little Bubbles	Ventral Swim into Bow	Ventral UW Float + Open Mouth	Vertical Curved Sink	Ventral Circle Swim	
Look at Trainer	Swim Around UW Footage	Move forward + Mouth closed	Vertical Float + Spit	Beginning of Backwards Tail Walk (Back up)	
Surface	UW Hula + Open Mouth	Stationary Vertical Float	Vertical Sink + Bubbles	Layback + Vocal + Left Pec Wave Layback + Vocal + Left Pec Wave	
Back Bend	Vocal - Raspberry	Turn Left + Open Mouth	Vocal (Response to Mr. French's Vocal)	Ventral Left Swim	
Slow Somersault UW Tail Lob	Sink into Tail Walk Diagonal Sink	Vocal - Peep Vocal - Jetsons	Barrel Roll Right Circle Photographer	Vocal Foghorn - Variation Horizontal Float at Surface + Attempt Fishing	
Pec Display	Bigger Open Mouth	Bubble Burst	UW Horizontal Float	Dorsal Line-Up with Photographer	
Backup - Faster Dorsal Layout	Circle Swim Right Lateral Roll	Lateral Roll + Open Mouth Laid to left + Came Back	One Slow Bubble	Stationary Tail Walk Backwards Tail Walk into Bow	
Vocal - Question	Vocal -Chirp	Ventral Station Swim to Photographer	Vertical Float +Spit	Ventral Float at the Bottom + Rise to Surface	
Hit Photographer with Tail					

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Bill across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(61, N = 196) = 297.47, p < .001$. There were 31 behaviors across sessions that were performed only one time and significantly below chance, and three behaviors that were performed more than 10 times, which was significantly above chance. Table 5 summarizes these behaviors.

Table 5

Original and Preferred Behaviors Exhibited by Bill Across All Sessions

	Original Behaviors		Preferred Behaviors
Back dive	Tail Up	Chin Slap	Left Turn
Bubble Ring	Turn	Tail Lob x2	Tail Lob
Surface Ventral Speed	Ventral Target	Stationary Tail	Right Pec
Run	Photographer	Walk	Wave
Exhale	Vocal - Whisper	UW Back Up	
Head Stand	Right Pec Display	UW Barrel Roll	
Horizontal Sink	Ventral Layout	Bubble Stream	
Left Dorsal Swim	UW Stationary	Fake Pop-up, Sink	
Swim Left	Vertical Sink	Spit Left	
Surface Bubbles	Jaw Pop	Three Bubbles	
Circle Photographer	Layback	Vocal - Chirp	
Vocal - Question			

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Champ across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(54, N = 227) = 614.96, p < .001$. There were 24 behaviors across sessions that were performed only one time and significantly below chance, and five behaviors that were performed more than 10 times, which was significantly above chance. Table 6 summarizes these behaviors.

Table 6
Original and Preferred Behaviors Exhibited by Champ Across All Sessions

Original Behaviors			Preferred Behaviors
Dorsal Swim	Vertical Sink	Turn Around Slowly	Bubbles
Head Down	Vocal- Whistle	Dorsal Layout + Spit	Partial Hula
Breath	Swim Around	Takeoff Bow	Left Turn
Roll Over	Vocal Peep	Stationary Vertical	Open Mouth
Burp	Submerge	Float	
		Head Down to the Trainer	Vocal
Vocal- Foghorn	Vocal Jetsons	UW Pec Wave	
Surface	Move Forward	Dorsal Speed Run to Beach on Platform	
Ventral	+ Mouth		
Speed Run	Closed		
Ventral	Horizontal	Horizontal Float at Surface + Trying to Catch Fish	
Float	Submerge		

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Mr. French across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(55, N = 170) = 324.12, p < .001$. There were 33 behaviors across sessions that were performed only one time and significantly below chance, and five behaviors that were performed more than 10 times, which was significantly above chance. Table 7 summarizes these behaviors.

Table 7
*Original and Preferred Behaviors Exhibited by Mr. French
 Across All Sessions*

	Original Behaviors		Preferred Behaviors
Head Down	Head Back	Right Vertical Sink	Back Up
Left Turn	Ventral Roll	Stationary Sink	Sink
UW Play Dead	UW Open	Swim Like a Shark	Vertical Sink
UW Pec Wave	Mouth Breath	Hula x2	Vocal - Foghorn
Ventral Layback	Barrel Roll Right	UW Orient with Right Eye	UW Layback
Vocal	Diagonal Sink	Barrel Roll – Variation	
Vocal – Whistle	Ventral Circle Swim	UW Horizontal Float	
Vocal – Scream – Variation	Turn Left + Look with Right Eye	Ventral Float at Bottom & Rise to Surface	

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Han Solo across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(65, N = 199) = 250.40, p < .001$. There were 34 behaviors across sessions that were performed only one time and significantly below chance, and five behaviors that were performed more than 10 times, which was significantly above chance. Table 8 summarizes these behaviors.

Table 8
Original and Preferred Behaviors Exhibited by Han Solo Across All Sessions

Original Behaviors			Preferred Behaviors
Bubble Stream	Layback	Left Rollover + Bubbles	Bubbles
Right Lay Horizontal Layout	Right Pec Display Burp	Sink into Tail Walk Turn Left + Come Back	Left Turn Tail Lob
Lateral Layout	Bite Seagrass	Turn Left + Swim Around	Target Camera
Roll over	UW Left Swim	UW Back Up	Spit
Tail Up	Bubble Burst	UW Backwards Tail Walk	
UW Ventral Swim	Left Lateral Layout	Vertical Curved Sink	
Vocal – Scream	Left Roll Over	Vertical Float + Spit	
Horizontal Submerge	Vertical Sink + Open Mouth	Vocal (Response to Mr. French’s Vocal)	
Lateral Roll + Open Mouth	Horizontal Float at Surface	Vocal – Scream – Variation	
Head Down to Trainer	Left Lay + Come Back	Vertical Sink + Bubbles	

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Maury across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(62, N = 261) = 319.52, p < .001$. There were 25 behaviors across sessions that were performed only one time and significantly below chance, and eight behaviors that were performed more than 10 times, which was significantly above chance. Table 9 summarizes these behaviors.

Table 9

Original and Preferred Behaviors Exhibited by Maury Across All Sessions

	Original Behaviors		Preferred Behaviors
UW Play Dead	Back Bend	Vocal – Raspberry	Back Up
Spiral Swim	Vocal- Squeal	Starting Back Dive	Bubbles
Takeoff Bow	Breath	Surface	Sink
UW Circle	Bigger Open Mouth	Vertical Flip	Tail Lob
Vocal	Circle Swim	UW Barrel Roll + Bubbles	Ventral Layback
UW Head Stand	Faster Back Up	UW Open Mouth	Vertical Sink
UW Ventral	Vocal- Whistle	UW Whistle Stream	Vocal
Speed Run	– Variation		Whisper
Backwards Tail	Horizontal	UW Barrel Roll +	Hula
Walk into a Bow	Submerge	Open Mouth	
Beginning of Backwards Tail Walk			

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Poli across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(43, N = 199) = 322.15, p < .001$. There were 17 behaviors across sessions that were performed only one time and significantly below chance, and five behaviors that were performed more than 10 times, which was significantly above chance. Table 10 summarizes these behaviors.

Table 10

Original and Preferred Behaviors Exhibited by Poli Across All Sessions

Original Behaviors		Preferred Behaviors
Exhale	Backwards Hula	Submerge
Vocal – Whisper	Come Up	Right Pec Display
Vocal – Whistle	Turn	UW Hula + Open Mouth
Head Nod	Ventral Roll	Head Up + Open Mouth
Swim Around	Layback + Open Mouth	Vertical Sink + Open Mouth
UW Footage	Mouth	Mouth
Head Back + Open Mouth	Layback + Vocal + Left Pec Wave + Layback + Vocal + Left Pec Wave	Left Turn
		Open Mouth
		Head Back
		Hula
		Jaw Pop

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Ritchie across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(47, N = 165) = 173.91, p < .001$. There were 20 behaviors across sessions that were performed only one time and significantly below chance, and six behaviors that were performed more than 10 times, which was significantly above chance. Table 11 summarizes these behaviors.

Table 11

Original and Preferred Behaviors Exhibited by Ritchie Across All Sessions

Original Behaviors			Preferred Behaviors
Backwards Tail Walk	Blowhole Water Squirt	Left Lateral Layout	Left Turn
Exhale Tail Up	Ventral Layback Breath	Right Pec Display Tail Lob x3	Back Up Open Mouth
Tail Walk	Burp	Tail Presentation	Sink
UW Circle	Head Nod	Tail Slap	Vocal - Whistle
UW Ventral Swim	Horizontal Ventral Layout	UW Stationary	Ventral Tail Lob
Back Up + Tail Presentation	Hit Photographer with Tail		

A chi square goodness of fit test was performed to examine the distribution of preferred and original behaviors for Ronnie across all sessions (H2b, O₁). The results indicated that the distribution significantly deviated from the expected distribution, $\chi^2(74, N = 182) = 282.84, p < .001$. There were 37 behaviors across sessions that were performed only one time and significantly below chance, and two behaviors that were performed more than 10 times, which was significantly above chance. Table 12 summarizes these behaviors.

Table 12

Original and Preferred Behaviors Exhibited by Ronnie Across All Sessions

	Original Behaviors		Preferred Behaviors
Back Dive	Lateral Roll	Slow Somersault	Bubbles
Backwards Bow	Lateral Swim	Spiral Swim	Left Pec Display
Barrel Roll	Left Dorsal Swim	Somersault	
Barrel Roll x2	Left Pec Display	Surface Bubbles	
Big Bubble Burst	Swim Left	Tail Walk	
Bubble Stream	Little Bubbles	Takeoff Bow	
UW Head Stand	Look at Trainer	Target Camera	
Exhale	Open Mouth	UW Circle	
Flip over to ventral	Pec and Tail Wave	Ventral Float	
Partial Hula	Right Lateral Roll	UW Pec Wave	
Vocal – Scream	Roll Over	UW Roll Over	
Horizontal Layout	Left Roll Over	Vertical Sink	
Lateral Layback	Sink	UW Tail Lob	
Vocal – Whisper	Head Down to the Trainer	Vocal – Squeal	
Dorsal Line up with Photographer	Ventral Target Photographer	Ventral Swim into Bow	
Blowhole Water Squirt	Ventral Station Swim to Photographer		

Discussion

Creativity has many specific definitions. Interestingly, all definitions imply the same basic criteria: creativity must be useful, novel, fluent, and problem-solving. For the current study, we examined the creative behaviors of dolphins under stimulus control. The previous studies on innovative behavior by dolphins under stimulus control presented data on frequency of responses, originality of responses, elaboration, and some flexibility

although these researchers did not specifically identify these constructs (Braslau-Schneck, 1994; Herman, 2006; Kuczaj & Eskelinen, 2014a; Lawrence et al., 2016; Mercado et al., 1998; Pryor, 1975; Pryor & Chase, 2014; Pryor et al., 1969). To standardize measurement for creativity across future comparative studies of creativity, several definitions were created and assessed for two of the constructs: fluency and originality.

Fluency

In the current study, fluency was examined with three different definitions. The first definition, a percentage of rewarded novel behaviors, allowed the assessment of how many novel behaviors were offered across the study in proportion to amount of overall behaviors. The second definition, number of novel behaviors presented before repetition, allowed the measurement of the animals' ability to produce correct responses before erring at the task. Finally, the last definition, allowed for the measurement of the overall performance of new behaviors across trials within each session.

Kuczaj and Eskelinen (2014a) measured frequency of varied behavior without repetition (i.e., comparable to F_1) and the number of components (e.g., aerial plus fluke action, elaboration) present in each behavior performed. Given that the three dolphins in the study conducted by Kuczaj and Eskelinen were above 90% accurate in their responses, it was clear their animals were fluent in their creativity when under stimulus control. The eight dolphins in the current study were rewarded, on average, for 52-72% of their novel (i.e., different from other behaviors in the session) behaviors. Although the dolphins increased their success during test sessions, their performance did drop across the last two sessions. It is possible that the dolphins may have experienced session fatigue or motivation issues. The testing protocol called for five continuous days of testing with increasing numbers of test trials per session and a smaller reinforcement to behavior ratio. The dolphins may have experienced ratio strain in the last two sessions. The second measure for creativity in Kuczaj and Eskelinen's study aimed to measure components used for construction of behaviors. The current study did not allow

constructed behaviors as a reinforced action; only single behaviors were accepted. Perhaps, future directions for this research would include constructed or combination behaviors as innovative.

We also examined a fluency definition in which the number of trials from the beginning of a session were counted until the dolphins started repeating behaviors. On average, the dolphins performed three to seven behaviors across sessions before repeating behaviors. This measure also resulted in decreased performance the last two sessions. A review of the data suggested that there were two patterns of responses on this measure. Half of the animals (Bill, Champ, Han Solo, and Poli) showed increased numbers of new behaviors displayed across trials through session three where it dropped for session four but then increased in the last session. The other half of the animals continued to increase through session four and dropped in session five. These dropped performances may be related to stretching the reinforcement as sessions got longer. Future research should examine the validity of this measure as it is the first time to be employed.

Despite the variations described above, fluency remained stable across the sessions. The dolphins' performance suggested that they had learned the innovate concept, but perhaps not all dolphins had mastered the concept. This explanation is partially supported by the third definition of fluency (F_3) in which all behaviors were examined regardless of reinforcement or whether the responses were composed of more than one behavior (i.e., chain). On average, animals were presenting 19-20 different behaviors per trial. Unlike the analysis for reinforced responses only (F_1), when all behaviors exhibited by the animals were considered, their fluency did not drop off as dramatically. The observed pattern of responses may have been related to the types of behaviors produced after not receiving reinforcement multiple trials in a row. The dolphins may have produced more complex combinations and chains in response to the lack of rewards as a strategy to elicit a reward.

Another possible explanation for the relatively lower fluency scores as compared to Kuczaj and Eskelinen (2014a) was the level of experience with the task. Several animals had less than a year of experience while others had more than five years of experience with the innovate discriminative stimulus. However, some of the dolphins had also received training intermittently compared to other dolphins that had been trained consistently. These variations in training may have impacted the fluency scores of this sample. Additionally, too many sessions in a row, even on different days, could have limited their performance as the dolphins had not rehearsed the testing protocol nor received training frequently prior to testing. Session fatigue during a session, especially in the longer sessions, may have limited the dolphins' motivation and overall performance.

Originality

Originality was interpreted as behaviors that occurred once across the study (O_1) and behaviors that occurred once across all sessions per animal (O_2). These definitions are similar to Pryor et al.'s (1969) definition of originality – behaviors that were not part of the animal's repertoire and were not shaped. However, for this study we only assessed if the behavior was novel within the context of the study and did not consider if displayed behaviors were part of the animal's repertoire or not. We first examined the dolphins' preferred behaviors at a group level, which we defined as occurring more than 70 times across the study, and then at an individual level, which we defined as occurring more than 10 times across session per animal.

A total of 89 out of 217 behaviors were categorized as original in this study. Some of the novel behaviors recorded aligned with those presented by the porpoise in Pryor et al.'s (1969) study. For example, "hula x2", which is an inverted swimming position with the right side up then repeated, is the same as "corkscrew". Variations of "tail walks", "jaw claps", and "tail waves" were also shared by animals across the 1969 study and the current study. Kuczaj and Eskelinen (2014a) did not specifically report on original behaviors in their study.

Individually, these animals performed an average of 28 original behaviors. The lowest performer was Poli with 17 original behaviors and five preferred behaviors. It is likely that this low number of original behaviors was related to her inexperience with the discriminative stimulus. As one of the youngest subjects with about a year of experience with the concept, Poli likely did not have mastery of the concept. In contrast, Ronnie, an older and more experienced animal, had the highest performance of original behaviors with 37 original behaviors and only two preferred behaviors. This performance aligns with the second half of test sessions by Hou, the female porpoise, tested by Pryor and her colleagues (1969). Once Hou understood the constraints of the discriminative stimulus, she performed a number of truly novel (i.e., never-seen-before) behaviors and eventually no other familiar behaviors within a session.

Overall, this study found that a sample of eight bottlenose dolphins from RIMS showed limited originality and limited fluency under stimulus control while assessing performance of novel behaviors. Norris (2002) stated that dolphins modify learned behavior, inventing new behaviors to create more complex play patterns. Play is common in dolphins of all ages (e.g., Greene, Melillo-Sweeting, & Dudzinski, 2011; Kuczaj & Eskelinen, 2014b), suggesting that it is intrinsically motivated. Moreover, dolphin play includes a number of different behaviors and may or may not include objects. For example, mutual play between dolphins (two or more animals interacting in a social play or object play interaction), supports the notion that dolphins are aware of their environment and current social structure (i.e., humans and other dolphins). Additional evidence of this awareness is reflected in behaviors that are influenced by conspecifics, including synchronized breathing, contagious play behavior, and foraging actions (Allen et al., 2011; Fellner, Bauer, & Harley, 2006; Kuczaj & Eskelinen, 2014b; Smolker et al., 1997).

Creativity may be another component of expressing welfare that needs to be examined. Degree of creativity may alter

levels of play behavior, allowing populations to be more cognitively engaged with their environment. While it is clear that dolphins can be spontaneously creative, does the frequency and nature of creativity matter in measuring their well-being? In a controlled environment, could instrumental learning impact the intrinsic motivation for creativity, namely increase it because animals will practice behaviors they are learning? If increasing creativity through stimulus control occurs, will creativity then decrease if rewards are removed? These are some questions that future research should begin investigating with more specific outcomes in mind. For example, one could focal sample play behavior of subjects following contingency learning sessions of creativity. This strategy may allow us to observe the impacts of learning on intrinsic motivation to produce novel behaviors while also examining spontaneous behavioral indications of well-being.

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Appendix A
Behaviors Produced Throughout the Study

Back Dive	UW Stationary	Somersault
Pop-up	Ventral Tail lob	Spiral x2
Slow Hula	Barrel Roll x2	Left Rollover
Submerge	Sink	Vocal - Jetsons
Sink + Mouth Open	Feces	Vocal - Whistle
Tail Presentation	Back Bend	Come Up
Diagonal Sink	Turn Around	Hula
Back Up - Faster	Swim Left	Bubble Stream
Back up	Pec Display	Surface Bubbles
Tail Up	Dorsal Layout	Head Stand
Tail Lob x3	Bow	Bow x2
Right Lay	Speed Run	Bubble Burst
Partial Layback	Head Nod	Vocal - Foghorn
Left Pec Display	Backwards Bow	Ventral Layout
Exhale	Lateral Layout	Bite Seagrass
Slow Somersault	Lateral Roll	Ventral Float
Backwards Bow	UW roll Over	Tail Lob
Right Turn	Left Pec Wave	Horizontal Sink
Breath	Lateral Layback	Chin Slap
Half Bow	UW Pec Wave	Vocal - Clicks
UW Left Swim	Backwards Hula	Vocal
UW Open Mouth	Tail Lob x2	UW Barrel Roll
Hula x2	Spit Left	Lateral Swim
Big Bubble Burst	Jaw Pop	Dorsal Swim
Head Down	Surface	Swim Right
Roll Over	Vocal - Question	Right Pec Wave
Tail Walk	Bubbles	Circle Swim
Ventral Roll	Spiral Swim	UW Jaw Pop
Turn	Roll Over x2	Vertical Sink
Left Pec Flare	Swim like shark	UW Layback
Target Camera	Vocal -Peep	Head Back
Vocal - Scream	Sink + Spit	Horizontal Layout
Barrel Roll	Layback	Right Lateral Roll
Left Roll Over	Stationary Sink	Vocal - Raspberry
Ventral Circle Swim	UW Head Stand	One Slow Bubble
Double Pec Wave	Bubble Ring	Vocal - Cockatoo
UW Play Dead	Sink Vertical Left	Right Vertical Sink
	UW Circle	Dorsal Tail Lob

Left Dorsal Swim	Move Forward + Mouth Closed
Left Lateral Layout	Turn Left + Swim Around
Backwards Tail Walk	Stationary Vertical Float
Partial UW Tail Lob	Vocal - Scream-Variation
Bigger Open Mouth	Hit Photographer with Tail
Vocal - Whistle - Variation	Starting Back Dive
Flip Over to Ventral	Brought Trainer Grass
Ventral Target Photographer	Turn Left + Open Mouth
Left Forward Tail Walk	UW Barrel Roll + Open Mouth
UW Horizontal Float	Submerged Bubbles
Partial Hula + Open Mouth	Stationary Tail Walk
Barrel Roll into Bow	Surface Ventral Speed Run
UW Hula + Open Mouth	Spit at Photographer
Horizontal Ventral Layout	Fake Pop-up / Sink
Swim Around UW Footage	Left Lay + Come Back
Barrel Roll - Variation	UW ventral Speed Run
Head Up + Open Mouth	UW Barrel Roll + Bubbles
Partial Hula	Turn Left + Come back
Takeoff Bow	Open Mouth
Tail Slap	Vocal - Whisper
Look at Trainer	Right Pec up
Left Turn	Vertical Spit
Vertical Flip	Grab Seagrass
Vocal - Squeal	Little Bubbles
Vocal - Chirp	Barrel Roll Right
Vertical Curved Sink	Spit
Vertical Barrel Roll	Pec & Tail Wave
Turn Around Slowly	Bubble Blast
Vertical Sink + Open Mouth	UW tail lob
Vertical Sink + Bubbles	Ventral Layback
UW Orient with Right Eye	Three Bubbles
Left Rollover + Bubbles	UW Back Up
Backwards Tail Walk into Bow	Slow Turn Left
Head Down to the Trainer	Pushing Photographer
Left Horizontal Layout	Horizontal Float at Surface
Spiral Swim into Bow	Turn Left + Look with Right Eye
Sink + Open Mouth	Ventral Swim into Bow
Back up + Tail Presentation	Head Back + Open Mouth
	UW Ventral Float + Rise
	Dorsal Layout + Spit
	Backwards Tail Lob
	Pop-Up + Tail Walk
	Layback + Open Mouth

Vertical Float + Spit
Vocal - Foghorn - Variation
Lateral Roll + Open Mouth
UW Ventral Float + Mouth Open
Sink into Tail Walk
Circle Photographer
UW Whistle Stream
Ventral Station Swim to photographer
Beginning of Backwards Tail Walk
Dorsal Speed Run to Beach on Platform
Dorsal Line-Up with Photographer
UW Ventral Up Circle in Opposite Direction
Horizontal Float at Surface + Trying to Catch Fish
Vocal (Responding to Mr. French's Scream)
Horizontal Submerge
Layback + Vocal + Left Pec
Wave + Layback + Vocal + Left Pec Wave
UW Ventral Swim
Right Pec Display
Ventral Left Swim
Burp
Swim Around
Blowhole Water Squirt

Teaching CREMA: The Essential Elements of Culturally- responsive Evaluator Education

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Significant attention has been paid to the need for culturally-responsive evaluation, measurement, and assessment (CREMA) as a means of protecting people against the collateral damage of measurement and its various uses (Yancey, 2017). The risk of unintentional harm is especially profound when the evaluand is a non-profit organization, since the likelihood that the key stakeholders will be part of a traditionally marginalized population is elevated.

In response to these concerns, the field of evaluation has produced templates and guidelines to ensure that evaluators are ethically meeting their client's needs while promoting social justice outcomes. When evaluating a community-based program, it is necessary to disaggregate factors like gender, socioeconomic status, and race/ethnicity in order to avoid losing sight of critical factors that may be affecting the evaluand.

Although the field has recognized the importance of cultural-responsiveness, relatively little is known about how to adequately train evaluators to carry out CREMA. In order to fill this gap, educators must consider the content knowledge and dispositional characteristics necessary for evaluators to carry out CREMA objectives. In this paper, I present a basic curriculum that could reasonably be expected to produce evaluators that have the requisite knowledge and philosophical orientation to

conduct culturally-responsive evaluation, measurement, and assessment.

Teaching CREMA: The Essential Elements of Culturally-responsive Evaluator Education

Ethical program evaluation requires a careful consideration of the cultural context in which a program is situated (Frierson, Hood, & Hughes, 2002). Hence, culturally-responsive evaluation, or CRE, ensures the validity of results by intentionally accounting for the ways in which culture influences organizational performance and human behavior.¹ In 2011, the American Evaluation Association (AEA) released a public statement discussing the significance and expectations regarding this issue. Their statement made clear that the rich cultural diversity within the United States required evaluators to deliberately consider the culture(s) of the community in which a targeted program is located (American Evaluation Association, 2011). This means that evaluations must go beyond simple “counting” methods of evaluation where the evaluator enumerates the demographics of service recipients. Rather, valid representations accurately document the sociopolitical context within which organizations and their programs exist. A truly culturally-responsive approach goes even further by involving stakeholders throughout the evaluation process. Funders, program staff, and service recipients are integrated into the evaluation process from beginning to end; they engage in the question asking, data collection, data interpretation, and response phases of the evaluation. CREMA also takes into consideration the consequences of data collection on the stakeholders, particularly the disenfranchised stakeholders who have the least sociopolitical power.

¹ To account for the different aspects of a successfully responsive evaluation, I have chosen to incorporate measurement and assessment into the acronym, and throughout the paper, will refer to it as culturally responsive evaluation, measurement, and assessment (CREMA).

Key characteristics of CREMA

Validity is the single most important factor in evaluation. Therefore, evaluators are beholden to validity above all other considerations. Any approach, method, or philosophical orientation must ultimately be judged by the extent to which it adds or subtracts to the overall validity of the results.

A misunderstanding or lack of consideration of culture threatens validity by introducing systematic error. CREMA improves validity by accounting for unexplained variance in outcomes, particularly by identifying contingency factors that correlate with social group membership. On the other hand, cultural responsiveness minimizes error by working against cultural biases and stereotypes. CREMA forces the evaluator to take ownership of their own identity, including social group memberships, formal training, and evaluation perspective. In order to successfully evaluate an organization that is composed of individuals from marginalized groups, the evaluator must “check their privilege” and consider their own social standing and how it can assist or be detrimental for the evaluation. Simply put, cultural responsiveness is essential because it improves evaluation in the direction of validity.

There are a limited number of frameworks for culturally-responsive evaluation in the literature. For example, Frierson, Hood, and Hughes (2002) contributed a chapter outlining the need for culturally-responsive evaluations to the National Science Foundation (NSF). In that chapter, they made the argument that evaluators, tests, and laws cannot be culture-free because all individuals are inherently driven by their culture and values. They argued that evaluators must therefore assess cultural predilections that exist within measurement instruments and procedures to successfully limit influences that may be detrimental to the validity of the evaluation.

Another example is Nastasi, Moore, and Varjas (2004) who developed an interdisciplinary model known as the Participatory Culture-Specific Intervention Model (PCSIM). The PCSIM includes enhances problem identification and analysis by

focusing attention on cultural aspects of the processes. The PCSIM is also recursive as the aspects of the evaluation shift over time, which makes it even more likely to be responsive by nature. The PCSIM has been used successfully in assessing psychological well-being in an urban setting by Bell, Summerville, Nastasi, Patterson, and Earnshaw (2015).

Educating for CREMA

Despite the obvious need for evaluators to carry out this work, relatively little attention has been paid to what a formal education program in evaluation, measurement, and assessment should look like if it is to yield evaluators capable of producing culturally-responsive reports. A statement released by the American Evaluation Association (2011) discussed the essential practices for cultural competence in evaluation: acknowledging how complex cultural identity can be, recognizing the dynamics of power, eliminating biased language, and ensuring that culturally appropriate methods are being employed.

Symonette, Mertens, and Hopson (2014) reviewed how the AEA has attempted to address the need for CREMA education through the Graduate Education Diversity Internship (GEDI) program, which aims to expand the number of students from under-represented groups in the field of evaluation and increase the number of individuals able to work in diverse settings. The GEDI had vast implications for the AEA, representing a shift in the way the association viewed evaluation. However, they believe there are still more ways that CREMA could be used: to address diversity in a more conscious manner. Among these are the inclusion of stakeholders in the process of evaluation and an appreciation of the various levels involved in evaluation.

The GEDI ensured that interns would emerge transformed; they would not become bystanders to practices that were not contextual and cultural in nature, and would always find a way to make a difference. The GEDI cohorts were not just conscious evaluators in a general sense; they were more aware of the various discrepancies that occur due to issues of diversity. Unfortunately, although the GEDI program has aided the field of evaluation in creating a group of individuals that are culturally

responsive and competent, as of 2014 it had produced only 10 cohorts and fewer than 65 participants.

While this is a good starting point, the AEA has not provided a framework for how to ensure that cultural-relevance is, in fact, being instilled in the education of future evaluators. For starters, evaluators need to be aware of the differences between and within cultures/subcultures or the evaluation may not accurately represent the populations and programs being studied. In reference to power dynamics, a competent and responsive evaluator avoids perpetuating stereotypes and generalizations about groups, and instead recognizes diversity as well as the experience of marginalization that may be experienced by the evaluand. Evaluators must consider the cultural context of measurements that they may use for data collection and analysis, as these tools may be culturally biased and may not be applicable within the context of the evaluation. Evaluators must instead determine different approaches that take the multiple perspectives of the stakeholders into consideration.

Knowledge and Values Common to Culturally-Responsive Evaluators

Non-neutrality

Consistent with contemporary theories of racism, culturally-responsive evaluators must reject the idea of color-blindness. Evaluators cannot fall prey to the false narrative that programs occur solely in power-neutral contexts. Racism and other power-serving ideologies justify the unequal distribution of power and resources while ensuring that the oppressed are kept from organizing against the group in power (Omi & Winant, 2015).

Perhaps most importantly, evaluators should be fully aware of the ascribed power afforded to faculty and universities, and should use that power in a positive manner in order to promote the interests of members of the community. If the evaluator is not careful, they might end up increasing the gap that is already in place. If the evaluation fails to empower marginalized and disempowered members of a community or

organization, their position in the social strata falls further, adding to the problem (Hall, 2016).

Power Awareness

Valenzuela (1999) described how teachers that exhibited power-aware authentic caring were ethical deliverers of curriculum within a schooling system that functions to sort students by class and race. She further argued that schools subtract resources from young students in two major ways: by dismissing their idea of education and by minimizing their individual culture and language through assimilationist policies. Through her work, educators have become more aware of the need to recognize and act in response to power dynamics rather than having power covertly affect how their teaching affects students.

The concept of being power-aware could be applied to culturally-responsive evaluators as well. Evaluators must be able to recognize power dynamics, particularly as they relate to the ways in which community members have their needs identified, the inherent values underlying service provision, and the methods used to collect, analyze, and report findings. A failure to recognize and respond to power dynamics necessarily influences the validity of the evaluation, which as I mentioned before, is the single most important criterion by which evaluations should be judged.

Understanding of the history of testing

The tools and methods currently being used to assess individuals are the product of a long evolution of testing that originated with a desire to rationalize the superiority of Whites. Army Alpha and Beta testing, for example, was ostensibly a method of evaluating soldiers during World War I so that soldiers of exceptional ability could have important positions. However, it also functioned to justify not promoting non-white citizens and illiterate immigrants (Murphy, 2007). Likewise, the Stanford-Binet allowed for the rapid classification of people by a speciously defined “intelligence,” and in effect, justified the stratification of people by class and race (Atkins, 2012).

In contemporary times, accrediting bodies have used program evaluation and student assessment as a means to attack progressive teaching in colleges and universities (Harclerod, 1980). While other means of data collection exist, they are not afforded the same status as empirically-based methods. Moreover, defining student development only in terms of quantifiable bits of knowledge has been a subtle attack on the authentic goals and objectives put forth by humanities faculty.

Alternative means of evaluating programmatic success certainly exist; they have just been suppressed by neo-liberal and conservative interests. For example, color-blind racism and critical race theory privilege storytelling and qualitative forms of measurement. While color-blind racism can be quantitatively measured using the Color-Blind Racial Attitudes Scale (Neville, Lilly, Duran, Lee, & Browne, 2000), Bonilla-Silva (2003) has argued that the qualitative ways in which color-blind racism can be identified contextually, such as when observing microaggressions, are of more importance. The same could be applied to critical race theory, which has also been studied by measuring the number of racial microaggressions toward people of color (Solórzano, 2000).

Validity

Ultimately, evaluators are tasked with creating a model of reality. Effective models mirror reality as closely as possible. Culturally-responsive evaluation, measurement, and assessment are not about advocating for marginalized populations as much as they are about the accurate modeling of reality, which includes achieving the highest level of validity possible. The methods used to assess and evaluate the organization/community can be organically derived from the population being assessed, or can be derived from the standardized instruments that are already in existence. The only thing that is truly critical is that the instruments accurately model reality.

Valid evaluations also account for the context within which data are collected, as well as the motivations of the members of the community. Assuming that participants are going

to answer similarly regardless of context fails to appreciate role diversity, power dynamics, and the effect that the evaluator has on responses. Evaluators must be able to detect the magnitude and direction of these factors if they are going to model reality as closely as possible.

Questioning stakeholders' understanding of reality

Well-intentioned evaluators may believe that they are operating in a culturally-responsive manner when they do the bidding of community members. Their error may come from a more general belief that the less academic and more slavish they appear in terms of their own behavior, the more culturally-responsive they will be. Clearly, this is not the case, and it is neither productive nor consistent with culturally-responsive methodologies to mindlessly do whatever stakeholders tell you to do, or to merely regurgitate stakeholders' views of their programs, even if the stakeholders are marginalized by society. Rather than doing the bidding of the community members, an evaluator must be able to situate the ideas and concerns of the community members' social, cultural, and ideological contexts within which they exist.

To be clear, the evaluator should actively seek to construct a model of reality based on stakeholder input. They should just avoid incorporating their input wholesale. Community members, like the rest of us, are victims of formal education and the mass media, influences that largely dictate the parameters within which thinking occurs. If they have been guided toward a neo-liberal way of understanding their plight, they are unlikely to perceive structural causes of social stratification, and even less likely to express them in a coherent manner.

Marx's conceptualization of "false consciousness" may be helpful in understanding this point. False consciousness refers to the systematic representation of the social relations of the power group in the consciousness of the groups that are oppressed and not in power, further perpetuating their exploitation. It is common for community members to believe that their interests align with the interests of capital because they have been taught

that this is so and that rewards and punishments have been doled out on the basis of how well they parrot these ideas.

Consequently, more than few of the oppressed brashly espouse the language and worldview fed to them by the oppressor, either because they have been convinced that their version of reality is correct or because they have been ideologically beaten into submission and are afraid of espousing a counter-narrative.

Diverse and representative input

In line with awareness of power, effective evaluators must not allow for a small, highly vocal group of stakeholders to influence the representation of the evaluand. Just as power dynamics exist at the broader macro level, they can also exist between organizations and the community, within organizations, and within the community. If the evaluator only takes certain groups into consideration when completing their measurements, assessments, and ultimately, their evaluation, then their evaluation runs the risk of not being truly culturally-responsive. The needs and considerations of the entire organization/community must be considered when engaging in CREMA.

The evaluator as instrument

Evaluators are instruments. As such, they must think about how their unique social identities and perspective influence the process of evaluation and assessment. The matching hypothesis whereby the best evaluators are thought to have come from the organizations and/or communities they are evaluating, lacks empirical and theoretical substance. Much like the position multicultural counselor education has taken, good evaluators are marked by their knowledge and skills, including, but not limited to, their culturally-responsive perspective rather than genetic lineage or residential and/or employment history. An evaluator can come from a completely different background, but because they are aware of their social identities and how those identities can affect the process of evaluation and assessment, they are more able to work against biases and influences.

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CREMA and capitalism

Culturally-responsive evaluators must understand that the work they do is likely to be under-appreciated and under-compensated, especially if they are a faculty member at a university. Tenure review committees are less likely to be impressed with the products of culturally-responsive evaluation and assessment than with peer-reviewed manuscripts. Evaluators can work against these problems at their home institutions if they are faculty, but they cannot compromise the quality of their work out of frustration with the compensation schedule.

On a related note, the relationship between capitalism and culturally-responsive evaluators must be explored as well. Evaluators entering the profession or making professional decisions based on profit incentive bring a value orientation to the work they do that could be inherently opposed to what they are trying to accomplish. At the very least, evaluators must take stock of their individual political and economic beliefs to better understand how their ideologies affect the work they do.

Educating CREMA Evaluators

Guiding principles of CREMA

CREMA practica should not be classified as service-learning. In service-learning courses, students with little to no knowledge embark upon sightseeing tours of communities with the hopes of becoming less prejudiced and more aware of worldly issues. Students engaging in a CREMA practicum, on the other hand, should already be sufficiently competent in the practice of assessment and evaluation, and should be able to produce valid reports on their respective organizations and communities.

CREMA practicum students should also have an understanding and be able to apply the notions of “compulsory” and “authentic” stakeholders. That is, they should be able to distinguish between stakeholders that are stakeholders only because they contribute resources that allow the program to exist and stakeholders who are targeted for the services provided. Typically, the overwhelming concern among organizational staff is keeping funders happy without considering that the funding

would be unneeded if there were no community members to receive the services.

Additionally, CREMA education should emphasize the process of self-discovery much like counselor educators facilitate. In particular, evaluators should be discouraged from entering the profession of evaluation as a martyr or in order to help the less fortunate to become more assimilated. CREMA practicum students should consider how different organizations can be associated with their individualized values and whether those associations could possibly influence whether they were “rooting for” or “rooting against” the data.

Furthermore, it should be recognized how paradigms guide the questions that are asked, the methods used, and the conclusions drawn. In a particularly powerful work, Blea (1988) made the distinction between the “sociology of Chicanos” and the “sociology for Chicanos.” Her main thesis was that seeing Chicanos through a dominant lens necessarily impacted the study of individual and collective behavior. By enacting a Chicano perspective, researchers would be able to achieve much more genuine data and settle on more accurate conclusions.

Of course, her work returns us to the concern about whether evaluators need to be a member of the organization or community they are evaluating. While at some level, Blea’s distinction may appear to suggest that one needs to be Chicano in order to contribute to the current literature on Chicanos, another view could be that any researcher could contribute to Chicano research so long as the researcher in question operated within a framework that reflected and encompassed the Chicano worldview. The same line of reasoning could be applied to CREMA training; valid evaluations capture the perspective of otherwise ignored stakeholders regardless of the identity of the evaluator.

Finally, evaluators should hold organizational staff accountable to the idea that ethical organizations exist to serve the needs of communities rather than to ensure that the staff remains employed. The staff should not just passively acknowledge that

culture is contextually important, but should be actively responsive and willing to work. Not considering or prioritizing the needs of the community, or using the existing, non-culturally-responsive methodologies of program evaluation will never bring about change that benefits the disenfranchised. In a related piece, Lourde (1979) discusses the need for feminist scholars to recognize their own discriminatory practices in analyzing intersectional hierarchies; the same practice must be applied to the field of evaluation. The master's tools (non-contextualized methods) will never dismantle the master's house (disparities in social stratification).

Curriculum and Experiences

Based on the knowledge and values indicative of a culturally-responsive evaluator, the following courses are recommended for CREMA courses. Additional coursework in specialized areas would obviously provide value-added; however, these courses would comprise the core elements of an ethical training program.

Social identity and social power

In order for students to make the most of their classes, they need to have already developed a perceptual lens that will enable them to appropriately contextualize the incoming information. The students must acquire a sense of their social identity, and be versed in the structural causes of social stratification.

Research design

Students must understand basic research design, including their strengths and limitations. Students must also be aware of which situations they would work most successfully and appropriately.

Statistics

Students must have an understanding that qualitative and quantitative research approaches are both concerned with explaining variance. As evaluators, students will need to practice statistics in a way that appreciates both mediators and moderators as they relate to social identities.

Instrument Development

Students need to know the history of instrument development in order to appreciate the motivations behind measurements and how norms have been developed. Students must also understand the notions of consequential and ecological validity and how they both relate to their work as evaluators.

Practicum

To become successful evaluators, students must accrue ethically defensible experiences that meaningfully contribute to the well-being of community members and the organizations that serve them. The practicum course should serve as an opportunity to coalesce the student's course knowledge into a working perspective.

Recommendations and Remaining Questions

The integration of cultural-responsiveness versus aseparate course

In this case, arguments can be made for either approach. With respect to integrating information across the coursework, students are likely to achieve more of an understanding that cultural-relevance and responsiveness is not a box that can be checked while en route to credentialing. Each course would emanate from the perspective of cultural-relevance and responsiveness, including statistics and research methods courses.

On the other hand, having a course on cultural-responsiveness would call to attention the importance of a culturally-responsive perspective, which allows for the distilling of information into a powerful dose, arguably making more of an impact on the student. Having a separate course would also decrease the number of faculty who need to be well-versed in culturally-responsive evaluation and assessment, which could resolve a common practical issue for department chairs and program directors. Of course, the ideal situation would be to have both a separate course about cultural-responsiveness as well as the integration of that same topic into the rest of the curriculum.

Course order

The order in which the courses are taken should be considered; if there is a course based solely on cultural-responsiveness, it would be ideal that it be a necessary course to begin the CREMA curriculum. The course on social power and social identity could be taken at any time, although, like the course on cultural-responsiveness, it would be most beneficial at the beginning of the CREMA curriculum. The course would assist the student in coming to terms with their identity and how it shapes their actions and ideologies, which could be instrumental as they continue with their subsequent courses.

It could be argued that research methods and statistics could be taken concurrently, although I make the recommendation of statistics being taken first so that the student may have an understanding of how statistics fit into the research design. However, only a basic understanding of statistics is necessary for an evaluation project; if necessary, the statistics course could diverge into basic and advanced statistics, with the basic being taken prior to research methods, and the second being taken at any time after that.

The instrumentation course would have to take place after the basic statistics and research methods courses. The student must have an understanding of reliability and validity in the research process in order to explore tests and measures. The practicum would obviously be last, as the student must have an adequate understanding of statistics, social power/dynamics, research design, and instrumentation prior to being able to engage in CREMA.

Appropriate level of training

Bachelors, Masters, or Doctoral-Level Training. ""

""""""""""Kk""presently unclear as to what level of education would be necessary in order to achieve a minimal level of adequate training in culturally-responsive evaluation and assessment. There is currently only one known undergraduate-level program that trains students to be culturally-responsive evaluators: the Certificate for Community-Based Assessment and Evaluation (CBAE) at St.

Mary's University, which is based out of the Department of Psychology but accepts students from all fields of study. The CBAE program is both in-person (for the undergraduate population) and online (for the graduate population).

Other programs for graduate students, like the GEDI and the Center for CREA (Culturally Responsive Evaluation and Assessment) at the University of Illinois aim to serve graduate students at various levels. These programs have been relatively successful, but seeing as there is no baseline for the education of CREMA, there may be disparities between the current programs.

Previous knowledge in content area. Also unclear is whether it is necessary to specialize in a particular substantive area prior to being trained in CREA. In other words, should the training in culturally-responsive evaluation and assessment be overlaid on top of training previously received in the field of education, public policy, or some other applicable domain? Or, should training in culturally-responsive evaluation and assessment be part of the training that students receive in the process of becoming evaluators?

The CREMA-based programs that have been examined in this paper have all been interdisciplinary, with the application of culturally-responsive evaluation being laid on top of the respective domains of study of the students. While the students currently engaged in the programs may not necessarily be seeking to become evaluators, it is beneficial for them to be educated in the concept of cultural-responsiveness.

Marketing the degree. There could be diversity in terms of who would be included in building a critical mass of culturally-responsive evaluation professionals, but there should still be a game plan with respect to how to properly advertise CREMA education. Would the best way be to recruit students from undergraduate programs in the social sciences, or would it be more effective to lure staff from non-profit organizations back to school to complete an education in CREMA?

Conclusion

To ensure that future evaluators are adequately trained, I explored the characteristics of culturally-responsive evaluation, measurement, and assessment, as well as the current need for the education of CREMA. There are various aspects that had to be considered when looking at the important values of CREMA: non-neutrality as part of the evaluation process; awareness of power dynamics and how they can be helpful or detrimental to the evaluation process; the history of testing and how it has affected the current evaluation practices; the validity of the instrumentation; issues can arise when taking what stakeholders say at face value; having the evaluation be representative of the community; and being an instrument of the community as an evaluator. It should also be noted that an evaluator should go into the field of CREMA for the sake of the marginalized and disenfranchised groups that will often be part of the evaluand.

Considering that there is currently no baseline for what the study of CREMA should look like, I have drafted the coursework that would most likely be necessary to have a successful CREMA education program. While more courses could certainly be added, this should be the minimum requirement in educating future culturally competent and culturally-responsive evaluators. While there are still various considerations and questions related to CREMA, the preceding recommendations provide a starting point for the education of evaluators who could reasonably be expected to produce culturally-relevant evaluations.

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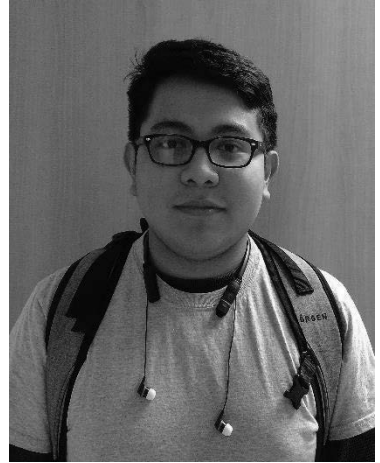
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Computational Mechanics Framework for Crack Growth Analysis

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The development of a code that utilizes Fatigue Crack Growth Mechanics to make fatigue predictions in a digital twin environment will assist in the identification of the size of a crack and the determination of when the crack will reach its critical size during any given flight cycle of an aircraft. This research utilizes the methods of rainflow counting and fatigue crack growth mechanics to predict crack propagation. This procedure does not require a fatigue profile, which can be given experimentally; the profile is then reduced, using rainflow counting methods. We are assuming that a crack is always present, and that the size is always known. Fatigue mechanics presents Paris' equation, which allows for the identification of the size of a crack after having experienced a stress cycle. The rainflow results, the range of stresses experienced and the cycles per range, are utilized in the Paris' Equation. This research evaluates crack propagation in two types of cracks: a surface crack in an infinite plane and a through radial crack from a hole; the methodology analyzes them under tensile stresses exclusively. This code runs through the fatigue stress profile until it reaches the defined critical failure point for the size of the crack. The accuracy of the code has yet to be determined through comparisons with experimental data, however the graphs presented as a result were accurate to the type of relationship when compared with similar research previously conducted.

I. Introduction

Having the ability to conduct real time digital analysis of an aircraft will save both time and money. The digital twin concept [1] is focused on generating a computer model which is identical and specifically assigned to an existing aircraft. Utilizing probabilistic methods, the computer model will analyze the integrity of the aircraft in real time. It will be able to identify any accumulated damage during usage. This concept will also identify the location of any damage based on the methods used. Being able to identify the exact location of the vitiation on the aircraft eliminates the need to take the plane apart, to guess its location.

The research being conducted in this study consists of designing a computational framework that will predict the size of a crack after a given number of cycles and determine the amount of cycles before a part reaches critical failure. To identify that point, we do need material properties for the aircraft part being used, which is very similar to Poly(methyl methacrylate) (PMMA) for this study we are using the properties measured by Hao et al.[2]. To predict the size of a crack, we will be utilizing crack growth analysis [3]. We will then need a fatigue profile, which will be acquired experimentally.

To make the computations more efficient in cases where the data acquired for the fatigue profile are excessive, rainflow counting [4] will be used. This method shortens the amount of data given, by eliminating the data that contains stresses that have little or no impact when compared to the stresses that immediately follow the previous set of data.

Using these methods to identify when a part reaches critical failure is essential when identifying the integrity of an aircraft. Since many aircrafts are flown with known cracks, it is essential to make sure that the parts containing the cracks are not near critical failure when experiencing the stresses during usage.

II. Methodology

This section describes the methodology used for this research and is divided into the following subsections: Fatigue Crack Growth, Rainflow Counting, and Numerical Implementation.

Fatigue Crack Growth

Identifying the size of a crack after having experienced various stresses of various strengths helps to establish the integrity of the piece. For this experiment, we are assuming two types of cracks: a through crack on the surface of an infinite plate (Figure 1), and radial through crack from a hole (Figure 2). We are also assuming a mode I type loading [3] or tensile stresses.

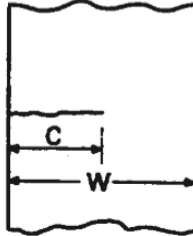


Figure 1. Through crack [5]

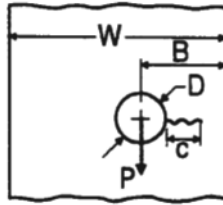


Figure 2. Through crack from hole [5]

The fatigue crack growth model used was Paris' equation (Eq. 1) [3], which relates stress intensity to critical crack growth under fatigue stresses. This equation is used to identify the size of a crack after having experienced a certain load strength over a known amount of cycles. For this equation, we need to know material properties (m and C), the amount of cycles (N) experienced, the size of the crack (a), and stress intensity factor (K).

$$\frac{da}{dN} = C(K)^m \quad (\text{Eq. 1})$$

Paris' equation can then be integrated to obtain the following equation (Eq. 2), where ai is initial crack size and af is final crack size.

$$af = C(K)^m * N + ai \quad (\text{Eq. 2})$$

Stress intensity factor K (Eq. 3) measures the stresses that a crack would experience at the crack tip. This equation requires the stress applied (σ), the initial crack ai , and correction factor $f(g)$ [3].

$$K = f(g) * \sigma * \sqrt{\pi * ai} \quad (\text{Eq. 3})$$

Correction factor $f(g)$ (Eq. 4) is an equation that is dependent on the type of crack that is on the part. If it is a through crack on the surface of an infinite plane, then the value used is 1.12 [3]. If it is a radial through crack from a hole, then it also depends on the diameter of the hole (D), the width of the part W , and the hole offset B . The equations used are presented as follows [5]:

$$f(g) = G_o * G_w \quad (\text{Eq. 4})$$

In the above equation, G_o is the geometrical factor due to the presence of a hole and G_w is the geometrical factor due to the width. Both equations use fits from finite element analysis to find the equations presented below.

$$G_o = f_o(z_o) \quad (\text{Eq. 5})$$

$$f_o(z) = 0.7071 + 0.7548 * z + 0.3145 * z^2 + 0.643 * z^3 + 0.919 * z^4 \quad (\text{Eq. 6})$$

$$z = \left(1 + \frac{2*ai}{D}\right)^{-1} \quad (\text{Eq. 7})$$

$$G_w = \left(\frac{\sec \lambda (\sin \beta)}{\beta}\right)^{\frac{1}{2}} \quad (\text{Eq. 8})$$

$$\lambda = \left(\frac{\pi}{2}\right) * \left(\frac{D+ai}{2B-ai}\right) \quad (\text{Eq. 9})$$

$$\beta = \frac{D}{B} - \frac{2D}{W} \quad (\text{Eq. 10})$$

$$B = \frac{W}{2} \quad (\text{Eq. 11})$$

This study will assume that the hole will always be the center of the part resulting in Eq. 11.

In this research, identifying the amount of cycles that the part would experience leading up to critical failure (x) is important. Critical failure is when the crack becomes the size of the part, essentially breaking it into two. Defining critical failure, is dependent on the type of crack. When considering a surface crack on a plane, w is width. When considering a through crack in a hole, w is width and D is diameter of the hole.

$$x = w \quad (\text{Eq. 12})$$

$$x = \frac{w}{2} - \frac{D}{2} \quad (\text{Eq. 13})$$

Rainflow Counting

Rainflow counting is the process in which a fatigue profile is given and is evaluated to reduce the amount of data present into an equivalent, smaller data set. The profile is reduced by comparing different stresses and determining if the latter stress has a greater or lesser effect on the part than the former stress. Essentially, the data can consist of a thousand cycles reduced to a few hundred, so that the code can read through the data more efficiently. Rainflow counting works by first taking a full cycle (one whole reversal), labeling the first data point in the reversal as a placeholder value z and running the data through the following flow chart (Figure 3) [6]:

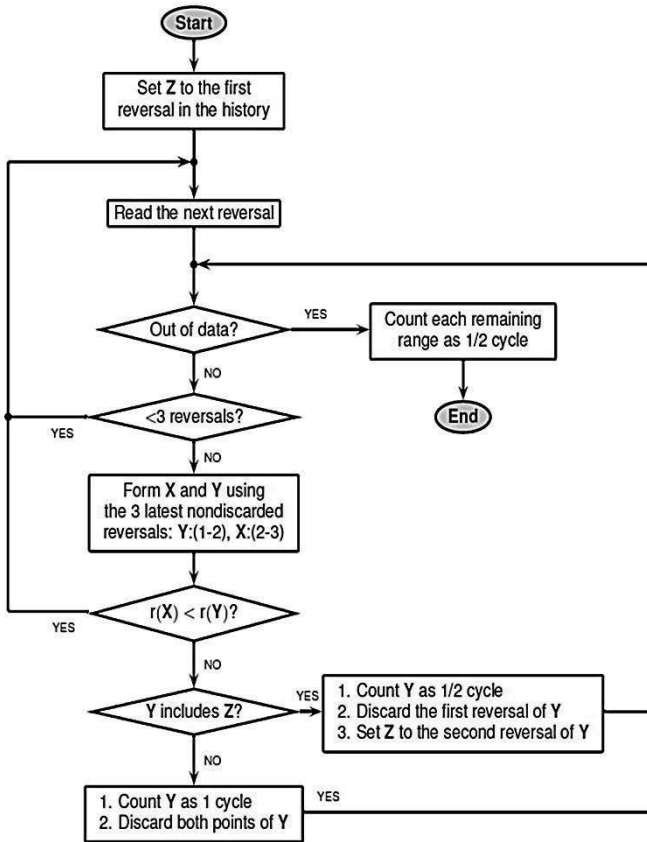


Figure 3. Rainflow Flowchart [6]

After all the cycles are analyzed the rainflow algorithm results, are a table consisting of the amount of cycles the part has experienced, and the range of stress experienced every half or complete cycle [6]. Once generated, this data is used as an input to stress intensity factor (Eq. 3) and Paris' equation (Eq. 2) [3].

Numerical Implementation

The code developed utilizes the methods for fatigue crack growth and rainflow counting; it operates according to Figure 4. The code was implemented in MATLAB.

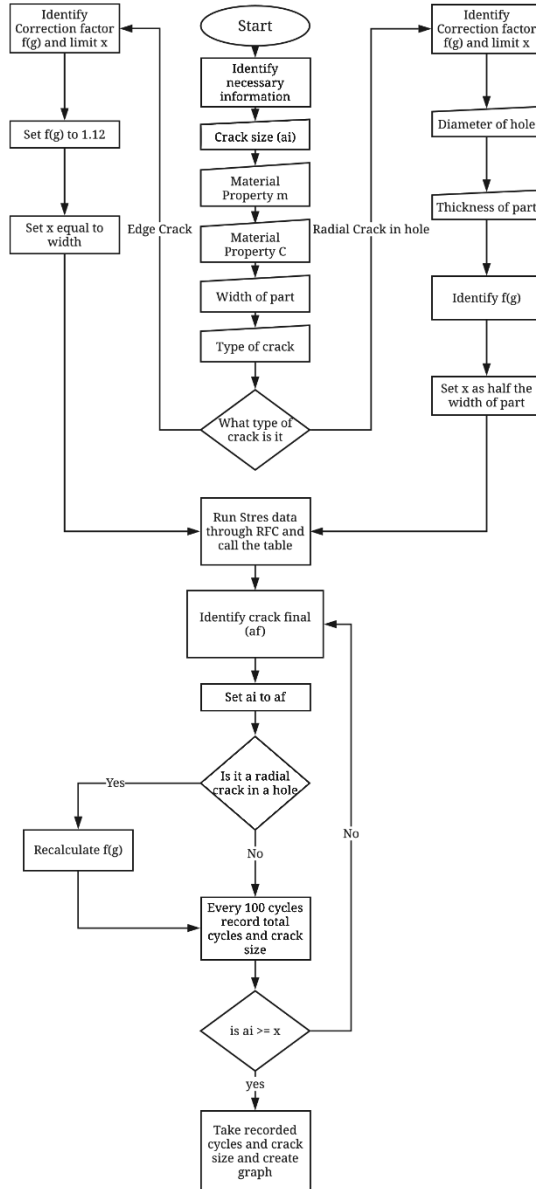


Figure 4. Code Flow Chart

The code begins by gathering data from the user, that is necessary in the computational equations for both types of cracks

being evaluated in this research. It first asks for the initial crack size (a_i). Then, the required material properties: C , m , and width of part (W) are obtained. The code also requires the type of crack being analyzed, whether it is a through crack on the surface (ec) or a radial through crack extending from a hole (ch). The code then evaluates the type of crack and follows the corresponding answer.

If the crack is an ‘ ec ’ or an edge crack, then the code requires no more information and the correction factor is set to 1.12[3]. Critical failure is defined as the entire width of the part (Eq. 12).

If the crack is a ‘ ch ’ or crack propagating from a hole, then it requires more information on the part, the diameter of hole (D), and the thickness of the part (t). With this information, correction factor $f(g)$ can be calculated following Eq 4-11. The code then defines the critical failure point (x) using Eq 13.

After calculating the correction factor ($f(g)$) for either type of cracks, the code then acquires the table labeling the amount of cycles and the stress per cycle after the data has been reduced by rainflow counting [4] (Figure 3). It then solves for the size of the crack after having experienced a single or half cycle of stress using Paris’ equation (Eq. 2). It solves for the stress intensity factor (Eq. 3) as it solves for Paris’ equation. The new crack size is then compared to the critical failure value to determine if the crack size is equal to or exceed its then the part has fractured. If the part has not reached critical failure, it then sets the new crack size as the initial crack size, so it can analyze the new crack size after having experienced the next cycle in the list of data.

If the crack was a crack propagating from a hole, then the correction factor needs to be reevaluated with the new crack size, since the properties of the equation rely on the crack size that is currently being considered.

Data on the crack size and the total amount of cycles experienced are recorded every 100 cycles to make the code more efficient when collecting new information. With this information

the amount of cycles necessary we can create a cycle versus crack size graph, which shows for the part to fracture completely.

III. Example Problem

The following example problem is conducted using the fatigue profile in Figure 5. For this example, the crack is assumed to be propagating from the surface of a plane (Figure 2). The material being used is also assumed to be vero material and the properties C and m are $1 * 10^{-8}$ and 4.0, respectively. The part itself will have a width of 0.1m and the initial size of the crack will be 0.00127m.

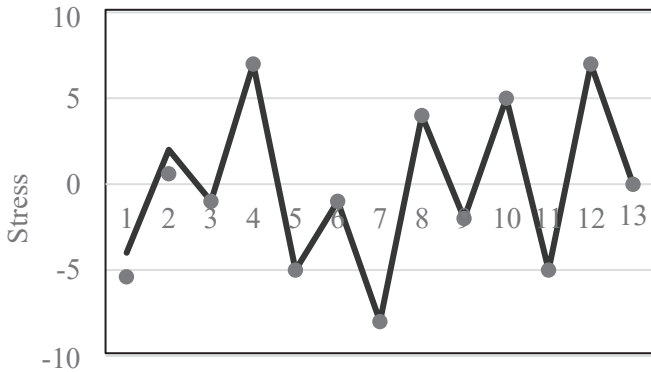


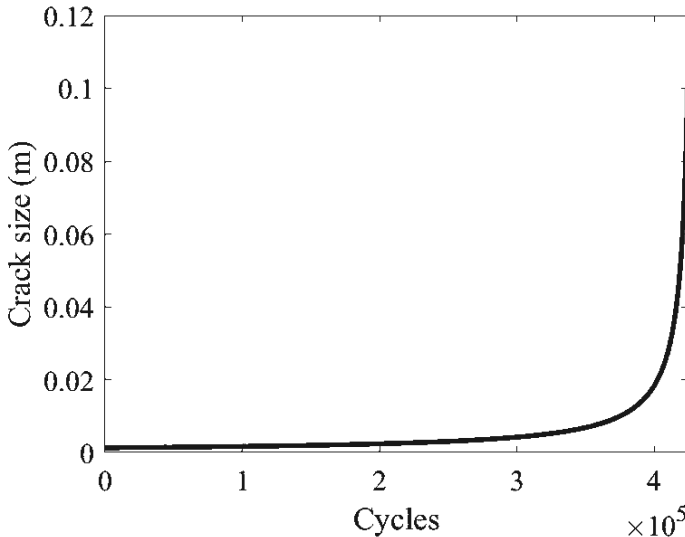
Figure 5. Fatigue Profile

The profile is then entered into the rainflow counting code (Figure 3) and the following data is the results (Table 1).

Table 1. Rainflow Algorithm Results

	Cycles	Range	Mean	Start	End
1	1.00	3	0.50	2	3
2	0.50	11	1.50	1	4
3	1.00	4	-3.00	5	6
4	1.00	6	1.00	8	9
5	1.00	10	0.00	10	11
6	0.50	15	-0.50	4	7
7	0.50	15	-0.50	7	12
8	0.50	7	3.50	12	13

From Table 1, the cycle count and the range count are both used in Paris' Equation (Eq. 1) to identify the size of a crack after having experienced one of the cycles. When utilizing fatigue mechanics to determine the point of failure, following graph is obtained (Figure 6):



For this example, since it is an edge crack, critical failure is defined as the width of the part (Eq. 13) 0.1m. Figure 6 shows the crack growth as it experiences every cycle, in this case it took about 420,000 cycles before the crack grew equal to the width of the part.

IV. Conclusions

This research demonstrates the usage of a rainflow counting and fatigue crack growth mechanics for a digital twin application. The example problem was presented to demonstrate the results of the methodology used in this research. Results showed the amount of cycles experienced before the crack grows to a critical size.

V. Acknowledgements

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Leaving Mythology to the Ancients: An Exposure of Rape Myths and Their Contributions to Oppression

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Introduction

It is important that we as a society begin to talk about the things that make us uncomfortable. If we continue to avoid having necessary conversations about the harms that exist within our society, the continuous cycle of being angry and wishing that someone would do something about an issue will continue. Sexual assault is an issue that exists both within and outside of the United States. However, even in its prevalence many actively avoid having to confront the issue because it is uncomfortable, thus allowing for the harms that stem from it to exacerbate. This paper works to expose rape myths and evaluate the harmful implications that stem from their influence upon society. It focuses on three myths in particular: only certain types of women can be sexually assaulted, victims of sexual had to have been doing something in order to be assaulted, and only psychotic or sex-starved men are capable of rape. I argue that accepting rape myths as truths contributes to the formation of oppressed subjects and, thus, contributes also to the structural oppression of women. This will be accomplished by first defining rape myths, followed by demonstrating the harms of accepting these myths as truths. Next, Ann Cudd's definition of oppression is introduced in order

to provide a foundation for thinking about the nature of oppression and oppressive states of affairs, which will be helpful in displaying how rape myths contribute to the oppression of women within societies in which these myths are more widely accepted. Finally, it is argued that rape myths contribute to the formation of oppressed subjects and harm the identities of those who have been subject to oppression.

What Are Rape Myths?

The “#MeToo” movement has exponentially increased the awareness of sexual assault as a social issue, but there are still individuals that refuse to or avoid having necessary conversations about sexual assault. Instead, these particular individuals tend to defend the beliefs they have been socialized to accept and reject those that make them uncomfortable with the way that they view society. An example of such beliefs are rape myths. In this section, I define rape myths, discuss three of the most common rape myths, and argue that each myth carries with it harmful implications that influence the beliefs of individuals within societies where they are more widely accepted.

Rape myths, as defined by Gerd Bohner and Efthymios Lampridis, are “beliefs that justify male sexual violence against women.”¹ However, rape myths are not limited to only justifying sexual violence against women. Rather, rape myths are often false misconceptions about how and why rape happens. What this means is that these beliefs not only contribute to a false image of how sexual assault happens and its prominence within society, but they are also relied upon to absolve rapists from facing any repercussions. What’s more, as a society we tend to gloss over or ignore sexual assault related issues. This refusal to acknowledge sexual assault as an issue within society partially stems from discomfort with talking about rape. I argue that part of why individuals are uncomfortable with having conversations about sexual assault is because, acknowledging problems like sexual assault within society bring those who ignored the issue face to

face with themselves and their beliefs. Nevertheless, it is important that rape, social constructs like rape myths, and things related to violence against women be something individuals talk and learn about.

Bohner and Lampridis discuss three different rape myths, all of which proved to be the most commonly discussed within rape myth culture.ⁱⁱ The first myth is: only certain types of women are raped. This myth implies that not all women are in danger of being sexually assaulted, and that only women who behave promiscuously are in danger of being assaulted. Promiscuity here meaning either dressing immodestly or having a “reputation” of enjoying or often participating in sexual activity. Immodest, or “slutty,” is used to describe a type of dress that leaves large parts of a women’s body exposed (legs, arms, chest, abdomen), and is often taken as a social signifier for a woman’s interest in sexual activity. The first myth, thus, also implies that “normal women” are not in danger of sexual assault, which creates a problem for a woman and her willingness to be open about her sexuality. The problem being the fear of either only being seen as “slutty” or, worse, being sexually assaulted because a woman’s being in tune with her sexuality was used as a justification for a man to take advantage of her.ⁱⁱⁱ This ultimately suggests that, the victim played a role in her being assaulted. However, this is not the case. Immodesty or promiscuity does not eliminate the necessity for consent from all participating individuals. The acceptance of rape myths and beliefs related to them influences individuals to think about women and their bodies in such a way that causes them to believe that women owe something to men.

The second rape myth suggests the victim of sexual assault had to have been doing something in order for them to have been assaulted. The phrase “doing something” includes activities ranging from flirting, dressing immodestly, and initiating sexual intercourse. However, within the activities just listed, the potential of one party not being interested in sexual

intercourse to begin with or changing their mind during sexual intercourse is possible and should be respected. A withdrawal of consent, whether it be before or during sexual activity, is a withdrawal of consent without qualification. Simply because a woman is willing to get behind closed doors with a man does not mean that she is required to please him if she decides she no longer wishes to participate in sexual or sexually charged activities.

I understand that withdrawal of consent during intercourse is a version of “no” that many are less familiar with, or comfortable with accepting. In order to help understand how withdrawal of consent should always result in the halt of sexual activity, and why it is wrong to take advantage of the other party’s vulnerability, consider the following. Imagine walking into a tattoo shop with a design in mind and going to sit in an artist’s designated area of the shop. When the artist sees your design, he informs you that he is unable to re-create your desired design but can offer one that he created himself. While hesitant at first, you eventually decide that you like the custom tattoo and want to get it that same day. However, once the process begins, you’re sitting in the chair and can feel the needle against your skin, you realize that you’re making a terrible mistake and tell your artist that you’ve changed your mind and want to stop immediately. The expectation would be that the artist stops what he was doing. However, in this particular scenario he ignores your request, and the many pleas that came after it and continues on until he is finished. At this point, it is obvious that the artist is not concerned with your wellbeing, or the quality of your undesired tattoo and is only concerned with getting his money. Once finished, your artist does not apologize and instead takes the money you owe him for the tattoo, and leaves for the day.

In this scenario, the individual getting the undesired tattoo represents a woman who may have originally liked the idea of having sexual intercourse with her date or partner but decides at

some point that she no longer wishes to continue. In the same way that the tattoo artist neglected to acknowledge the wishes of his customer, which would be a violation of the customer's body, the refusal to acknowledge a woman's withdrawal of consent is and should be considered as a violation of her body and vulnerability. Unfortunately, initiating physical activity, flirting, or dressing immodestly, are all still often seen as forms of consent, or as justifications for forcibly having sex with a woman.^{iv} Consequently, this myth manifests itself within society through instances like rape victims being asked what they were wearing or doing when interacting with their attacker, rather than prioritizing questions about the attacker and his potential whereabouts. It also stands as a form of testimonial injustice.

Miranda Fricker argues that testimonial injustice "occurs when prejudice causes a hearer to give a deflated level of credibility to speaker's word" and is caused by what she calls "prejudice in the economy of credibility."^v Testimonial injustice occurs when, the listener or hearer, gives less credibility or attention to a speaker due to an existing prejudice about the speaker. For example, a police officer may not believe someone, or believe them less than another party, simply because they are black. Fricker defines the central case of testimonial injustice as "identity-prejudicial credibility."^{vi} Identity-prejudice, refers to what she introduces as a label for prejudices against people who belong to a certain social type. One way in which rape myths contribute to instances of testimonial injustice, is the lack of credibility given to sexual assault victims during testimonies, or reports regarding their assault. The reason for this, is because rape myths generate ideas about women and sexual assault that imply sexual assault is the victim's fault. When attempting to testify against an individual for sexual assault, if the law enforcement officer that is faced accepts rape myths they will be less likely to take the case seriously. For example, legal officials tend to have a less serious reaction to sexual assault reports when the victim was

drinking, acquainted with their attacker before the assault, or waited to report the incident.^{vii} This is still an issue that many victims of rape face when attempting to report an assault.

While the implications that stem from both the first and second myths are very similar, it is necessary to acknowledge the critical difference between the two. This difference lies within how false ideas about a woman's potential to be "asking for it", or to "owe it" to someone is used as not only a justification for sexually assaulting a woman, but more disturbingly, as a reason or motivation to sexually assault someone.^{viii} The second myth, as opposed to the first, deals with a matter of action rather than a state of being, or type of person. This myth suggests that there is an actual doing of something that makes sexual assault happen. The belief that a woman can dress or behave in such a way that justifies sexually assaulting her is misconstrued on several ends. One of the most concerning mistakes being the belief that a certain set of behaviors, style of clothing or level of flirtation should be considered as a means of consent. The reason it is one of the most concerning justifications for sexual assault is because any kind of "signal" that the victim may have intentionally or unintentionally given their perpetrator can be used against them when attempting to testify. What this implies, like the first myth, is that the fault ultimately gets placed upon the victim rather than the perpetrator.

Rape myths and their tendency to misconstrue ideas about sexual assault are put into a more striking perspective when taking into consideration statistics provided by Cécile Grossin, Isabelle Sibille, Geoffroy Lorin de la Grandmasion, Ahmed Bansar, Fabrice Brion and Michel Durigon. They gathered 418 sexual assault victims were and divided into two separate groups. The first group contained victims that had been examined within a 72-hour period of having been sexually assaulted. The second group was examined after a 72-hour period. Within the second group of victims from the study 76% of victims were under the

age of fifteen years old and 31% presented high vulnerability states like disability or pregnancy.^{ix} When taking into consideration that 76% of the sexual assault victims examined within the second group of this study were under the age of fifteen years old, and that 31% had very little to no control over the situation, it becomes much easier for one to begin recognizing the implausibility of ideas that suggest a victim could do anything to deserve being sexually assaulted. The stereotypes attached to this myth depict the same type of promiscuous woman targeted within the first myth; the data, on the other hand, reveals that a large portion of sexual assault victims are children. While this example only includes a sub-group of sexual assault victims^x, the truth of the matter still applies to all women and rape victims. The statistics do not suggest that the falsity of this myth only applies in the case of children or highly vulnerable women. They merely provide evidence in support of the fact that the reason women are sexually assaulted has nothing to do with what they choose to wear, say or do.

The third and final myth proposes that only sex-starved or psychotic men are capable of rape. While this myth does not directly imply that sexual assault victims are at fault for their own attack, like the others, it often absolves perpetrators from severe retribution. Additionally, this myth suggests that women should only fear ‘scary’ or ‘strange’ looking men who hide in the shadows, waiting for an opportunity to rape someone.^{xi} One of the ways in which this misconception is reinforced is through the tendency of media outlets to perpetuate representation in movies and TV shows that portray rapists as strangers. For example, the TV show *Law and Order: Special Victims Unit* deals specifically with criminal justice cases regarding sexual offenses. If done well, this type of show would have the potential to assist in education regarding how sexual violence occurs. Unfortunately, the show consistently portrays the assailants as strangers or mentally unstable. Manifestations of this rape myth, like the ones

seen in *Law and Order*, reinforce the justifiability of sexual assault cases and generates false ideas about who women should fear. Rather than fearing mentally unstable or strange men, we should instead be weary of most, if not all men for two main reasons. The first reason is the willingness of a male who personally believed that they would be incapable of sexual assault, to go against their moral standards once in an impassioned state. The second reason lies within statistics regarding the relationship between sexual assault victims and their attackers.

In Dan Ariely's *Predictably Irrational*, Ariely reports on a study he conducted that observes college males while in heated states. A heated state is when an individual is in the grips of passion, causing them to behave less rationally than if they were in a cold (un-aroused) state.^{xii} One of the heated states that he studies is sexual arousal. While in this state, the willingness to engage in immoral sexual activity (telling a girl what she wanted to hear to have sex, using a date rape drug to have sex, or encouraging a girl to drink alcohol so that she would be more willing to have sex) was 136% higher than what participating individuals predicted they would be willing to engage in while not aroused.^{xiii} A similar study conducted by Sarah R. Edwards that surveyed 86 college males revealed that one in three men would be willing to act on "intentions to force a woman to have sexual intercourse" if they could get away with it.^{xiv} What both studies reveal is that perpetrators of sexual assault do not have to have a mental condition, or even be a certain type of man. The data emphasizes how easy it is for an aroused man to go against his own moral compass for the sake of satisfying himself. Nevertheless, while this data reveals how easily men can turn against their own moral standards, it does not speak for the relationships between sexual assault victims and their attackers.

Recalling the study referenced earlier regarding the 418 cases of sexual assault, Grossin, et al. found that within the

second group of victims, 58% of the victims were assaulted by family members. Of that 58%, 30% of those victims' perpetrators was their own father. Within the same group, 24% of the victims were attacked by an acquaintance.^{xv} Portrayals of sexual assault within the media carry a large influence upon viewers' perceptions of how sexual assault happens. While being attacked by a stranger is possible, it is not the most probable way in which sexual assault occurs. It is important to recognize the ugly truth of where actual threats exist as opposed to dramatized versions of these threats. In being exposed to this data, it becomes evident that sexual assault happens, more frequently, within the victim's own home by someone the victim is already familiar with. However, many still carry one of, or a combination of all three misconceptions about sexual assault and victims of sexual assault due to a lack of exposure to factual information about the issue.

As I hope has become clear, there is a running pattern within rape myths. These myths have created a tunnel vision for a large portion of men and women within our society and must be exposed for what they are: myths. Myths that not only create a false consciousness, but also encourage oppressive and dominant behavior towards women. It is not enough to simply address the issue of rape myths as wrong. Because of the impact they have had, and continue to have upon women in society, the issue warrants a heftier criticism.

Rape Myths and Oppression

Ann Cudd offers a four-part definition of oppression, which provides four necessary and sufficient conditions for oppression, they are:

The Harm Condition: there is a harm that is perpetrated through a social institution or practice.

The Social Group Condition: the harm is perpetrated through a social institution or practice on a social group whose identity exists apart from the oppressive harm.

The Privilege Condition: there is another social group that benefits from the institutional practice in (1).

The Coercion Condition: here is unjustified coercion or force that brings about the harm.^{xvi}

On the basis of this definition, in order for something to be considered as oppressive it must involve harm generated through social institutions and practices. Such harms can range from inequality to dehumanization, psychological/physical harm and trauma. Secondly, the harm must also be directed towards a social group like women or a particular minority race. Thirdly, there must also be a social group that benefits from the harm of the harmed social group. One example of this benefit or privilege, is the general allowance that men are granted due to their dominance over women. This general allowance is usually cashed in when sexist or misogynistic attitudes are acted upon. Finally, in order to be considered as oppressive, the act or state of affairs must involve some measure of potential coercion or force. Coercion does not always appear in the form of a physical threat, rather it can also appear in as a social threat situation in which an individual is aware of the potential dangers of their actions.^{xvii} One example of a non-violent coercive circumstance is a woman who must be wary of becoming pregnant, or already being pregnant when applying for or working in a professional setting. The force must only be validated as a possibility that is related to the structure of the social situation. This is especially harmful when women are forced into choosing between their families and their jobs, and their male counterparts don't experience the same dilemma. Cudd's framework for oppression is the most appropriate for present purposes, in that, she argues for a set of conditions that leave the least amount of room for the misapplication of term. What's more, she encompasses some of the conclusions found in Marilyn Frye's account of oppression.^{xviii}

Marylin Frye differentiates between what it means to be oppressed and what it means to be miserable in “Oppression.” She provides a helpful analogy that depicts the complexity of oppression. She states that the “experience of oppressed people is that the living one’s life is confined and shaped by forces and barriers which are not accidental or occasional and hence avoidable but are systematically related to each other in such a way as to catch one between and among them and restrict or penalize motion in any direction.”^{xix} She describes this restriction as being “caged,” depicting oppressed individuals as like birds stuck in cages. When looking at a birdcage, if one looks very closely at one wire on the cage or chooses to only recognize or acknowledge the one wire, the appearance of the other wires is no longer in their field of vision. Consequently, confusion arises as to why the bird does not simply fly around the single wire to free itself or fly away once one wire is removed. Even in taking the time to analyze each and every wire of the cage with this myopia, the confusion still persists. Frye argues that it is only when one takes a step back to look at the cage in its entirety that they can begin to understand the confining qualities of the cage.^{xx} This analogy is important because it depicts the complexity of oppression in such a way that displays why certain individuals are unable to see the whole picture. In order to truly understand the ways in which certain groups within society are oppressed, it is first necessary to recognize that all oppression is connected in some way, shape or form. Rape myth acceptance is an example of this connection that is often overlooked, mainly due to how deeply rooted and reinforced these myths have been and continue to be within modern society. The four necessary and sufficient conditions for oppression provided by Cudd support Frye’s respective positions. Frye’s support, stems from the way in which Cudd establishes coercion’s role in maintaining systems of oppression. In her bird-cage analogy, she depicts the way in which the actions and decisions made by women are constricted

by different structures of oppression. In the same way that the cage does not pose a physical threat to the bird, structures of oppression do not necessarily have to actively threaten a targeted group in order to maintain its confinement.

Women's oppression, and the tendency of many men and women in society to devalue, dehumanize, sexualize and objectify women has been constructed over an extended period time.^{xxi} As a result, these tendencies have intertwined themselves with the habits and beliefs that have developed within society. If certain understandings about society are structured by a powerful group, or institution within a society, social facts will follow suit.^{xxii} Put differently, if the dominant group within a society develops ideas or opinions about how things should work, these, often misconstrued, ideas are accepted as truths by both the oppressor and oppressed groups within society. The acceptance of rape myths within a society, for example, contributes to the development of a cultural space that works to constrain the actions or decisions of women.

There are several ways in which rape myths contribute to the development of false ideas regarding women's bodies and how or why sexual assault happens, two will here be discussed in detail.

The first way in which the acceptance of rape myths contributes to this development of false ideas is how they condition women (the targeted oppressed group) to accept the ideas stemming from them as truths. As a result, many women fail to recognize it to be so, because of how normalized those actions, behaviors, and habits, have become in social life. The failure to recognize oppressive behaviors, eventually leads to the oppressed group making contributions to their own oppression. When this happens, it is a case of false consciousness. Cudd provides an excellent explication of this phenomena, stating that false consciousness "has been used to refer to beliefs held by members of privileged groups that rationalize and support their

dominance,” and is also “beliefs and desires held by members of oppressed groups that support their subordination, and beliefs held generally about the nature of social relations, which support the status quo relations.”^{xxiii} She offers three criterion for identifying something as a matter of false consciousness, they are: “(1) its falsity, (2) its origin, and (3) its implications for oppressive social relations.”^{xxiv} What this means, essentially, is that one must prioritize, not only the falsehood of a belief, but must also take into consideration where the belief originally stemmed from and also the implications that stem from it. Cudd argues that both the second and the third criteria should be considered as motivating factors for rejecting a belief. While the falsity of a belief is problematic to begin with, origin and, more so implication, are what cause false beliefs to become harmful within a society. What’s more, the most troubling effect of developing false consciousness is that it conditions oppressed individuals to become oblivious to their own oppression, and thus fail to resist their oppression. Ultimately, this complacency causes some oppressed individuals to wholeheartedly believe that their place within society, as a diminished subject lacking full recognition, is deserved.

The second way in which rape myths contribute to the false development of ideas and structural oppression is how they affect the targeted group’s individual identities. Bohner and Lampridis gathered data from the participants, all of whom were women, on their acceptance of rape myths, individual self-esteem and collective self-esteem.^{xxv} This information was gathered both before and after the experiment.^{xxvi} After having taken the first survey, Bohner and Lampridis prepare the participants to expect a conversation about one of three topics. The topics were expected to be either about the other woman’s illness, studying, or the other woman’s experience of having been sexually assaulted. The results of the second survey, taken after being given a topic, found that those who were expecting to speak with a rape victim

and also rejected rape myths had a lower individual and collective self-esteem. Because the acceptance of these myths serves as a way to separate one's self from those who are affected by them, those who accepted rape myths as truths were seen to have a higher collective self-esteem after given the same expectation. This happens because, in accepting rape myths, one also accepts the idea that they are separate from the vulnerable group in question. This is a helpful example of how obtaining a false consciousness can cause an oppressed individual to become oblivious to their own oppression. One reason this is dangerous is because it slowly begins to turn the oppressed into contributors to their own oppression by influencing the ways in which women view themselves within society.

Formation of Oppressed Subjects

This section explores the ways in which social constructs, such as rape myths, contribute to the formation of oppressed subjects. The aim for this section is to analyze the ways in which power relations play a role in socializing and habituating women into oppressed subjects. It also works to provide an explanation as to how the subjugation of women is accomplished through a multiplicity of social barriers. This will be done by exploring Johanna Oksala's evaluation of feminist perspectives on Michel Foucault's account of power and what it means to be feminine in a society dominated by the patriarchy, and through arguing for examples that reinforce the subjugation of women. In *Feminist Experiences*, Oksala aims to provide a firm defense of feminist philosophy. She notes that a "key objective of feminist philosophy is to expose, analyze, criticize, and ultimately change the power relations that produce and organize society, or more fundamentally reality, in a way that makes it unequal or unjust for beings who are constructed and classified as women."^{xxvii} One of the many ways Oksala explores how power relations produce reality in such a way that makes it unjust for women is by

analyzing different feminist accounts regarding Foucault's establishment of power relations.

In "The Subject and Power," Foucault seeks to examine the different ways in which human beings are made into subjects. Subject meaning either, "subject to someone else by control and dependence" or "tied to his own identity by a conscience or self-knowledge."^{xxviii} Foucault argues that a subject is an individual who is answerable to another because of their dependence or fear of them, or as one who is answerable to that which ties them to their identity. He specifies that "what characterizes the power we are analyzing is that it brings into play relations between individuals (or between groups)."^{xxix} The actual exercising of power should not be simplified to merely a relationship between partners, or groups. Rather, power is "a way in which certain actions modify others" and power "only exists when it is put into action."^{xxx} What this implies is that power is something that comes into play when one party puts themselves in a position to affect another party to the extent that the affected party, in some sense, allows it to happen. There are some cases in which the affected party allowed for the exertion of power over them, and others where it is simply a matter becoming accustomed to the exertion of power. Power is not something that an individual or group possesses, nor is it something that is physically attainable. Instead, power is something that operates within societal relationships.

The development of a power relation that is intended to control those within a society or group, has the ability to simultaneously develop disciplinary measures in order to maintain control. Oksala identifies several feminist accounts of Foucault's power relations that argue "feminine subjects are constricted through patriarchal, disciplinary practices as[...]subjects who are dependent on others, who must suppress their aggression, egotistical interests and ambitions and demonstrate caring and nurturing qualities."^{xxxi} Women are

exposed to social constructs and habituations that mold them into being what patriarchal practices depict the ideal woman to be. This exposure goes beyond any kind of psychological barrier that can develop in the face of traumatic or oppressive environments, like false consciousness or adaptive preferences.^{xxxii} Rather, the exposure to social constructs and habituations is what Foucault refers to as disciplinary power. What is important to note about disciplinary power is that it does not directly coerce its target. Rather the target is placed within a social threat situation in which they are constantly aware of potential threats. “Through detailed training”, this form of power, “reconstructs the body to produce new kinds of gestures, habits, and skills”^{xxxiii} through disciplinary practices. Disciplinary practices meaning, various methods or techniques which are intended to make the female body docile and useful.^{xxxiv} Oksala states, “the rationality of these disciplinary practices can thus only be understood in the light of the modernization of patriarchal domination. They subjugate women by normalization, by constructing them as particular kinds of subjects, not simply by taking power away from them.”^{xxxv} Some examples of disciplinary practice that Oksala provides are habits such as dieting and fitness^{xxxvi} but can be extended to hair and skin care or makeup – all of which aim at making a woman more desirable, and shape her expectations in a way that habituate her to wanting to present herself as such and to believe that she realizes her value as a woman (only) when she does so.

While the value of being a woman may not be grounded in living up to the perfect body image, what it means to be a woman in a society dominated by the patriarchy is yet another form of discipline that has worked to condition women over time. Iris Young’s analysis in “Throwing Like a Girl: A Phenomenology of Feminine Body Comportment Motility and Specialty,” agrees with Simone de Beauvoir regarding Beauvoir’s understanding of what it means to be “feminine”. Young states that, rather than being something that all women have by virtue of their being

biologically female, femininity is “a set of structures and conditions which delimit the typical situation of being a woman in a particular society, as well as the typical way in which this situation is lived by the woman themselves.”^{xxxvii} More simply put, what it means to be a woman is not knowledge or a set of characteristics that every female is born with, nor is it something that must necessarily be defined. In Beauvoir’s concise formulation, “one is not born a woman, but rather becomes, woman.”^{xxxviii} Disregarding experience and individual methods of learning about one’s own identity, the socialization or habituation of women is not something that happens as a result of self-reflection, or traumatic event. Rather, it happens through the constant reinforcement of false ideas about a woman’s place within society, which includes rape myths.

Women who accept rape myths as truths often fall into the habit of victim shaming and advising other women or young girls to behave in such a way that prevents them from brining attention to themselves. This is often reinforced through tradition, an outlet of oppression that Cudd defines as “the set of beliefs and values, rituals, practices, formal and informal, explicit and implicit, that are held by and constitute a culture”^{xxxix} wherein the members of this culture follow them unquestionably. One example of this is the double standard of women being expected to remain polished and modest while men are, not only open about their sexual endeavors but praised for them. For example, young girls who are a part of Hispanic cultures are often prohibited from dating or getting into relationships, while their brothers or male cousins are encouraged to pursue those same opportunities.^{xl} Often times, men within these cultures will be praised for these same behaviors. However, even not being allowed to date, young girls are expected to look clean, modest and presentable at all times. This expectation feeds off of the idea that an immodest looking girl is one that is asking for attention, an idea that stems from rape myths like the first and second. Not only does this practice

reinforce the idea that women can only be seen as sexual objects that need to be shielded, but also the idea that women are not active beings. Rather, they're seen as passive recipients of action. This practice makes young girls feel guilty about wanting to pursue relationships or explore their sexuality, a guilt that follows them into adulthood. What this guilt does, is make being in romantic relationships or even being a part of a brief encounter with someone who a woman is attracted to feel as though it is inherently wrong. If this is all true, this shows that the implications that stem from rape myths have carried into the way that certain traditions handle raising their daughters as opposed to their sons.

On the other hand, there are instances outside of tradition in which women advise other women on how to prevent being sexually assaulted. Robin Warshaw's *I Never Called it Rape* was one of the first individuals to face the issue of date and acquaintance rape head on. She does a fantastic job of displaying the ways in which women were confused about, or oblivious to what counts as rape and how it happens. She also explores several different aspects of the issue within her book and emphasizes the importance of changing the way society thinks about rape. However, there is one section within her book titled "How to Prevent Acquaintance Rape"^{xli} that is problematic and contradictory to the purpose of her text. Granted, this section appears to have been written with the intention of keeping other women out of danger, however, what is problematic about including a section like this one, is that it offers suggestions that buy into rape myths. Providing a list of things to do in order to prevent a sexual assault contradicts the aim of books and articles like hers, because it feeds into the idea that it is a woman's responsibility to not be raped. The reason that this is problematic is because it reinforces the idea that men who rape are not the root of the problem, but rather that the issue is a matter of women being in the wrong place at the wrong time. This refusal of

accepting the truth of the matter, not only serves as a motivating factor for men to continue treating women this way, it also feeds the idea that it takes a certain type of woman to be sexually assaulted. Consequently, this perpetuates the misconception held by women who accept rape myths, that it would be impossible for them to be sexually assaulted due to their being the “right” kind of woman.

In summary, Oksala’s analysis of Foucault’s power account reveals that women are subjects of oppression that are formed by the patriarchy through disciplinary practices like rape myths. The formation or construction of women as oppressed subjects is reinforced by social constructs like rape myths because they influence, or condition both men and women to see women and their bodies as subordinate to men. This can be seen through examples of tradition and Warshaw’s book, but also through the everyday experiences of a woman. We live in a society where women are expected to have their best foot put forward in every situation in order to be taken seriously, and where women’s bodies have been sexualized to the extent that young girls are told the exposure of their arms is a distraction to young boys. Instead of desexualizing women’s bodies and teaching men to respect women as equals, women are stuck in a reality where they are constantly expected to keep themselves out of harm’s way.

Conclusion

Rape myths are social constructs developed through misogynistic depictions of women. Not only do they perpetuate patriarchal dominance, but they also generate false depictions of how and why rape happens. Recognizing the falsity rape myths and the harm inflicted upon women by their acceptance, establishes their contributions to the structural oppression of women. This is especially true, when considering the ways in which rape myths work as a disciplinary practice within society and aid in the development of a false consciousness. What’s more, these myths meet the four necessary and sufficient

conditions for oppression provided by Cudd. Rape myths play a role in harming women mentally and physically, while men benefit from the implications that stem from rape myths and the social threat situation that they create for women.

Marilyn Frye's bird cage analogy is a helpful depiction of the ways in which tradition, education, and the media all play significant roles in reinforcing disciplinary practice. This analogy emphasizes the importance of recognizing that oppression is the result of a multiplicity of factors, not just one major social issue. For example, while rape myths contribute to the widespread oppression of women, they also aid in the social domination of women. An understanding of Foucault's account of power relations, in that power is a matter of relationships and can only be exercised in so far as the affected party allows it, prompts the question of why women do not simply resist and overcome their domination. While it seems simple, Foucault argues a subject is an individual who is answerable to another because of their dependence or fear of them, or as one who is answerable to that which ties them to their identity. Because of the detailed training that goes into maintaining disciplinary power and the psychological effects that stem from the acceptance of rape myths within a society, simply overcoming patriarchal domination is much easier said than done. When large populations of individuals accept rape myths as truths, it contributes to the formation of oppressed subjects and, thus the structural oppression of women. Things like false consciousness, and their tendency to condition women into believing that their current place within society is deserved, convince women that there is not anything to fight against.

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Endnotes

ⁱ Bohner & Lampridis 2004, 78.

ⁱⁱ Ibid.; see also Burt 1980, Wegner et al., 2015.

ⁱⁱⁱ Wegner et al. 2015, 1020.

^{iv} Ibid.

^v Fricker 2007, 1.

^{vi} Ibid., 4.

^{vii} Lafree 1981, 582.

^{viii} Wegner et.al. 2015, 1020.

^{ix} Grossin et al. 2003, 125.

^x Krebs et al., 2016.

^{xi} It is important to acknowledge the issue of sexual assault cases involving minority men as perpetrators, often leading to harsher sentencing and further instances of testimonial injustice. For example, a black male who sexually assaults a white female is sentenced more harshly than any other sexual assault case, regardless of the extralegal details of the assault (Spohn & Spears 1996, 650). The reason for this is due to pre-existing prejudicial attitudes towards black individuals. The majority of sexual assault cases, unfortunately, end up taking into consideration extralegal details regarding the assault so as to give the perpetrator a break (ibid.). However, as noted before, this is not done in the cases with black males and white women. Instead, black male testimony is heard, but not listened to, nor deemed as worthy of taking into consideration.

^{xii} Ariely 2008, 113.

^{xiii} Ibid., 114.

^{xiv} Kingkade 2015.

^{xv} Grossin et al. 2003, 125.

^{xvi} Cudd 2006, 25.

^{xvii} Ibid., 91.

^{xviii} Young established a less stringent set of sufficient conditions, as far as what counts as oppressive. She establishes five different faces of oppression, as she is more concerned with exploring the different variations of oppression's forms (Young 1999).

^{xix} Frye 2000, 12.

^{xx} Ibid.

^{xxi} In *Ethics of Ambiguity* Beauvoir notes that, unlike racial forms of oppression, the oppression of women does not have a specific event or series of events in time that marks its beginning in history (Beauvoir 1976).

^{xxii} Fricker 2007, 147.

^{xxiii} Cudd 2006, 178.

^{xxiv} Ibid.

^{xxv} Collective self-esteem was gathered in order to examine an individual’s self-esteem in regard to their being a part of a social group. Questions asked during this survey included “‘I am a worthy member of the group of women’; ‘I feel good about belonging to the group of women’; ‘Overall, my membership in the group of women has very little to do with how I feel about myself’ (Bohner & Lampridis 2004).

^{xxvi} Bohner & Lampridis 2004, 77.

^{xxvii} Oksala 2016, 3.

^{xxviii} Foucault 1982, 781.

^{xxix} Ibid., 786.

^{xxx} Ibid., 788.

^{xxxi} Oksala 2016, 111.

^{xxxii} Adaptive preferences, are situations, individuals or environments that an individual is “duped or beguiled” (Cudd, 180) into desiring after having been exposed to an oppressive environment or traumatic event. For example, an individual who is in an abusive (mental or physical) relationship will begin to desire the same types of partners. The trauma involved within an abusive relationship has the potential to psychologically damage a victim to the point where they begin to develop an attraction or desire for the same type of individual. This is not done on purpose, nor are many affected individuals aware of what they’re doing in the first place. While this is disturbing in itself, what is even more frightening is how the development of adaptive preferences can cause an individual to become accustomed to and eventually accept their oppressive conditions. What’s more, is that it can even go as far as causing one to prefer living with the restrictions that come with their oppressive environments (Cudd, 181).

^{xxxiii} Oksala 2016, 113.

^{xxxiv} Ibid., 112.

^{xxxv} Ibid., 113.

^{xxxvi} Tracy Isaacs and Samantha Brennan are co-authors of the blog *Fit is a Feminist Issue*, which serves as a platform for conversations about enjoying fitness outside the constraints of unrealistic body image expectations. This is a really helpful example of a form of resistance against disciplinary power.

^{xxxvii} Young 1980, 140.

^{xxxviii} Beauvoir 2009, 283.

^{xxxix} Cudd 2006, 166.

^{xl} This is not meant to limit these practices to Hispanic cultures, I acknowledge that these practices can and do occur within other cultures as well.

^{xli} Warshaw 1988, 151.

Feminism, Feminist Criminology, and the Incarcerated Female Population in the United States

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This research will analyze the correlation between the feminist movement and the growing female population in prisons. The decades following the feminist movement saw a societal shift where women gained economic, legal, and educational equality. In the 1970's criminology evolved to include women, and criminal behavior. Feminist criminology is the study of female offenders and the causation and nature of their crimes. For this research, an historical overview of the feminist movement will be presented. In addition, statistics on the female population in prisons from the Bureau of Justice Statistics will be gathered and analyzed. In the end, this research will attempt to answer the question: Is there a relationship between the increased equality of women in U.S. society and the growth and nature of the incarcerated female population?

Introduction

This research will analyze the relationship between the feminist movement and the growing female prison population. The decades following the feminist movement in the 1960's and 1970's saw a societal shift where women gained economic, legal, and educational equality. From the 1960's to the year 2000, the percentage of all bachelor's degrees in the U.S. awarded to women increased from 37 percent to 57 percent (Holbrook,

2002). In the 1970's criminology evolved to gain a better understanding of women, and criminal behavior (Adler,1975). Feminist criminology is the study of female offenders and the causation and nature of their crimes. For this research, an overview of the feminist movement and feminist criminology will be presented. In addition, statistics on the female population in prison from the Bureau of Justice Statistics will be gathered and analyzed to see if a relationship exists between the increased equality of women in U.S. society and its relationship to the growth and nature of the incarcerated female population.

The feminist movement refers to a long ongoing struggle for gender equality. The first wave of the feminist movement started in 1848 when women fought for their right to vote. On August 18, 1920 the 19th amendment granted American women the right to vote, but women were still a long way from equality (Flexner & Fitzpatrick. 1995). The second wave of the feminist movement peaked in the 1960's and early 1970's focusing on issues like reproductive rights, family life, and work place equality. It is at this time women of all races and all backgrounds stood in solidarity to fight for their rights. It was through the feminist movement that women were able to break through the housewife mold and focus on higher education and work life outside of the home. The idea of the women's role in society was completely transformed. Women were no longer seen as husband dependent and a baby maker, but rather as a conscious independent being who was just as capable as a man in all aspects of life (Hooks,1989: Bulter,1990).

I argue that because gender equality has become the norm the criminal justice system has responded by incarcerating more females than in the past. The basic thesis of this research is that the equality of women as produced by the feminist movement had led to an increase in the population of women in prison. I will utilize the feminist theory and feminist criminology to develop a better understanding of the equality and opportunity of women in society and its relationship to female criminality.

Literature Review

Existing research on female offenders is usually very specific. In many articles researchers focus on what kind of women become female offenders and what kinds of crimes they typically commit (Adler, 1975; Pollak, 2006). A conclusion that can be drawn from prior research is that with women gaining more independence, responsibilities and freedom in the decades following the feminist movement, the more opportunity has arisen to commit crimes (Myers, 2013). Adler (1975) and Pollack (2006) provided insights in explaining how the increase of gender equality can lead to higher incarceration rates for women.

Researchers have found that before and after the feminist movement the study of criminal activity involving women was approached differently than criminal activity involving men. Before the feminist movement and feminist criminology, it was a common misconception that women were incapable of participating in criminal activity willingly or without having abnormality (Lombroso & Ferrero, 1895). Rather than being deemed a criminal, women who committed crimes were seen as mentally unstable or easily influenced. The “Mad not Bad” theory states that women who commit violent crimes are viewed as mentally unstable and not inherently violent (Lloyd, 1995). The “Mad not Bad” theory greatly affected courtroom hearings, resulting in lighter sentencings (Farnworth & Teske, 1995; Embry & Lyons, 2012). The chivalry theory alludes to the fact that when female offenders entered the criminal justice system they were usually seen as vulnerable and in need of protection (Flexner & Fitzpatrick, 1995). Women who did not fit into this meek stereotype or were seen as problematic and were usually deemed as “unworthy of protection” (Belknap, 2007; Flexner & Fitzpatrick 1995). Both the chivalry theory and the “Mad not Bad” theory stem from stereotypes of what a woman should be.

However, it is important to note that because the “stereotype” of a woman has changed so has the context of these theories (Goethals, 1997). Some research also considers how

“social labeling” can have an impact on reducing the conviction rate (Box & Hale, 1984). Other research suggests that the new societal views of female socialization can lead to younger women becoming more “violent” (Carrington, 2013; Young, 2011).

Research Questions

For this study the research questions include; Is the female population in prisons increasing? When did the female population in prisons start increasing, and what have been the trends? Can the female population growth in prisons be connected to the feminist movement? Has the feminist movement changed the perception of women’s contribution and participation in crime?

Hypothesis

The current perception of a woman in today’s society greatly differs from the perception of a woman prior to the feminist movement. Existing research on female offenders and women involved with the criminal justice field has also changed when compared to the research conducted decades prior. Drawing from feminist criminology the following hypotheses have been developed:

Hypothesis 1. After the second wave of the feminist movement in the 1960’s, and the birth of feminist criminology in the 1970’s the number of women in prisons will increase.

Hypothesis 2. The increase of women in prison has occurred the last 20 years.

Hypothesis 3. The increase of women in prison can be representative of a societal shift where gender equality is a common theme in society.

Methodology

For this research the National Prisoner Statistics (NPS) program data, provided by the Bureau of Justice Statistics, was gathered and analyzed. The program distinguishes the difference between custody and jurisdiction. Custody is explained as having physical hold of an inmate in a facility, where as jurisdiction is having legal authority to exercise government power over an inmate regardless of where said person is being held. It is also important to recognize that prisons are state or federally owned

facilities that are long term (meaning one year or longer). It is significant to note three things from the prisoner statistics used for the years 1977 to 2016. First, nonsecure and privately-operated community correction facilities were included in the prison population count. Second, the information being used focuses on prisoners under jurisdiction of state or federal correctional authorities. Finally, if states failed to respond to the National Prisoner Statistics survey the Bureau of Justice Statistics utilized the state's online report or used the information provided the year prior to fill in any gaps.

The data being used in the research includes both state and federal jurisdiction. After statistics were gathered for the years 1977 to 2016 the rates were then calculated per 100,000 male and female U.S. residents. Although the NPS did provide some of the rates for selected years, to maintain consistency all the rates were calculated using the population count for each year provided by the U.S. Census. The incarceration rate for male and female prison population for a selected year was derived by obtaining the estimated prison population for that year divided into the male or female population estimate and then multiplied by 100,000. The resulting number is the rate per 100,000 U.S. residents of the corresponding sex.

Data Analysis

The data presented in Graph 1 indicate that the male population in prison has increased since 1977. In 1992 the male prison population spiked down dramatically to 633,148 prisoners. The highest male prison population was in 2009, with a population of 1,502,002. In recent years the male prison population has gone down since the high point in 2009. The most recent data shows that in 2016 there were 1,393,975 male prisoners.

The data in Graph 2 represents the female prison population, which had a significant increase between the years of 1977 and 2016. The highest number of female prisoners occurred in 2008 with a count of 114,311 prisoners. In recent years the female prison population took a little bit of a dip 2012, with a

count of 108,772 prisoners. The most recent data in 2016 shows that there were 111,422 female prisoners.

The table presented takes in to account the U.S. male and female population. The male and female rate are calculated per 100,000 male and female population. The rates presented reflect the prison population increase in both graphs. The table reveals that the male prison rate increased three times whereas the female prison rate increased six times.

Results

The data indicates that the prison population has grown for both males and females. However, the Uniform Crime reports indicate that crime rates have actually decreased since 1993. This leads to the conclusion that more people are being charged with felonies and are being kept in prisons for a longer period of time. This is a result of the nation-wide war on drugs. During President Reagan's "zero tolerance" policy the rate of female incarceration jumped from 19.2 to 37.6 (table 1). In 2014, 25% of female prisoners were charged with drug offenses. Some data (BJS, 2016) point to the fact that in recent years more women are being arrested for drug related crimes. This participation can be a result of the higher economic stress placed on families and in particular single parent families.

21 years after 1978 you start to see the results of the feminist movement, as shown in table 1. The female prison population rate hit a high in 1999 with 67.1 per 100,000 women in the U.S. Women who were young girls during the change likely raised their daughters with feminist values. When the recession occurred in 2006 the female prison rate increased noticeably once again hitting the highest it has ever been in 2007 with a rate of 74.6. In 2005 to 2006 drug violations began to increase nationwide which could have also led to the spike in 2007.

Through the data it can be seen that after the feminist movement and the birth of feminist criminology the female prison population did in fact increase. The female prison population rate jumped from 10.7 inmates per 100,000 female residents in the

United States in the year 1980, to 35.1 inmates per 100,000 female residents in the United States just ten years later. This growth in the female prison population can be a result of a better understanding of a woman's capability to participate in criminal activity.

In conclusion this study suggests that the feminism and the feminist movement, as it has developed over time, has directly (or indirectly) led to an increase in the incarcerated female population. It is undeniable that the feminism has led greater opportunity for women in higher education, an increase in women's labor force participation and their entrance in to professional careers. Cultural and social change does not occur in a vacuum. The increased number and rate of the incarcerated female population can be viewed as direct (or an indirect) product of feminism and the feminist movement. It is imperative that future researchers conduct studies that support or refute this thesis.

Limitations

The main limitation of this study is its weakness in drawing a direct link or correlation between feminism and the increase in the incarcerated female population. Secondly this study does not include data on what offenses female inmates have been incarcerated for. The research presented was limited to data gathered by The Bureau of Justices Statistics and the U.S. Census. The U.S. census provides only an estimate of the entire population and the specific male or female population. The sex rate calculated was not age specific, so the sex rate calculations included all ages.

Recommendations

The findings of this investigation indicate that women are in fact participating in more criminal activity. Through the use of the UCR, future research can identify what kind of criminal activity women are engaging in and how that data has changed since the feminist movement. For other future research the racial identity and social economic class of the women in prisons should also be taken in to account, to gain a better understanding of the

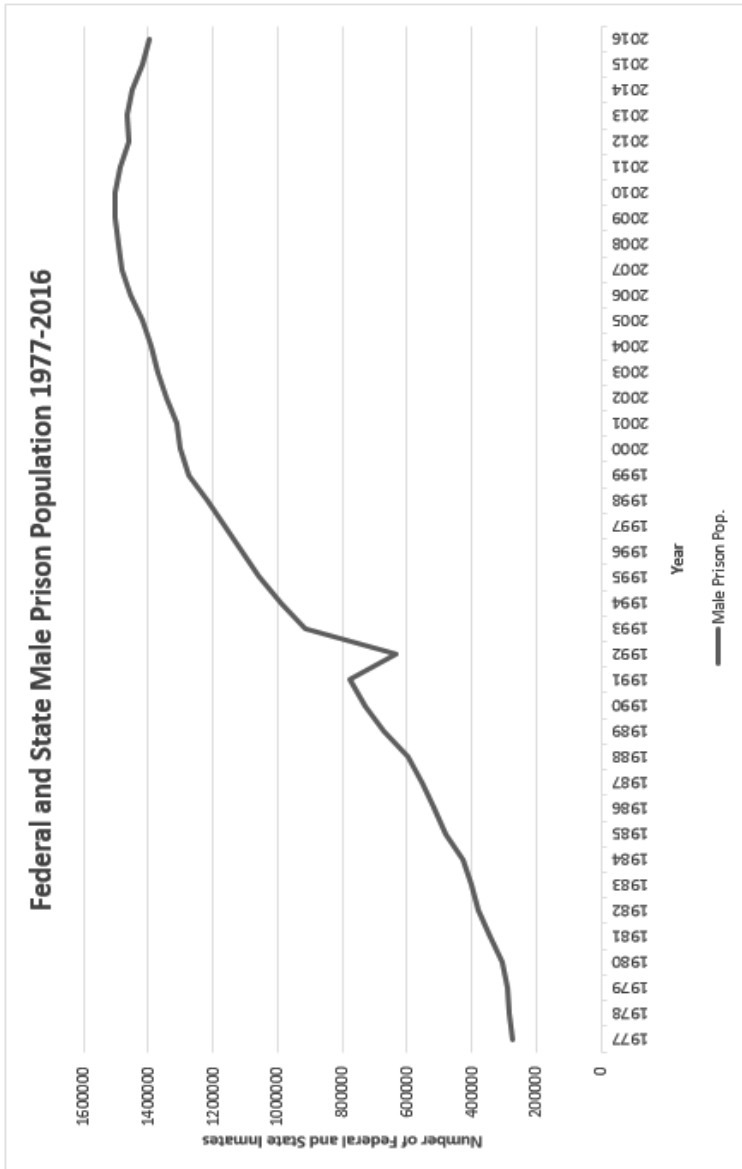
diverse populations in prison. It would be interesting to investigate violent tendencies of young ladies in juvenile detention centers over the past 20 years. This information will provide better insight into the idea that women are becoming “more violent”.

Data

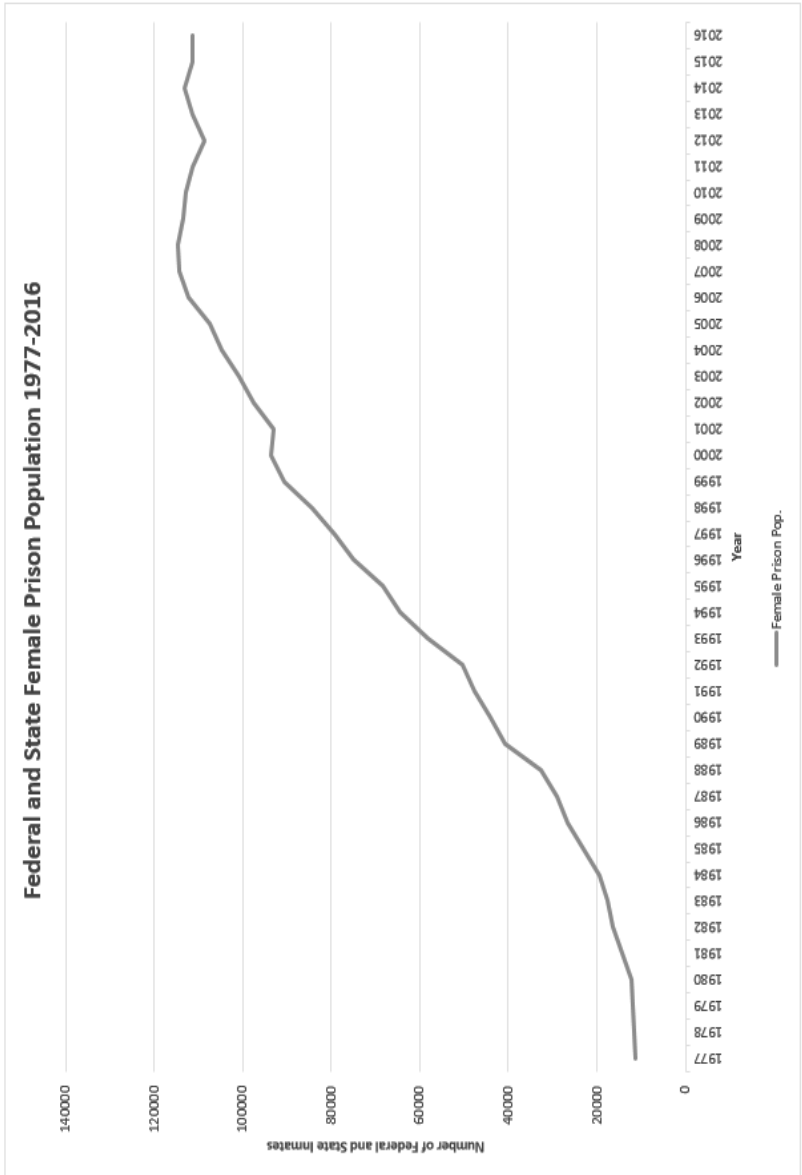
Table 1. Male and Female Prison Population per 100,000 Males/Females in the U.S.

Years	Male Prison Population	Male Rate	Female Prison Population	Female Rate
1977	671,991	255.5	11,212	9.9
1978	729,804	260.8	11,583	10.1
1979	775,723	264.1	12,005	10.3
1980	633,184	269.8	12,331	10.7
1981	912,194	298.8	14,298	12.3
1982	990,733	329.3	16,441	14.1
1983	1,057,406	346.5	17,476	14.8
1984	1,108,396	365.2	19,395	16.2
1985	1,162,885	407.9	23124	19.2
1986	1,216,219	456.8	26,655	21
1987	1,273,171	462.7	29,064	23.7
1988	1,303,421	489.8	32,592	26.4
1989	1,311,053	547.8	40,646	32.7
1990	1,342,513	587.8	44,065	35.1
1991	1,367,755	617.4	47,691	37.6
1992	1,392,278	500	50,409	39.2
1993	1,418,392	713.1	58,250	44.8
1994	1,456,366	769.4	64,340	48.9
1995	1,482,524	808.7	68,468	51.8
1996	1,493,670	835.9	74,970	56.5
1997	1,502,002	866.1	79,268	59.3
1998	1,500,936	892.6	84,354	62.9
1999	1,487,561	923.2	90,530	67.1
2000	1,461,625	941.4	93,504	65
2001	1,465,592	937.1	92,979	64
2002	1,449,291	950.5	97,631	66.8
2003	1,415,112	960.3	100,846	68.2
2004	1,393,975	968	104,822	70.3
2005	671,991	976.8	107,518	71.5
2006	729,804	993.1	112,308	74
2007	775,723	1001.2	114,311	74.6
2008	633,184	999.1	114,612	74.1
2009	912,194	995.9	113,485	72.7
2010	990,733	986.7	112,867	71.7
2011	1,057,406	961.9	111,407	70.9
2012	1,108,396	941.7	108,772	68.4
2013	1,162,885	931.7	111,358	70
2014	1,216,219	914.6	113,028	70.5
2015	1,273,171	888.4	111,491	68.9
2016	1,303,421	863.6	111,422	68.7

Graph 1. U.S. Federal and State Male Prison Population 1977-2016



Graph 2. U.S. Federal and State Female Prison Population 1977-2016



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Synthesis of a Fluorescent and Colorimetric Chemosensor for detection of trivalent cations

Crystalrose Quintero



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Abstract: 1,4-bis(4-diethylaminobenzyl)-2,3-diaza-1,3-butadiene (dye 1) has been synthesized. Dye 1 behaves as a colorimetric and fluorescent chemosensor for trivalent metal ions (Fe^{3+} , Cr^{3+} and Al^{3+}) in solution. The stoichiometry of the reaction between dye 1 and the metal ions Al^{3+} and Cr^{3+} was determined to be 1:1 by the Method of Continuous Variation. The limit of detection for Fe^{3+} , Cr^{3+} and Al^{3+} were determined to be 15 μM , 6 μM , and 8 μM , respectively.

1. Introduction

Trivalent metal cation detection is prevalent in today's research studies.¹ Metal cations are pertinent to the health of the human body and serve in noteworthy biological roles.¹ Iron is a biologically important molecule necessary for the production of central protein molecules such as hemoglobin. Iron deficiency can affect this and lead to diseases such as anemia.² Diseases such as diabetes and Parkinson's are more likely to occur as a result of iron deficiency.³ Aluminum exposure occurs through both dietary and non-dietary means. High intake or exposure to this metal has been found to provoke neurological disorders.⁴ Chromium in its trivalent state plays an important role in insulin regulation and glucose metabolism. Deficiency of chromium has been linked to

the development of diabetes. Exposure to metals non-essential for human health occurs through heavy metal contamination of bodies of water and urban soils by manufacturing processes.⁵

Synthesis of chemosensors as a method for cation detection has been researched and a topic of growing interest.⁶ Recently, fluorescence and absorbance chemosensors have been synthesized for trivalent cations⁷. A chalcone based chromofluorogenic probe has been synthesized and has the capability of sensing 6 trivalent cations which include Al^{3+} , Fe^{3+} , Cr^{3+} , Ga^{3+} , In^{3+} , and As^{3+} . While it is chromofluorogenic for trivalent cations over mono- and divalent cations, it does not distinguish among the 6 metals⁸. A rhodamine-based fluorometric and colorimetric probe has been selective toward Fe^{3+} , Al^{3+} , and Cr^{3+} . The focus of the experiment is on the selectivity of trivalent cations over mono and divalent metals. How pH affects fluorescence and a Job's plot is presented in the results. But, there is little focus on how the ligand synthesized absorbs in the presence of the indicated trivalent metals⁸. Another approach to detecting trivalent cations involved colorimetric test strips.¹⁰ Strips containing a spiropyran chemosensor were prepared; drops of trivalent metals were applied to the strips and the metal was detected via a color change. Although publications relevant to trivalent cation detection exist, limitations such as synthetic complexity and high limits of detection limit their use.

In this study, the approach was to detect the trivalent metal cations Al^{3+} , Fe^{3+} , and Cr^{3+} through the use of 1,4-bis(4-diethylaminobenzyl)-2,3-diaza-1,3-butadiene (**dye 1**). The synthesis of **dye 1** is presented in Figure 1. The stoichiometry between the dye and the metal ions was determined. The stoichiometry was investigated via constructing a Job's plot and performing a titration. Method validation was determined using such parameters as selectivity and limit of detection when quantifying the trivalent cations.

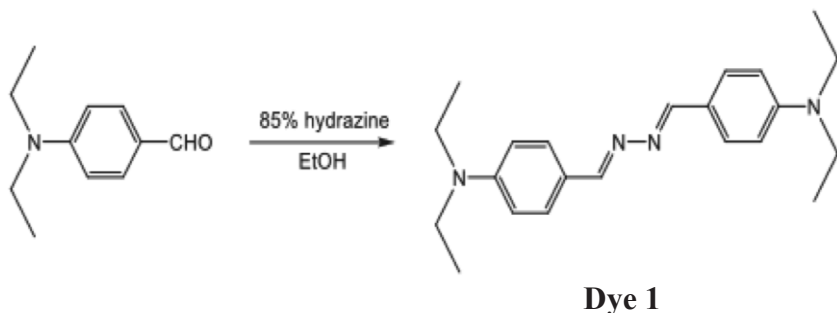


Figure 1. Synthesis of **dye 1**.

2. Experimental

Materials

2.1 Reagents and chemicals

Ferric chloride anhydrous and Chromic Nitrate were purchased from Fischer Scientific. High purity Acetone 99.5% lab reagent, 4-ethyl diaminobenzaldehyde, and 99.5% anhydrous ethanol 200 proof were purchased from sigma aldrich. Hydrazine hydrate was purchased from Acros Organic. Ultrapure water was provided by St. Mary's Ultra pure system.

2.2 Synthesis of Dye 1

4-ethyl diaminobenzaldehyde (1.25 g, 7 mmol) and Hydrazine hydrate (0.23 g) was dissolved in 99.5% anhydrous ethanol (50 ml) on a stir plate. The mixture was stirred overnight. The resulting yellow precipitate was isolated via vacuum filtration and rinsed with ethanol. The percent yield was calculated to be 78%.

2.3 Instrumentation

Absorption spectra were recorded using a UV-1800 Shimadzu Spectrophotometer. Fluorescence spectra was measured using FL-1065 Horiba Fluorolog. Mass of any solids were taken with a TLE 104E Mettler Toledo HIS Stem scale. 1cm path length glass cuvettes were used to perform fluorescence and absorption.

2.4 Procedure

A 1 mM stock solution of **dye 1** was prepared in acetone. A 1 mM stock solution of metal ion was prepared in water. Subsequent dilutions of all solutions were prepared in acetone. To prepare the Job's plot, 50 μM solutions of dye and metal ion were mixed with varying ratios to a total volume of 10 mL. Absorption spectra were acquired between 300-600 nm. The absorbance at 500 nm was used to construct the Job's plot.

The titration experiment was conducted in two ways. First, 3 ml of 20 μM **dye 1** was added directly to a cuvette. Increments of 250 μL of metal ion was added and absorbance data was acquired after each addition. Second, 3 ml of the metal ion was added to the cuvette and 250 μL increments of **dye 1** were added. The titration curve was prepared by plotting the absorbance at 500 nm as a function of volume added.

Calibration curves were generated by preparing a series of solutions containing 20 μM dye and varying concentration of metal ion. Absorbance spectra were recorded for each solution and calibration curve was graphed from absorbance values at 500 nm.

3. Results and Discussion

3.1 Chromium

Figure 2 shows the absorbance spectra of dye in the absence and upon the addition of Cr^{3+} . Visually, the addition of Chromium produced a color change from yellow to orange, corresponding to the appearance of the peak at 500 nm.

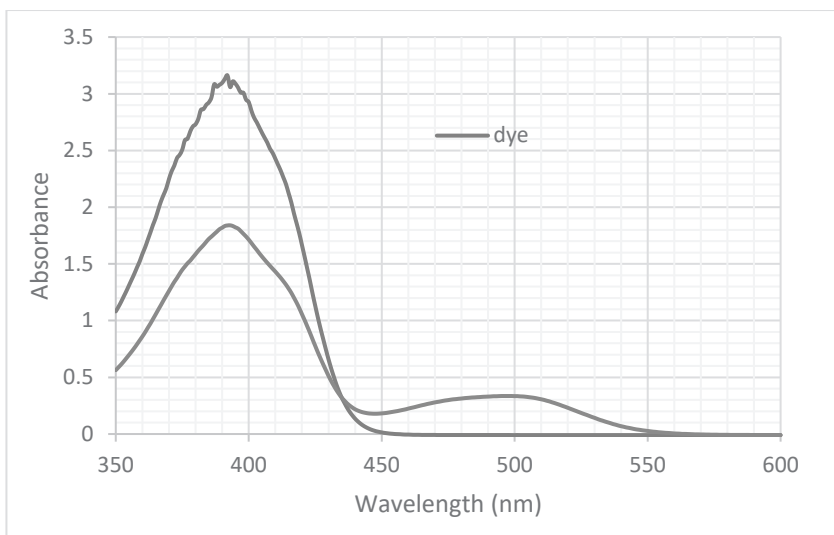


Figure 2. Absorbance spectra of **dye 1** (blue) and **dye 1 + Cr³⁺** (red).

A Job's plot displayed a maximum at mole fraction of 0.5, as seen in Figure 3. This confirmed a 1:1 ratio of dye to Cr³⁺. Mole fraction of dye passed 0.7 dropped below zero in absorbance; therefore significant data is apparent in dye mole fraction up to 0.7



Figure 3. Job's plot for metal-ligand complex between dye 1 and Cr³⁺. Absorbance was measured at 500 nm.

Titration of Cr^{3+} into the cuvette produced a gradual change at around 580 μL of Cr^{3+} , as seen in Figure 4. The absorbance graph at 500 nm wavelength began to level off at 500 nm and absorbance of 0.25. The leveling off at 500 μL of Cr indicated a 1:1 ratio.

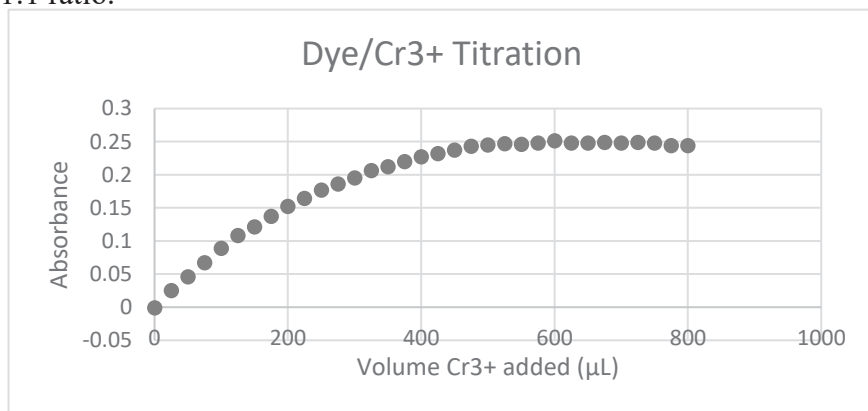


Figure 4. 250 μL increments of Cr^{3+} titrated and absorbance spectra taken at 500 nm wavelength.

The calibration curve, shown in Figure 5, had a linear relationship starting at 6 μM Cr^{3+} . No significant absorbance was detected at a concentration below 6 μM of Cr^{3+} . The linear relationship depicts how the concentration of the metal affects absorbance. From the calibration curve the limit of detection was calculated to be 6 μM .

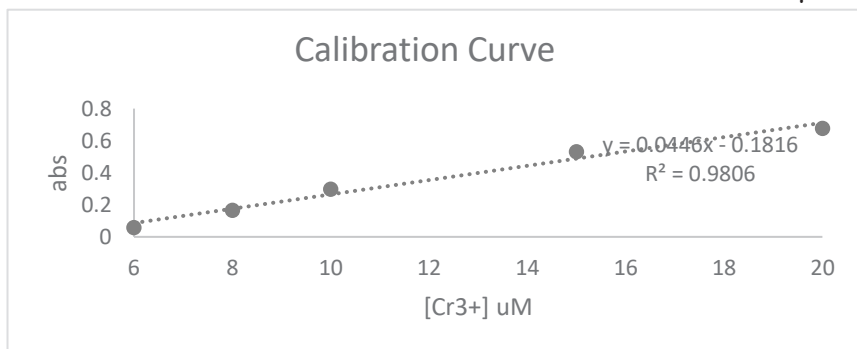


Figure 5. absorbance measured at 500 nm wavelength with varying concentrations of Cr^{3+} plotted

3.2 Aluminum

Aluminum Job's plot exhibited a maximum at 0.5 mole fraction of dye. This proved the stoichiometric ratio of Aluminum to dye to be 1:1. After about 0.7 mole fraction, the absorbance dropped below zero. Therefore, significant data pertinent to understanding Aluminum and dye stoichiometry reaches up to 0.7 X dye.

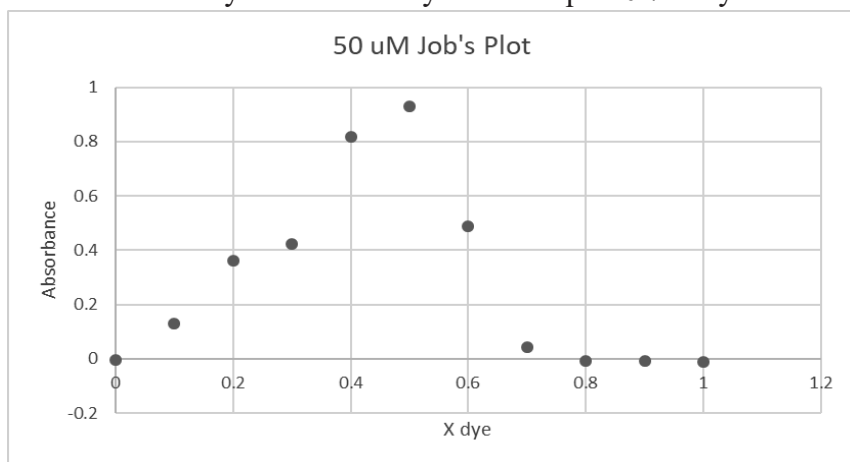


Figure 6. Job's plot for metal-ligand complex between dye 1 and Al^{3+} . Absorbance was measured at 500 nm.

Titration of aluminum into the cuvette beginning with 3 ml of dye produced a gradual increase in absorbance. The absorbance data taken at 500 nm wavelength showed a leveling at around 500 μL of Al^{3+} . This further proved aluminum-dye complex to be a 1:1 ratio.

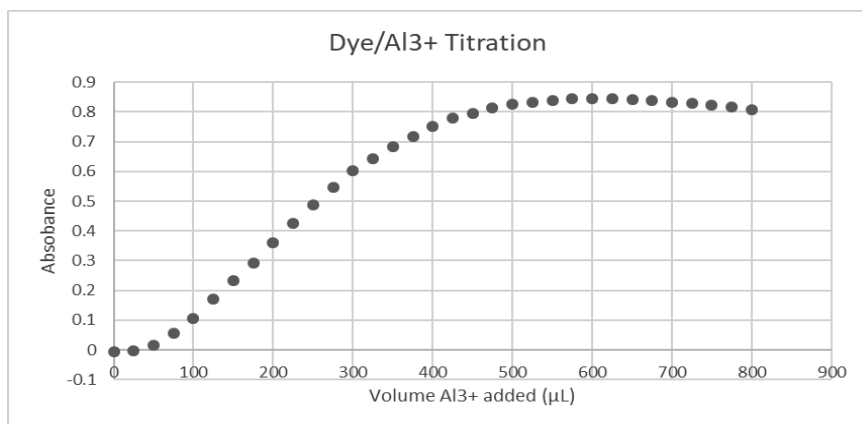


Figure 7. 250 µL increments of Al³⁺ titrated and absorbance spectra taken at 500 nm wavelength.

Calibration curve of aluminum began a linear relationship at around 6 µM. Little to no absorbance was detected at around 5 µM as observed in figure 8. The linear relationship in the curve was used to help find the limit of detection, which was calculated to be 8 µM.

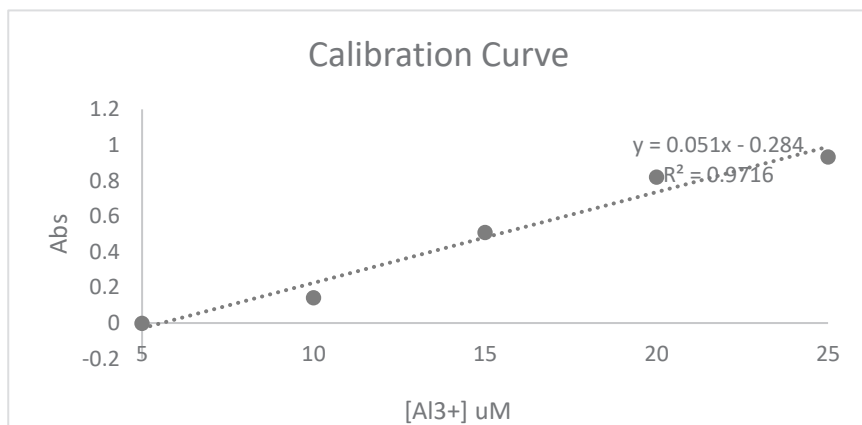


Figure 8. absorbance measured at 500 nm wavelength with varying concentrations of Al³⁺ plotted

3.3 Iron

Titration of iron into cuvette containing 3 ml of dye initially, showed no significant change in absorbance from 0-600 μL . After 600 μL a significant increase occurred that began to level off at around 1000 μL .

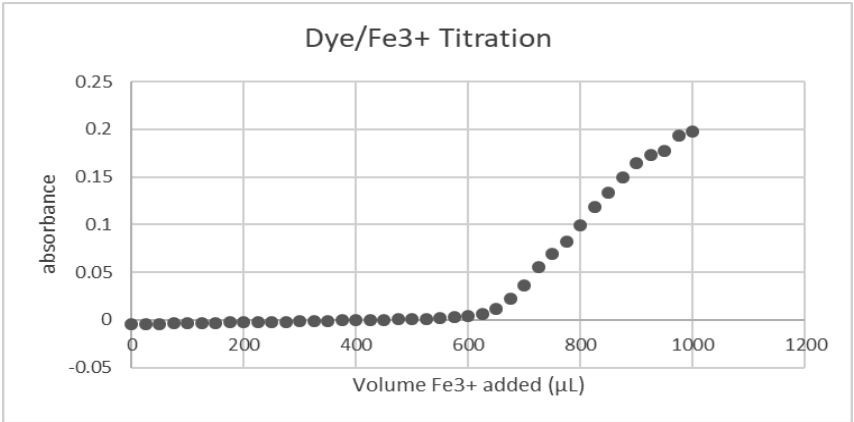


Figure 9. 250 μL increments of Al^{3+} titrated and absorbance spectra taken at 500 nm wavelength.

The calibration curve of iron began linear relationship at around 14 μM . at around 14 μM , little to no significant absorbance was taken. The limit of detection was determined to be 15 μM as calculated from the linearity of the calibration curve.

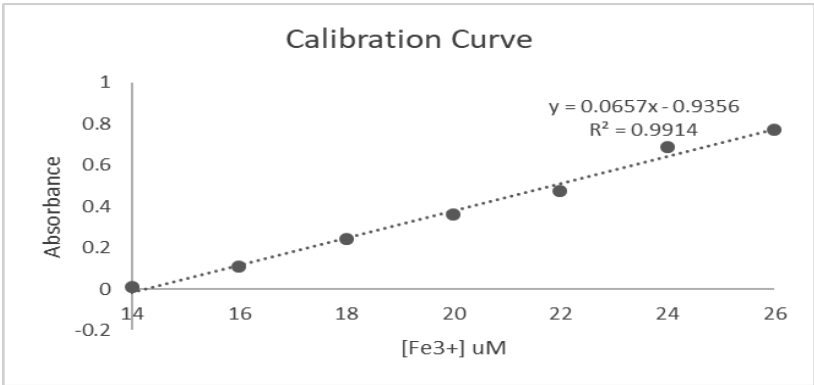


Figure 10. absorbance measured at 500 nm wavelength with varying concentrations of Fe^{3+} plotted

3.3 Sensitivity

Solution of varying metal ions and dye showed little to no significance in absorbance at 500 nm wavelength. In the presence of Cr^{3+} solutions of other metal ions and dye had absorbance taken; at 500 nm wavelength, Fe and Al were not affected by the presence of other metal ions.

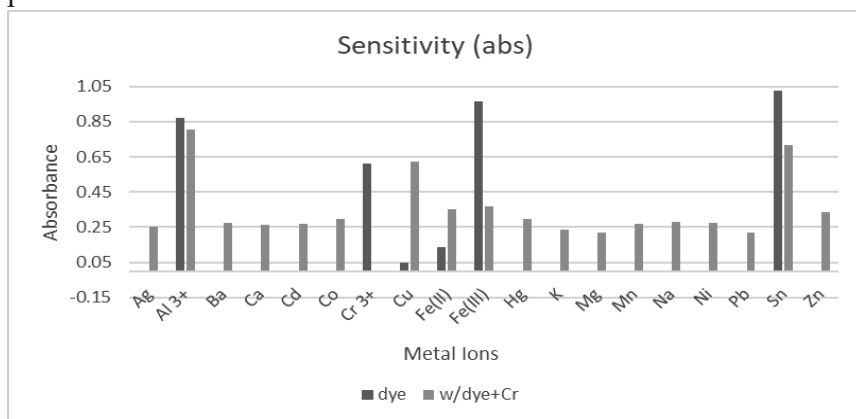


Figure 11. sensitivity measured at 500 nm wavelength. Solutions of varying metal ions and dye had absorbance taken; And solutions of varying metal ions and dye in the presence of Cr^{3+} .

Conclusion

In summary, **dye 1** is a colorimetric and fluourometric chemosensor for detecting the presence of Cr^{3+} , Al^{3+} , and Fe^{3+} . The stoichiometric ratio of metal to ligand is 1:1 as proven by Job's plot and titration. Dye 1 is selective toward the indicated trivalent cations indicated over other metals and is not affected significantly by the presence of other metals. With a moderate low detection limit for Cr^{3+} , Al^{3+} , and Fe^{3+} it is a candidate for metal detection of the metals.

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Analysis of Machine Learning: A Comparison of Classification Accuracy Between Decision Trees and Neural Networks in R

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The accuracy of classification is highly relevant in the fields of data science, computer science, data analytics, and artificial intelligence. Some of the most well know classification machine learning techniques are neural networks and decision trees. R, a statistical programming language, has become popular because of its high abstraction, graphing abilities, multipurpose programming ability, being open sourced, and the use of a wide variety of packages with consistently updated libraries. Decision trees typically make predictions about categorical data to make predictions as to the groups that are the best fit for specific data. Higher depths of a decision tree allow for more accuracy but is prone to overfitting the data it is analyzing which can decrease the accuracy of the decision tree on testing data. Neural networks are flexible in their ability to analyze data because they are designed to mimic the functionality of biological neurons. One of the many capabilities of the neural network is to analyze data based on classification, but like decision trees, neural networks are prone to overfitting training data which can cause inaccurate classifications in test data. With 1000 iterations this project showed that the difference of the means of accuracy between the neural network with the hidden layer size of 10 and the decision

trees was not significant ($p=0.4789$) at an alpha level of 0.01. The means of accuracy between the neural network with the hidden layer size of 100 and the decision tree was not significant ($p<2.2e-16$) at an alpha level of 0.01.

Literature Review

Machine learning Algorithms

A Machine learning algorithm is a technique that allows a computer to read, analyze, and make predictions about data. Often statistical techniques are used for machine learning to perform the computation which analyzes the relationships that different types of data may have. Statistical methods are effective ways to measure specific correlations that may occur in nature. Several factors give power to the algorithm's ability to make accurate predictions of unknown or future data. Depending on the dataset certain types of machine learning algorithms will be more efficient, accurate, or robust. Connections between information inside of datasets may be ambiguous or complex because the data was scattered with relationships that are not significant enough and have large confidence intervals of error making accurate conclusions more challenging to define. These methods may test various best fit scenarios but may fail to converge due to weak correlations or insufficient amounts of data (Lim, Loh, & Shih, 2000).

Neural Network

Much research has investigated the accuracy of various machine learning. Neural networks have been the focus of much of the investigation. These investigations analyze different algorithms by running different data sets and bootstrapping the algorithms to test their accuracy in predicting data (Cheng & Titterington, 1994). Studies have shown that neural networks have high accuracy, and smaller error in most cases, but the algorithm was prone to overfitting which can increase error. Neural networks are designed to mimic the brain as the receptors taking in the data act similarly to dendrites, and each perceptron

establishes some network to test data at different weights. With different weights tested on the data, each factor will make more significant contributions to reach the desired output. Large iterations are needed to provide the most accurate output but may be possible that the algorithm may not converge on a single output. With different weight on specific variables can strongly influence what the neural network will produce as an outcome (Gupta & Sexton, 1999).

Genetic Algorithm

Genetic algorithms are evolutionary algorithms which have been shown to be highly accurate with varying complexities and low error. A statistical study focuses on different parameters that affect genetic algorithms and using an Analysis of Variance to show the significance of differences in statistical power. The genetic algorithm works to find the best fit of information that optimizes the solution. It breaks down and adds weight to specific factors to meet the ideal outcome. The genetic algorithm tests several different possible solutions and of the best ones randomly selecting components from both to account for some variability found in the data. Comparing each generation and various weights added to each component it eliminates the weakest factors and promotes the stronger factors. With each generation, it gradually comes closer to the desired outcome with less of a confidence interval for error (Rojas et al, 2002). The algorithm imitates the behaviors of natural selection as one generation is broken into various parts of that generation and will be inherited by the next generation. These processes are known as selection and recombination (Whiteley, 1994).

Decision Trees

Decision trees assign specific probabilities to different possible outcomes to decide based on the information given to the decision tree. The decision trees allow for more accurate decisions because of their ability to parse through data based on the categorization of the different outcomes. Overall, the decision

tree technique can be useful if all necessary information for problem-solving is made available (Magerman, 2018).

Genetic Algorithms and Neural Networks

Genetic algorithms are defined for optimization, and neural networks are defined based on their function approximation (Gupta & Sexton, 1999). Various studies on neural networks show they can be optimized by using genetic algorithms to optimize different weights of the neural network. The genetic algorithm optimizes the factors that contribute to a neural network creating the best fit to perform an analysis with the neural network to produce a more desired output. Backpropagation decreases the error that may usually be produced with a traditional neural network (Gupta, & Sexton, 1999; Leung, Lam, Ling, & Tam, 2003; Shen, Wang, & Li, 2007).

R

The R program is an interpreted object-oriented programming language used for statistical analysis. R uses straightforward syntax that may be easier to learn compared to more traditional programming languages. Its syntax allows users to create functions, define loops, define variables, and interpret Boolean logic (The R Project for Statistical Computing, 2018). The software is free and has several packages with many libraries for statistical analysis, graphs, machine learning and a wide range of other tools. The package GA can be used for genetic algorithms (Scrucca, 2017). The package called nnet can be used for neural networks (Venables & Ripley, 2002). The package used for the decision tree was “rpart” (Therneau, Atkinson, & Ripley, 2018).

Hypothesis

The comparison between the neural network and the decision tree was made by analyzing the accuracy of the algorithms ability to make accurate predictions on test data. If the two methods of machine learning are evaluated by the comparison of their accuracy, then the true difference in means will be equal to zero. If the neural networks hidden layer

parameter is backpropagated by the genetic algorithm--or tested at different sizes--then the neural network will produce significantly more accurate classifications than the decision tree.

Method

For this project, several packages were installed including the `nnet` package which has the function used for the neural network, the package for the genetic algorithm GA with the function `ga` which was intended to optimize the neural network, and the decision tree package “`rpart`” has the function `rpart` which was used for decision tree classification. A matrix to store data was created with two columns and 1000 rows. The first column holds the accuracy of the predictions made by the neural network, and the second column holds the accuracy of the predictions made by the decision tree. A for-loop that ranges from one to 1000 was created to run the simulation and analysis 1000 times. The `rnorm` function is used to select four random numbers, with a mean of 100, and a standard deviation of 50 for both the x-axis and y-axis respectively. A matrix of three columns and 400 rows was created to store the training data. A second matrix of two columns and 400 rows was created to store the test data. The third matrix of 1 column and 400 rows was created to store the correct classifications for the test data. A single for-loop from the range one to 100 created to simulate the first group. The `rnorm` function is used to scatter data normalizing around the first point. The data is stored in the first matrix with a column length of 400. The first 100 points belong to group one, the next 100 points belong to group two, the following 100 points belong to group three, and the final 100 points belong to group 4. The data in the matrix is then randomly sampled to ensure variance in the categorizing of the groups. An example of the data can be found in Appendix A.

The data was classified and run through the neural network. The neural network function `nnet` used the parameters of the training data, the classifications of the test data, the size of the hidden network set to 100, and `softmax` set to true, all other parameters are set to the default. Initially, the hidden layer of the

neural network algorithm was intended to be optimized by the genetic algorithm, but the program was instead run twice with a hidden layer size of 10 and 100 (Appendix B). To predict the classes of the test data the function `predict` was used with the parameters of the neural network, the test data, and the type `class`. Accuracy was then calculated based on the percent correct of the prediction and the real classifications of the test data. The accuracy was then stored in the original matrix.

A data frame was created from the simulated data to be analyzed by the decision tree. The training data was passed as parameters to be interpreted by the function, and the method parameter was set to `class`, and all other parameters were set to default. The `predict` function was used to make predictions on the decision tree. Passed as the parameters for the `predict` function were the decision tree, the training data, and the type parameter set to `class` for the classification. R code used for the project can be found under Appendix C.

Results

An independent samples t-test was conducted with an alpha level of 0.01 to compare the means of the accuracy of predicted classifications on simulated data between the neural network and the decision tree. The mean differences were not significant for the neural network with a hidden layer of size 100 ($M=93.18325$, $SD=7.176724$) and the decision tree ($M=92.955$, $SD=7.236157$) with the conditions $t(1998)=0.70823$, $p=0.4789$. The test was run 1000 times, and 52.2% the accuracy of the neural network was better than the decision tree, for 37.1% of the trials the decision tree was slightly more accurate, and for 10.7% of the trials the neural network and decision tree had the same percent of accuracy. The analysis could not be run based on the backpropagation of the neural network algorithm due to the R program crashing while running the function to evaluate the parameters of the neural network.

The program was re-run with a neural network hidden layer size of 10 and a t-test conducted with an alpha level of 0.01

between the new neural network ($M=82.764$, $SD=21.53113$) and the decision tree ($M=93.269$, $SD=7.107789$) were not significant with the conditions $t(1998)=-14.651$, $p<2.2e-16$. The neural network was more accurate than the decision tree 36.3% of 1000 iterations. The decision tree was more accurate than the neural network with 10 hidden layers 56.9% of 1000 iterations. For 6.8% of the 1000 iterations, the neural network and the decision tree had the same prediction accuracy of the test data. For each technique, most of the most accurate percentages were found normalized around a mean of 100%, the optimal accuracy (Appendix D).

Discussion

Software Limitations

While running the genetic algorithm function (ga) with the intention to optimize the neural network (nnet) R would crash. Other neural network functions or genetic functions may be a better option when trying to optimize the size of the hidden layers parameter for the neural network. Other programming languages may also be more viable in optimizing the parameters of the hidden layer of the neural network. With an ideal sized parameter, the neural network's capability for accuracy may exceed the decision tree.

Future Directions

Future directions for the project may include a larger analysis of more machine learning techniques. Possible directions include a comparison of regression of machine learning techniques in R or python and further investigation into the backpropagation of algorithms using the genetic algorithm. The application of neural networks or decision trees for classification on real datasets. Something to further research is the possible correlation between a neural network's hidden layer size and the mean of the prediction accuracy.

Conclusion

The accuracy of making predictive classifications is not different between the neural networks and the decision tree. Both machine learning methods seem to be effective in their analysis and their ability to make accurate classifications. The analysis made by neural networks with different hidden layers may be more accurate with higher sizes but also failed to be significant in comparison to the decision tree. There was some variation that seemed consistent with the neural network's size of their hidden layer of nodes. The decision tree seemed to more accurate in its predictions than the predictions made with the neural network with a hidden layer size of 10, but the predictions made with the neural network with a hidden layer of size 100 seemed to make better predictions more often than the decision tree.

Overall, the R packages prove to be effective in making predictive categorizations whether the machine learning technique that is favored is the decision tree or the neural network. Some further testing is needed to evaluate the backpropagation of neural network algorithms using a genetic algorithm in R.

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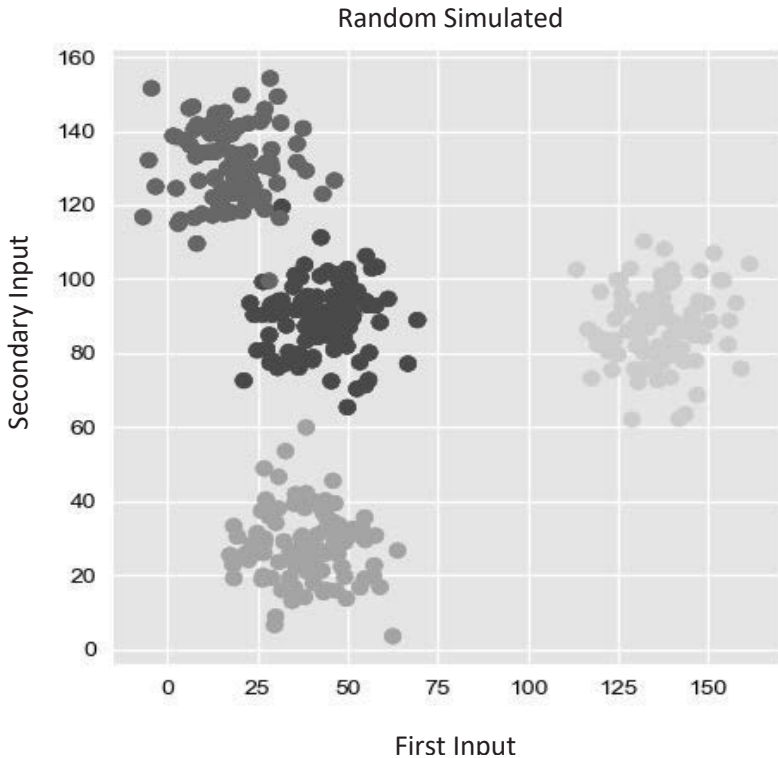
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Appendix A

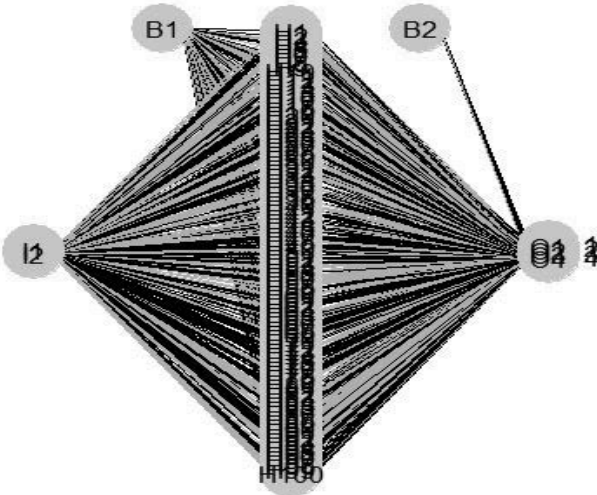
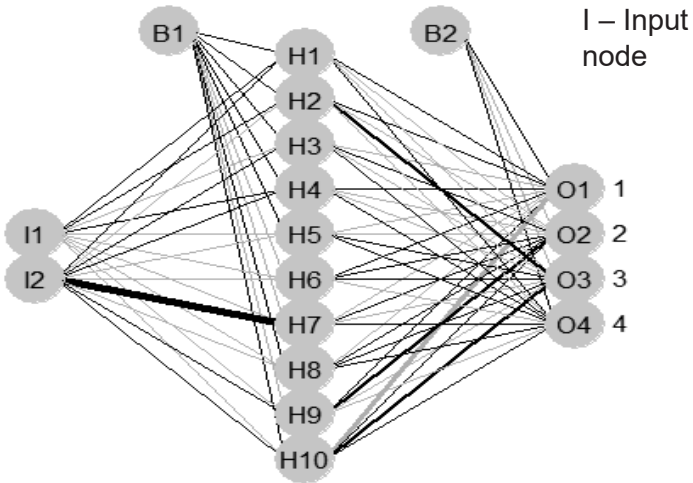
Example of Random Simulated Categorical Data

The data points on the scatter plot represent the random simulated categorical data. Each color of the dots represents a different hypothetical group. The groups in the project were listed as 1, 2, 3, and 4. The value on the x-axis represents the first input this value was normalized around the mean of 100, and each group was normalized around a single point. The y-axis represents the second input value where each group is normalized around a random point normalized around a mean of 100. The more each group overlaps with another increases the ambiguity of which group a single data point may belong to, which, decreases the accuracy of the predictions made by the machine learning method.



Appendix B

Neural Networks with 10 Hidden Layers and 100 Hidden Layers



Appendix C

R Code

```

#-----
# R program
# by Gabriel Reyes
# Summer 2018
# For McNair Scholars Program at St. Mary's
University
# This program simulates data that is analyzed
# by a neural network (nnet) and a decision
# tree (rpart). Accuracy of prediction is
# calculated over 1000 iterations and compared.
#-----
install.packages("nnet")
library(nnet)
install.packages("GA")
library(GA)
install.packages("rpart")
library(rpart)
# 1000 iterations / trials
Accuracy <- matrix(ncol = 2, nrow = 1000)
for (k in 1:1000)
{
# Create random cloud of scattered data
# X is training data
# y is test data
xran <- rnorm(4,100,50)
yran <- rnorm(4,100,50)
X <- matrix(ncol = 3, nrow = 400)
y <- matrix(ncol = 2, nrow = 400)
yreal <- matrix(ncol = 1, nrow = 400)
for (i in 1:100){ # group 1
X[i,1] <- rnorm(1,xran[1],10)
X[i,2] <- rnorm(1,yran[1],10)
X[i,3] <- 1
y[i,1] <- rnorm(1,xran[1],10)

```

```

y[i,2] <- rnorm(1,yran[1],10)
yreal[i,1] <- 1
}
for (i in 101:200){ # group 2
X[i,1] <- rnorm(1,xran[2],10)
X[i,2] <- rnorm(1,yran[2],10)
X[i,3] <- 2
y[i,1] <- rnorm(1,xran[2],10)
y[i,2] <- rnorm(1,yran[2],10)
yreal[i,1] <- 2
}
for (i in 201:300){ # group 3
X[i,1] <- rnorm(1,xran[3],10)
X[i,2] <- rnorm(1,yran[3],10)
X[i,3] <- 3
y[i,1] <- rnorm(1,xran[3],10)
y[i,2] <- rnorm(1,yran[3],10)
yreal[i,1] <- 3
}
for (i in 301:400){ # group 4
X[i,1] <- rnorm(1,xran[4],10)
X[i,2] <- rnorm(1,yran[4],10)
X[i,3] <- 4
y[i,1] <- rnorm(1,xran[4],10)
y[i,2] <- rnorm(1,yran[4],10)
yreal[i,1] <- 4
}
# randomize data
X2 = X[sample(1:400),]
# fit data for Genetic Algorithm
lst_CV_data <- lapply(1, function(i)
list(train_data = X2, test_Data = y, test_real =
yreal))

# create the columns for classification
ideall <- class.ind(X2[,3])
# run neural network
NeuralNet1 <- nnet(x=X2[,1:2], y=ideall,
size=10, softmax=TRUE)
# make a prediction

```



```

Predict2iction1 <- predict(NeuralNet1, y,
type="class")
# Calculate Accuracy
Compare1 = (yreal == Predict2iction1)
Accuracy1 = length(Compare1[Compare1 ==
TRUE])/length(Compare1) * 100

# create a data frame with data
X3 <- data.frame(X2)
# run the decision tree
fit <- rpart(X3[,3]~., data= X3[,1:2],
method="class")
# create data frame with test data
y2 <- data.frame(y)
# make a prediction
Predict2 = predict(fit,y2,type="class")
# calculate accuracy
comp = yreal == Predict2
Accuracy2 = length(comp[comp ==
TRUE])/length(comp) * 100

# Evaluate the parameters
evalParams <- function(train_data, test_data,
test_real, Size) {
  # fit nnet
  train_data = train_data[sample(1:400),]
  ideal <- class.ind(train_data[,3])
  NeuralNet = nnet(x=train_data[,1:2],
y=ideal, size=Size, softmax=TRUE)
  Predict2iction <- predict(NeuralNet,
test_data, type="class")
  # Calculate Accuracy
  Compare=(test_real==Predict2iction)
  Accuracy =
length(Compare[Compare==TRUE])/length(Compare) *
100
  return(Accuracy)
}

# Evaluate the fitness of the neural network

```

```

fitnessFunc <- function(x, lst_CV_Data){
  Size <- x[1]
  # Run evalParams function
  Accuracy <- sapply(lst_CV_Data,
function(in_data) with(in_data,
evalParams(train_data, test_Data, test_real,
Size)))
  return (Accuracy)
}

# upper and lower limits
theta_min <- c(Size = 1)
theta_max <- c(Size = 10)

# run genetic algorithm *Note this line of code
is commented out
#results <- ga(type = "real-valued", fitness =
fitnessFunc, lst_CV_data, names =
names(theta_min), lower = theta_min, upper =
theta_max, popSize = 10, maxiter = 10)

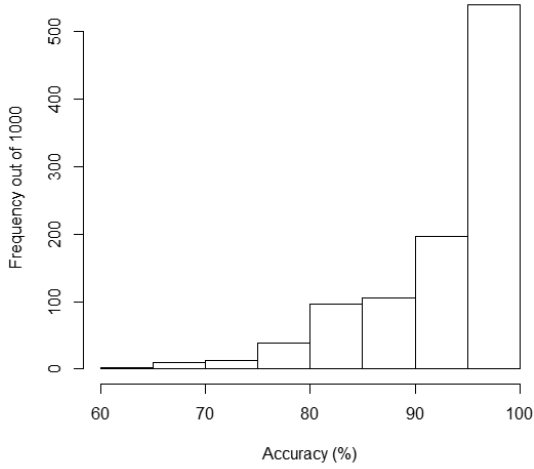
# store accuracy into matrix
Accuracy[k, 1] <- Accuracy1
Accuracy[k, 2] <- Accuracy2
}

```

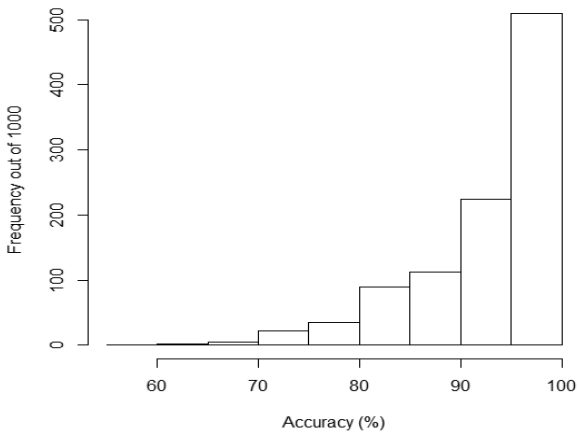
Appendix D

Histograms of Neural Networks and Decision Trees

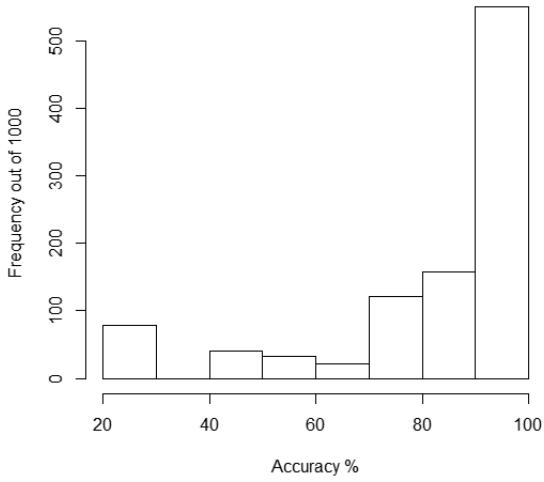
Histogram of Neural Network 100 Hidden Layers



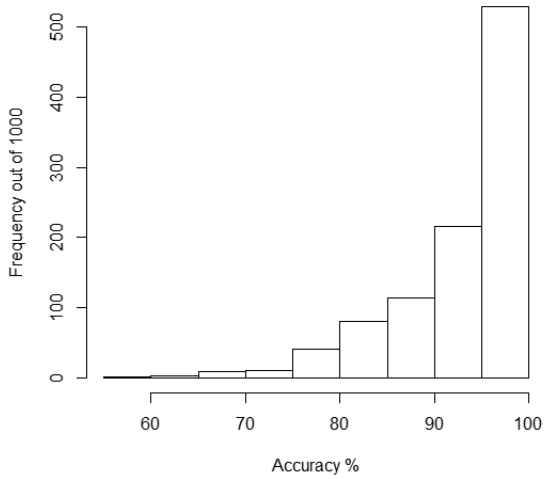
Histogram of Decision Tree



Histogram of Neural Network 10 Hidden Layers



Histogram of Decision Tree



A Clear as Mud: Colorism's Independence as A Form of Discrimination from Racism

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St. Mary's University



Racism is an enduring system of discrimination that is responsible for many continuing problems in contemporary society. Colorism and its effects can and should be thought of independently from racism. The present paper argues that colorism as such is not reducible to a mode or extension of racism. The paper first outlines the scholarship on race and racism, then surveys contemporary accounts of racism. Next, the paper explores the question of color in relation to racism and colorism. After surveying contemporary accounts of colorism, the paper demonstrates the problems of conceptualizing colorism as a mere manifestation of racism.

The methodical reason for exploring race, racism and color prior to colorism is that at a rudimentary understanding of these concepts assists in conceptualizing colorism. Since the present paper argues that colorism is not reducible to a mode or extension of racism, an exploration of 'racism' is crucial for an understanding of what colorism is not reducible to. In so far as an exploration of 'racism' is crucial, an understanding of the history of the idea of race is also important to grasping the complexity of the various accounts of racism. Furthermore, since the present paper's concerns regarding colorism survey accounts of racism and colorism an exploration of color is provided as it is a shared mode of discrimination by both systems.

The Idea and Ontological Status of Race

Modern racism has been formed with the idea of race.ⁱ In recognition of this relationship, the aim for this section is to briefly discuss the idea of race to understand its influence on racism. Thus, this section will first briefly outline scholarship on the idea of race, then explore various accounts of the ontology of the idea of race.

The conception of race has changed drastically overtime, and its first discussions have been attributed to the Purity of Blood Statutes of Spain in the fifteenth-century, or the debates by Bartolomé de Las Casas and Gines de Sepúlveda.ⁱⁱ Nevertheless, per Bernasconi and Lott, the first person to use the word race to mean “a major division of humanity displaying a distinctive combination of physical traits transmitted through a line of descent” was François Berneir.ⁱⁱⁱ However, Immanuel Kant is recognized as the first person to propose a scientific definition of race in his essay titled “Of the Different Human Races,” where he claims:

Races are deviations that are constantly preserved over many generations and come about as a consequence of migration (dislocation to other regions) or through the interbreeding with other deviations of the same line of descent, which always produces half-breed off-spring.^{iv}

he reason Kant’s account of race was counted as a scientific definition was because, unlike Berneir, Kant explained how the races which he had described were related to the human species. Since Kant had explained the races to be deviations from one human genus, he recognized the necessity for a “lineal root genus.”^v

The greatest riches of earth’s creation are found in this region [Europe] and this is also where human beings must diverge least from their original form, since the human beings living in this region were already well-prepared to be transplanted into every other region of the earth. We certainly find in this region white, indeed, brunette

inhabitants. We want, therefore, to assume that this form is that of the lineal root genus.^{vi}

It is here when he lays out which of the races had deviated the least from the one human genus which he claims to be white. In his “lineal root genus,” Kant explains that the races can be divided into four races which he labels by color. His separation of the races into colors is an example of some scholars employing color in their definitions of the idea of race.

Another example of scholarship on the idea of race which is at least influenced by the concept of ‘color’ in its definition of race is W.E.B. Du Bois’ definition of race in “The Conservation of Races.” This text was written at the time of the famous U.S. Supreme Court Case of *Plessy v. Ferguson*.^{vii} The influence the court case had on the work is evident in the mention of “separate schools and cars.”^{viii} While asking the question of race, Du Bois composes a text which not only provides an outline of the distinction of the human races, but also defines the duty of the Negro People to “develop for civilization its particular message” and the *Academy Creed* for the Negro Academy. Du Bois claims that there are eight races, and while he does not label them by color, as Kant does, his account of race and encouragement for conservation of races prompts questions about color - understood in relation to pigmentation of the skin and the role it plays in racial categorization.^{ix}

In addition to the exploration of historical scholarship which has prompted questions regarding color and the idea of race, a survey of contemporary debates on the ontology of race will assist in understanding the complexity of racial categorization. The second half of this first section of the paper explores various accounts of the ontological status of race. Most of the contemporary debates about race can be categorized into three main positions; (1) Racial Skepticism, (2) Racial Constructivism, (3) Racial Population Naturalism. Racial Naturalism is a position on the ontological status of race which claims biological truth to racial distinctions. These three positions explored in this paper on the ontology of race are the result of a

consensus on the falsity of Racial Naturalism – not to be confused with Racial Population Naturalism.^x The exploration of these accounts will consist of an outline of the main arguments of position.

Racial Skepticism is a school of thought which claims that since Racial Naturalism is false, then “race talk” cannot refer to anything real in the world since the thing the term could refer to does not exist.^{xi} Per the arguments made by the racial skeptics, the correct normative metaphysical conclusion regarding race is an eliminative conclusion; eliminate discussions of race because they are not referring to anything real.^{xii} One potential objection to the racial skeptics’ arguments is that “race talk” might be referring to populations which hold the feature of *reproductive isolation*; some population is because of a barrier to gene flow and to biological differences in the population a potential “candidate for the referents of racial terms and concepts.”^{xiii} Racial Skeptics, like Kwame Antony Appiah and Naomi Zack, claim that the objection is weak in that they are “skeptical of the existence of contemporary groups that have the requisite reproductive isolation.”^{xiv}

Like Racial Skepticism, racial constructionism begins from the claim that Racial Naturalism is false. However, unlike Racial Skeptics, Racial Constructionists claim that there is a reality to race; the reality of race is a socially constructed concept.^{xv} There are three types of constructionist accounts: Thin Constructionism, Interactive Kind Constructionism, and Institutional Constructionism. Thin Constructionism is a form of constructionism which claims that Racial Naturalism is false, but that we continue to have a use for “race talk to refer to persons in virtue of superficial properties that are prototypically linked with race.”^{xvi} Accounts of Interactive Kind Constructionism vary slightly depending on the “casual consequences they emphasize.”^{xvii} One example of an Interactive Kind Constructionism is Adrian Piper’s account which claims that racial labeling causes individuals categorized into the same racial label to have shared experiences.^{xviii} Institutional Constructionism

refers to an account which understands race to be “an important, efficacious, but socially constructed social institution.”^{xxix} One common objection proposed to the Racial Constructionists’ accounts is one of the main arguments presented by the Racial Skeptics; the Constructionists’ use of ‘race’ does not refer to anything real. To this, various Racial Constructionists reply in a similar way to Paul Taylor’s reply to Appiah; “Why can’t we just say that the processes of racial identification and ascription bring races into being?”^{xxx}

In opposition to Racial Skeptics and Racial Constructionists, which together agree that race is not something natural, Racial Population Naturalists claim that “racial naturalism is compatible with the rejection of racialism.”^{xxxi} Racial Population Naturalists, per Ron Mallon, are claiming that the Racial Skeptic’s standard of complete isolation is too stringent a requisite. The standard prescribes that “no racial population, past or present, has ever been completely isolated from other races in terms of breeding.”^{xxxii} In so far as racial population naturalists disagree with the standard of complete isolation of a population, then the Racial Skeptics’ objection to there being such a thing as completely isolated races is no longer applicable.

Contemporary Accounts of Racism

The survey of scholarship on the idea of race and the ontological status of race were intended to facilitate an understanding of the contemporary accounts of racism. Since the present paper is concerned with colorism’s irreducibility to a mode or extension of racism, an exploration of contemporary accounts of racism is needed for understanding that what is argued, when it is argued that colorism is not reducible to racism. The question of what racism is, and how the answers to that question determine what we can and cannot morally impugn have been central concerns in the work of many scholars. This section of the essay will briefly survey five accounts of racism; (1) the conservative conception, (2) existentialist conception, (3) social formation conception, (4) volitional conception, and (5) ideological conception of racism.

The conservative conception of racism is alternatively known as the doctrinal conception of racism. One account of racism which might be categorized as conservative or doctrinal is Dinesh D'Souza's account. D'Souza defines racism as "an ideology of intellectual or moral superiority based on the biological characteristics of race. Moreover, racism typically entails a willingness to discriminate based upon a perceived hierarchy of superior and inferior races."^{xxiii} Lewis Gordon identifies an important problem with this version of the conservative account; it explains how an individual might be racist without considering the role of an individual's attitudes in the matter.^{xxiv} Another objection to D'Souza's account, proposed by Jorge Garcia, is that the conditions he is using to identify racism are neither necessary nor sufficient.^{xxv} Additionally, D'Souza's account wrongly dismisses the concept of institutional racism. D'Souza rejects the notion of institutional racism, in part, because he has an all too narrow definition.^{xxvi} This rejection is problematic as, Garcia points out, in that if racism is a "real element in people's thinking, feelings, and behavior... there is no reason to deny it can become institutionalized."^{xxvii} D'Souza's account is also problematic in that at one point he faults the victims of discrimination or at least faults other members of their racial category for their victimization.^{xxviii} Furthermore, another problem with this account, which has been explored in various works, is that the characterization of racism which it offers allows the possibility for the mislabeling of individuals as racists.^{xxix}

Like the doctrinal account of racism, an existentialist account of racism might be concerned in part with the belief "either that one's own race is the only one qualified to be considered human or that it is superior to other races," but an existentialist account likely understands this belief as the result of a "self-deceiving choice to believe."^{xxx} One account of racism which might be categorized as existentialist is Lewis Gordon's account in *Bad Faith and Antiracist Racism*. One criticism of Gordon's account is that in that it too insists on a claim of the superiority of one's race, it appears to not be able to account for

same-race racism.^{xxxii} Finally, the existentialist account of racism Gordon proposes, like the doctrinal account, directs the attention to the victims of racism because of its existential psycho-analytic necessities.

In *Racial Formation in the United States: From the 1960s to the 1990s*, Michael Omi and Howard Winant employ the concept of racial formation to explore the way that society is organized. Their account of racism is categorized as a social formation account of racism. Racial formation is defined, by Omi and Winant, as “a process of historically situated *projects* in which human bodies and social structures are represented and organized.”^{xxxiii} The role of the *projects* is to serve as the “links” between the meaning of concepts (such as race) and their representations in society. In this case, *racial projects* are connecting the meaning of “race” in a specific socio-cultural context, and the way in which per that meaning “both social structures and everyday experiences are racially *organized*.”^{xxxiiii} With this approach, Omi and Winant, define racial projects to be “*racist if and only if it creates or reproduces structures of domination based on essentialist categories of race.*”^{xxxv} This social formation account is problematic because it claims that labeling a *racial project* as racist is only contingent on the ability to employ structures of domination. If that is the only contingency upon which labeling a *racial project* hinges, then it must follow that an individual can have racist attitudes toward people of other races but in so far as they are not able to employ a structure of domination to oppress the targets of their racist attitudes then their *racial projects* are not labeled racists. Thus, this account is at best incapable of correctly identifying racist individuals and at worse failing to condemn morally reprehensible behavior, specifically racist behavior.

Unlike the social formation account of racism which defines racism in relation to structures of domination, Garcia’s volitional account of racism grounds the concept on the wills and desires an individual has for others in such a way that they are contingent on the other’s race.^{xxxvi} This account does not take

beliefs to be central or essential to racism.^{xxxvi} One benefit, which Garcia highlights, about this proposed account is the ability it grants to “distinguish genuinely racist discrimination as a subset of race-conscious discrimination.”^{xxxvii} Nevertheless, this volitional account does not escape criticisms. In “Is Racism in the ‘Heart’?” Tommie Shelby raises two methodological concerns with the way in which Garcia structures his account. The first concern is that our commonsense understanding of racism is not clear enough to engage in a thick concept analysis.^{xxxviii} The second of these concerns is that Garcia merely stipulates that any analysis of racism must show that “racism is necessarily immoral” as opposed to convincing the reader of this desideratum. Shelby claims that a solution to these methodological concerns would be to reconstruct the concept of racism in a “morally neutral way” and to only after said reconstruction “offer our moral evaluation.”^{xxxix}

Shelby’s account of racism in “Is Racism in the ‘Heart’?” is an ideological account of racism. Shelby “suggests that we view racism as fundamentally a type of *ideology*.”^{xl} He defines ideologies as “widely accepted illusory systems of belief that function to establish or reinforce structures of social oppression.”^{xli} Shelby recognizes Garcia’s claim that racist beliefs are not central or essential to racism. One of Garcia’s main claims against racism being primarily a matter of belief is that “If racism must always be morally wrong, and racism is primarily a matter of having certain beliefs, then it must be possible to be held morally blameworthy for holding some of viewpoints.”^{xlii} Shelby answers to this by explaining that the conclusion reached by Garcia is firstly, making a category mistake and secondly, that the account he proposes does not claim that “ideologies are themselves immoral.”^{xliii} Finally, Shelby explains that racist beliefs have moral importance “regardless of whether these beliefs are accompanied by racially based vicious intentions.”^{xliv}

Color in Relation to Racism and Colorism

While an understanding of race and racism is helpful to for the goal of the present paper, thinking about these concepts

without considering skin and its color is problematic.^{xlv} Furthermore, concerns of colorism prescribe an understanding of color – understood in relation to skin. This section will briefly explore the question of color in relation to racism and colorism.

In *Black Skin, White Masks*, Frantz Fanon notes that “color is the most obvious outward manifestation of race it has been made the criterion by which men are judged, irrespective of their social or educational attainments.”^{xlvi} As one moves through Fanon’s text it becomes evident that his use of the term color is a reference to his skin.^{xlvii} While there are many definitions of ‘color,’ most include some component which is registrable visually, if they do not explicitly mention skin.^{xlviii} In “Skin Memories,” Jay Prosser’s understands skin’s role in racism as “remembering constituting social membership.”^{xlix} Prosser is concerned with attempting to “grapple with the somatopsychic dimension of racism that perpetuates it ruthlessly in the unconscious” to understand skin almost ‘unconscious’ role in the perpetuation of racism.¹ Prosser’s inclination to place the somatic and psychic aspects of the experience of racism in a dialectic merits a return to Fanon’s text.

Fanon’s text grants an understanding of Prosser’s inclination to place the somatic psychic aspects of the experience of racism in a dialectic. In Fanon, the categories of somatic and psychic are referred to as corporeal schema and epidermal schema respectively. However, it is important to note that Fanon’s use of the schemas, for the experience of the black subject in Europe, in the ‘real dialectic’ critiques Maurice Merleau-Ponty’s understanding of the body schema. Fanon accomplishes this critique by accepting Merleau-Ponty’s claim that the “self and the world are constructed through the work of the *schema corporel*,” but then claiming that in the case of the black subject in Europe the *schema corporel* is not the “locus of reciprocal emergence of the self to the world.”^{li} Thus, Fanon explains the corporeal schema to be “a slow construction of myself [himself] as a body in a spatial and temporal world.”^{lii} Moreover, the corporeal schema which Fanon is describing is constructed by the racist

discourses which surround him, but it cannot be simultaneously reconstructed by the corporeal schema, because the “locus of reciprocal emergence of the self to the world” is “undermined” in the case of the black subject in Europe.^{liii} In turn, the epidermal schema is “a historical-racial schema” one which is constructed by the information he is given by “the Other, the white man” but one which cannot be negotiated.^{liv} In other words, arguing the two schemas are in a real dialectic criticizes Merleau-Ponty’s understanding of the body schema as inadequate in relation to the lived experience of the black subject, the subject subjected to oppression. Thus, skin’s fascinating role in racialization is its capacity to work both on the exterior and the interior of the subject being racialized – influenced also by Jean-Paul Sartre’s notion of being-for-others.^{lv}

The capacity of skin to work both on the interior and exterior is evident in many of James Baldwin’s essays. In his “Notes of a Native Son,” Baldwin describes his experience of working in New Jersey in a factory where he was “never looked at but simply at the mercy of the reflexes the color of one’s skin caused in other people.”^{lvi} At this stage in his story, Baldwin is retelling the way in which his body was interacting with his world. Then, suddenly Baldwin’s story shifts from a perspective of how his body is interacting with the world to how it affected him:

I was mad. And it did begin to work on my [his] mind, of course; I [he] began to be afraid to go anywhere and to compensate this I went places to which I really should not have gone and where, God knows, I had no desire to be.^{lvii}

In his retelling of these experiences, one becomes aware of Baldwin’s nascent awareness of his body and the other’s reading of his body as through his skin or as reducible to his skin and what associations that carries in one’s cultural space.

Furthermore, it is important to note that Baldwin’s narratives which are reflective of said clashing resonate with the many realities experienced by individuals who are also slave not to the “idea” others have of me [him], but to my [his] appearance.”^{lviii}

Accounts of Colorism

James Baldwin's essays are incredibly powerful in that they convey his lived experiences while simultaneously resonating with the community of racialized individuals in the United States. These essays are, while anecdotes which underscore the 'real dialectic,' attesting to the role of color in the system of racism. It is difficult to understand color, and its role as a basis for some discriminatory systems, as separate from racism because they are interconnected. Color may play a role in racist forms of discrimination, but it need not only function in terms of racism. Rather, color can operate as its own basis for discrimination, separate from conceptions of race or the dynamics of racism. Prompted by this distinction, one might naturally question why the present paper, concerned with colorism, has not yet surveyed contemporary accounts of colorism. The methodical reason for exploring race, racism and color prior to colorism is that at least a rudimentary understanding these previously explored concepts is necessary to understanding colorism. Since the present paper argues that colorism is not reducible to a mode or extension of racism, an exploration of racism was crucial. In so far as an exploration of racism was necessary, an understanding of the history of the idea of race was necessary to understand the complexity of the various accounts of racism. Since the present paper's concerns regarding colorism explore accounts of racism and colorism it too was necessary to explore color as it is the mode of categorization which is shared by both systems of discrimination.

The following section explores various accounts of colorism. Any exploration of the accounts of colorism must be premised with recognition that, at least within scholarship in the United States, awareness of colorism was, until recently, quite low.^{lix} This section will survey some of the few accounts of colorism – not all of which are grounded in experiences lived within United States – in a chronological order.

In *Black Skin, White Masks*, Fanon defines color prejudice by explaining that, "as color is the most obvious outward

manifestation of race it has been made the criterion by which men are judged, irrespective of their social or educational attainments.”^{lx} He then explains how the color prejudice affects interracial relations “light-skinned races have come to despise all those of a darker colour, and the dark-skinned peoples will no longer accept without protest the inferior position to which they have been relegated.”^{lxi} While Fanon is not explicitly defining colorism, his definition of color prejudice and other the other definitions of colorism explored in the present paper have commonalities enough to suggest that Fanon was defining colorism. The definition of color prejudice in *Black Skin, White Masks* was published in nineteen-fifty-two and, per Bean and Stevens, the increased awareness of colorism was related to the shift in the color line in the nineteen-eighties through the early two-thousands.^{lxii} If Fanon’s definition of color prejudice can be interpreted as a definition of colorism, then he would have been doing so, while in a French Afro-Caribbean context, a few decades prior to the increased awareness of colorism in United States’ scholarship.

A few decades later, Alice Walker defines colorism in her essay “If the Present Looks Like the Past, What Does the Future Look Like?” Walker defines colorism as “prejudicial or preferential treatment of same-race people based solely on their color.”^{lxiii} The understanding of color she is employing is one concerned with the lightness or darkness of the skin. Walker’s definition of colorism is part of her account of what “black black women would be interested in” from light black women as prompted by discussions of the hostility between black black women and light black women.^{lxiv} She suggests that black black women do not seek an apology from the light black women, rather they seek “a consciously heightened awareness on the part of light black women that they are capable, often quite unconsciously, of inflicting pain upon [black black women].”^{lxv} Walker’s analysis of the hostility between black black women and light black women through the lens of color delates an important feature of Walker’s account of colorism. She takes colorism to be

something which occurs within one racial category. Her understanding of colorism as a system of discrimination which occurs only within the same racial category is evident when she claims that “[colorism] is an insanity that has helped whites turn blacks on themselves and that has caused the black middle class to claw itself into a form of psychic annihilation.”^{lxvi} While Walker understands colorism as a system which discriminates individuals into advantaged or disadvantaged groups solely based on color, she restricts the scope of colorism to a same-race discrimination.

Margaret Hunter defines colorism differently from Walker in that Hunter does not limit colorism to same-race discrimination. Hunter defines colorism as “the process of discrimination that privileges light-skinned people of color over their dark-skinned counterparts.”^{lxvii} Hunter, like Walker, understands colorism as “concerned with actual skin tone.”^{lxviii} She recognizes colorism is its own system of discrimination, but she recognizes colorism as a second system of discrimination under the “larger systemic, social process” of racism. In other words, she believes that “colorism is one manifestation of it [racism].” Hunter provides examples from various studies which suggest, contrary to Fanon and Walker, that “colorism is actually practiced by whites and people of color alike.”^{lxix} Said examples include the tendency of many people, regardless of race, to hire light-skinned employees over dark-skinned employees of the same races, or the propensity of many individuals to marry lighter-skinned women. Her claim that colorism is practiced by whites and people of color alike should not be misinterpreted to mean that colorism is practiced to discriminate against whites and people of color alike. It is important to note, that in this account of colorism the only breaking away from racial categories is in the sense that those who practice colorism are not necessarily of the same racial category as those they are discriminating against. This shift away from defining colorism as only observable within racial categories but never across racial categories, even if only

by the perpetrators, is crucial to understanding colorism as a system of discrimination independent of racism.

One overarching problem with the accounts of colorism surveyed thus far is that they all define of colorism in the context of racism. Since a central concern of the present paper is to separate racism and colorism as distinctive, if sometimes overlapping, forms of systemic discrimination, it is necessary to explore a few accounts of colorism which are not contextualized in racism. Colorism is a system of discrimination which is present in other countries as well as the United States. Stepping outside of the societal context of the United States, reveals that colorism is not contextualized in racism as frequently in the scholarship of other nations. Aline DJokic, a Brazilian philologist, presents an account of colorism in her article “*Colorismo: O Que É, Como Funciona.*” DJokic’s account of colorism aims to show the effects of colorism on the lives of “*peessoas negras no Brazil*” and how “*horrendamente*” it affects the “*autoestima,*” affective relationships, and the exercise of full citizenship of “*peessoas negras.*”^{lxx} This account is an example of an account which is not contextualized in racism. DJokic defines colorism as “*a pigmentocracia é a discriminação*” based on the “*cor da pele.*”^{lxxi} One aspect of DJokic’s definition of colorism which is dissimilar to the previous definitions of colorism explored—which define colorism in relation to color or skin—she employs the color of skin which emphasizes her use of the term *pigmentocracia*, pigment. She explains *pigmentocracia* as a term which refers to a hierarchy structure where “*quanto mais pigmentada ima pessoa, mais exclusão essa perssoa irá a sofrer.*”^{lxxii} While her approach to the structure of her definition of colorism is distinct from the previously explored accounts, the most grave distinction between DJokic’s account and the others’ is that she explains *colorismo* as “*contrário do racism*” because racism focuses on the identification of a “*sujeito como pretencente a certa raça para poder exercer a discriminação*” and colorism focuses “*somente*” in “*cor da pele da pessoa.*”^{lxxiii} Similar to the other accounts, DJokic claims that the question of whether colorism is not “*um*

problema exclusivo” of the “*interção entre*” whiteness and the “*sujeito negro*” – two of the most “*variados*” skin tones in society – and claims that it also generates “*conflicto também dentro da comunidade negra.*”^{lxxiv}

Recognizing Colorism Independently of Racism

The present paper is concerned with the problems of conceptualizing colorism as a mere manifestation of racism, however, understanding colorism as more than a manifestation of racism does not preclude these systems from periodically overlapping. Colorism and racism overlap at times in that colorist discrimination is color-based and, in racist discrimination, color can be included as a factor in the outlining of racial categories. Colorism is a color-based system of discrimination in that color is the single mode by which discrimination is carried out in this system. Racism, on the other hand, while it is a race-based system of discrimination might include color as one of the various factors in the outlining of racial categories. This section of the paper will aim to outline the simplicity of colorism in contrast to racism, in addition to exploring the importance of recognizing colorism and its effects as irreducible to a mode or extension of racism.

Colorism and racism have a complex relationship that results from their periodical overlapping. However, one of their main differences is their respective complexities; colorism is a simple system of discrimination whereas racism is a complex system. Colorism is a simpler system of discrimination because the only mode of discrimination it employs is skin color. Racism, on the other hand, can include a variety of factors in addition to skin color in the outlining of racial categories. Some examples of the factors included in the delineating of racial categories which racism employs, apart from skin color, are blood, heritage, and other visual aspects not specific to skin. The various factors which can be included in the outlining of racial categories in a racist system of discrimination is problematic because it complicates the placement of some individuals into racial categories. Take for example an individual, we will call him Kyle, who is a light-skinned half-Japanese half-Hawaiian man. The simplicity of

colorism would entail that Kyle be privileged or disenfranchised solely on the color of his skin. On the other hand, racism would prescribe that Kyle be placed into a racial category, such a task would be problematic regardless of which factors, such as heritage, blood, or skin color, were included in the delineating of the racial categories. Placing Kyle into a racial category would be problematic, if the outlining of racial categories included heritage as a factor, because Kyle would have both Hawaiian and Japanese heritage. Alternatively, if the outlining of racial categories included blood as a factor, Kyle would have both Japanese and Hawaiian blood. In these scenarios, the task of placing Kyle in a racial category outlined by including any factor other than skin color would be problematic. The task results problematic in that Kyle could be placed into more than one racial category simultaneously. In this sense, colorism and racism are distinct because of the complexity with which racism operates. The outlining of the racial categories employed by racism as a system of discrimination can include a variety of factors such as heritage, blood, or skin color. This variety of the factors which can be included in the outlining of these racial categories generates a complexity which renders the racial categorization of mixed-race individuals problematic.^{lxxv}

Although colorism is simple in comparison to racism, the process of attributing a discrimination practice to one system over the other is difficult which is one of the reasons that manifestations of colorism are often, mistakenly, categorized as manifestations of racism. One example of the difficulty of discerning which system is responsible for discriminatory practices is of skin bleaching. This phenomenon in which dark-skinned individuals employ creams or serums to lighten their skin is understood to be a way in which dark-skinned individuals seek to obtain some of the privileges available only to individuals of light-skin in their societies.^{lxxvi} Skin bleaching is recognized as a colorist practice, largely attributed to the racist practices of European colonialism.^{lxxvii} Furthermore, skin bleaching is often considered a colorist practice that is a manifestation of

racism.^{lxxviii} While skin bleaching might have roots in racist colonial and slavery practices, it is not clear that every instance of skin bleaching is a manifestation of racism. Skin bleaching is a practice motivated by the lightness of skin – understood as color of skin. Since colorism is a system of discrimination based on color, then the practices of skin bleaching could be colorist practices independent of racism. However, a concern about Jamaica’s colonial history raises an important concern. In this case, one might argue that the colonial era’s racist practices continue to impact the practices of Jamaicans in the present day. This problematizing of the Jamaican example sheds light on the importance of the colonial history of populations in determining whether their colorist practices can truly be recognized as independent of racism.

One example of a population with a colonial history which supports the recognition of colorism as independent of racism is Mexico’s population. The history of miscegenation between colonizers and the colonized in many of the Latin American countries, Mexico included, renders the concept of racial purity an impossibility according to Linda Alcoff.^{lxxix} The impossibility of racial purity resulting from the miscegenation practices of colonizers is a reiteration of the problem of placing a mixed-race individual in a racial category. Within Mexico’s population, there cannot be simply operative racial categories because the task of trying to trace one’s heritage or blood is near impossible. The impossibility to trace one’s own heritage or blood is clear in my own case. To my best knowledge, with much uncertainty, I can trace some descent to the following populations: Native Mexican Indigenous, Spanish, Italian, French, Belgian, and Cherokee among others unknown. Many *Mexicanos* are in similar positions about tracing descent; they have heard stories about who their great grandparents were, or where their great-great grandparents came from, but in the end, there is no certainty, we are all *mestizos*. Therefore, because of the miscegenation practices of colonialism in Mexico, the population’s status as *mestizos* makes it prohibitively difficult to place these individuals in racial

categories in any socially functional sense. Yet, within this *mestizo* population, there are color-based discriminatory practices which in other populations might be attributed to racism. Skin bleaching is one of these color-based discriminatory practices that *Mexicanas* more so than *Mexicanos* engage in.^{lxxx} The privilege which lighter-skin continues to afford individuals drives darker-skinned women to engage in practices like skin bleaching or preventing sun exposure to avoid becoming *prietas* – or brown. These examples of color-based discriminatory practices cannot be manifestations of racism because in this *mestizo* population racial categories cannot be delineated. The color-based discrimination practices of the *mestizo* population of Mexico – *el colorismo del mestizo* – are in so far as they are not racist practices, colorist practices.

This *colorismo del mestizo* and its effects is not accommodated in the accounts of colorism which the present paper previously explored. The example is not accommodated in either Fanon's, Walker's, or Hunter's account because those accounts recognized colorism as a mere mode or extension of racism. While DJokic explains the way in which colorism and racism are distinct in her account, she does not claim that colorism must be recognized as more than a mode or extension of racism. Thus, the *colorismo del mestizo* prescribes that we recognize colorism and its effects independently of racism in the interest of adequately accounting for lived experiences.

The present paper recognizes that racism is an enduring system of discrimination responsible for many continuing problems in contemporary societies. However, this paper argues that colorism and its effects should be thought of independently of racism, in the interest of adequately accounting for lived experiences. The case for recognizing colorism and its effects as independent of racism was made by way of a sequence of steps explored in this paper. The first of these steps was acquiring an understanding of racism as a race-based system of discrimination. Recognition that race is the mode of discrimination of racism entails that the conceptualization of race is central to the outlining

of the racial categories. The second of these steps was acknowledging that both colorism and racism have distinct relationships with color, which often complicate the understanding of the relationship between racism and colorism. The next step was showing how common accounts of colorism conceptualize colorism as an extension of racism, perhaps as the result of the complications with the understanding of the relationship between racism and colorism. Finally, it was argued that common accounts of colorism are insufficient to account for cases like that of the *colorismo del mestizo* in Mexico, grounding the claim that colorism should be thought of as a system of discrimination independent of racism. In order to define colorism in a manner adequately account for lived experiences, like the *colorismo del mestizo*, colorism and its effects should be theorized independently of racism.

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Endnotes

ⁱ Bernasconi & Lott 2000, vii

ⁱⁱ *Ibid.*, vii- viii

ⁱⁱⁱ *Ibid.*, viii

^{iv} *Ibid.*, 9

^v Kant believed that there were four races, which he distinguishes between by color:

“ If so, the four presently existing races and the natural causes that account for their origins can be illustrated by means of the following summary:

Lineal root genus:
 White of brownish color
 First race
 Noble blond (northern Europe)
 from humid cold
 Second race
 Copper red (America)
 from dry cold
 Third race
 Black (Senegambia)
 from humid heat
 Fourth race
 Olive-yellow (Asian-Indians)
 from dry heat”

(Kant qtd. in Bernasconi & Lott 2000, 20, 45).

^{vi} Bernasconi & Lott 2000, 20

^{vii} Plessy - who was seven-eighths Caucasian – was asked by the “Committee of Citizens” to repeal the Separate Car Act by sitting in the ‘whites only’ section of the car. While the ruling in this case was that separate but equal facilities were not unconstitutional, the role of Plessy as a seven-eighths Caucasian man was important because his race was a legal status since his skin color was allegedly light. (Oyez 2018, n.p.).

^{viii} “It is necessary, therefore, in planning out movements, in guiding our future development, that at times we rise above the pressing, but smaller questions of separate schools and cars, wage-discrimination and lynch law, to survey the whole question of race in human philosophy and to lay, on a basis of broad knowledge and careful insight, those large lines of policy and higher ideals

which may form our guiding lines and boundaries in the practical difficulties of every day” (Bernasconi & Lott 2000, 108).

ix “They are the Slavs of eastern Europe, the Teutons of middle Europe, the English of Great Britain and America, the Romance nations of Southern and Western Europe, the Negroes of Africa and America, the Semitic people of Western Asia and Northern Africa, the Hindoos of Central Asia and the Mongolians of Eastern Asia” (Bernasconi and Lott 2000, 110).

x See Mallon 2004

xi See Appiah 1995, 1996; Zack 1993, 2002.

xii Mallon 2006, 645

xiii Ibid., 532

xiv Ibid.; see also Appiah 1995, 1996 and Zack 1993, 2002.

xv Ibid., 534

xvi Ibid.

xvii Ibid.

xviii Ibid.

xix Ibid., 536

xx Ibid., 537

xxi Ibid., 538

xxii Ibid., 542; see also Kitcher 2004.

xxiii D’Souza explains that the criteria to be considered a racist is fourfold: “In order to be a racist, you must first believe in the existence of biologically distinguishable groups of races. Second, you must rank these races in terms of superiority and inferiority. Third, you must hold these rankings to be intrinsic or innate. Finally, you typically seek to use them as the basis for discrimination, segregation, or the denial of rights extended to other human beings” (D’Souza 1996, 27- 28). He notes that the final item is while typical of racists not essential to being categorized as a racist. In his account of racism, to be a racist one must simply hold racist beliefs, but the account places no importance on the individual’s aims.

xxiv Garcia 1999, 9.

xxv “They are not necessary because a race-hater who never troubles to rationalize her or his hatred with a doctrine that those she or he assigns to the hatred race are inferior in such a way as to justify that hatred is still a racist, indeed, a paradigmatic racist... But even if the hostility in the some racially intolerant people is rooted in precisely in their resentment of those they deem superior in some threatening way, then it follows that – contrary to what D’ Souza suggests (and many other theorists say explicitly) – the judgement that R1s are inferior is not essential to racism against them.” “To see why D’ Souza’s conditions are not sufficient for racism, consider his odd claim that racism should not be treated like a sin, should not be ‘suppressed.’ D’Souza thinks this follows from his view that racism is an ‘opinion,’ but that is

problematic. First, an opinion is something believed but, according to his account of what it takes to be a racist, racism consists not in the opinion itself, but in holding the opinion... Second, and more to the point, even if a proposition cannot itself be morally criticized or suppressed, an individual's holding it may be" (Garcia 1999, 4).

^{xxvi} D'Souza's definition of racism, which is too narrow to accommodate institutional racism, is: "Traditionally, racism refers to an ideology of biological superiority. The concept of institutional racism abandons this conventional view, divorcing racism from the concept of intentions or even individuals" (D'Souza 1996, 289).

^{xxvii} Garcia 1999, 6.

^{xxviii} D'Souza faults individuals who are the victims of racial discrimination or those who are also in their racial category for their victimization: "It is difficult to compel people to admire groups many of whose members do not act admirably" (D'Souza 1996, 286).

^{xxix} An example is: "Someone who is innocently misinformed about racial equality and then goes on to act on that basis need not deserve the label 'racist.'" (Garcia 1999, 7).

^{xxx} Gordon 1995, 2-3.

^{xxxi} Some of the criticism that Garcia presents of Gordon's argument are that while his account of racism does not allow for same-race racism, he includes an entire chapter dedicated to 'Black Antiblackness'; perhaps he thinks there is a possibility for same-race racism and his account simply does not allow for that. (Garcia 1999, 9).

^{xxxii} Omi & Winant 2000, 184

^{xxxiii} We can understand *racial projects* to be "*simultaneously an interpretation, representation, or explanation of racial dynamics, and an effort to reorganize and redistribute resources along particular racial lines.*" Thus, these *projects* can help conceptualize with more clarity some of our most complex "contemporary controversies and dilemmas involving race, including the nature of racism" among others. (Omi & Winant 2000, 184).

^{xxxiv} Furthermore, Omi and Winant, claim that "In order to identify social projects as racist, one must in our view demonstrate a link between essentialist representations of race and social structures of domination." (Omi & Winant 2000, 207).

^{xxxv} "Since, so conceived, racism is primarily a matter of what a person does or does not wish, will and want for others in light of their race – the contents of a person's will, broadly conceived – I call it a volitional conception of racism, in contrast to the doctrinal (ideological), existential choice, and 'racial formation' conceptions we treated." (Garcia 1999, 13).

^{xxxvi} Shelby 2002, 413

^{xxxvii} *Ibid.*, 16

^{xxxviii} Shelby claims that the thick concept analysis “strategy seems to work best when our pretheoretic understanding of the relevant phenomenon is sufficiently clear and complete to justify the generalization that all manifestations of it are morally problematic.” (Shelby 2002, 412).

^{xxxix} Shelby 2002, 413

^{xl} Ibid., 415

^{xli} Ibid., 415

^{xlii} Ibid., 416

^{xliii} Shelby explains that the category mistake which Garcia is making is “Beliefs aren’t the kinds of things that can be immoral.” In other words, beliefs can be various things such as true or false, but not moral or immoral. (Shelby 2002, 416).

^{xliv} Shelby 2002, 419

^{xlv} On the matter of ontologizing race, Pile argues it to be problematic: “Cauterizing the social from the body not only masks the ways in which the social imposes upon the body, it also obscures the ways in which the body might construct the social and all its concepts, capacities, and communities.” (Pile 2010, 28).

^{xlvi} Fanon 2008, 97

^{xlvii} It is evident throughout the text that Fanon’s use of the term ‘color’ is a reference to skin, particularly the color of one’s skin. He notes that “the man of color encounters difficulties in elaborating his body schema” because “All around the body reigns an atmosphere of certain uncertainty.” Then, as he prepares to explicate the skin as part of the bodily or corporeal schema, he notes that the “black man could whiten himself and thus rid himself of the burden of his bodily curse.” Moreover, it is evident that his bodily curse is his skin as he refers to the revealing of the epidermal schema “the body schema, attacked in several places, collapsed, giving way to an epidermal racial schema,” and then refers to the process again as “Peeling, stripping my skin, causing a hemorrhage that left congealed black blood all over my body.” Finally, in his delineation of the difference between a Jew and himself, he notes that unlike the Jew who has a white body he is “a slave not to the “idea” others have of me [him], but to my [his] appearance.” (Fanon 2008, 90-91, 95).

^{xlviii} According to James Baldwin, “the word ‘colored’ has very special reverberations.” “... this can mean, depending on the speaker, the situation, the subject... overbearing, incompetent and so uncertain of his value that he is perpetually adopting the most outrageous and transparent affectations.”

Baldwin also notes that “the same phrase can also be applied to someone who is direct, warm, unaffected and unconquerable...” (Baldwin 1998, 673). He also notes that “the word color, ravaged by experience and heavy with the weight of peculiar spoils, returns to its first meaning... not *negro*... but vivid, many-hued, e.g. the rainbow, and warm and quick and vital, e.g., life.” (ibid.). Furthermore, Baldwin warns that “Color, for anyone who uses it, or is used by it, is a most complex, calculated and dangerous phenomenon” (ibid., 676).

xlix Prosser 2001, 56

¹ Ibid., 56

li Weate 2001, 174

lii Fanon 2008, 91

liii Pile 2010, 29; Weate 2001, 174

liv Fanon 2008, 91

lv Weate 2001, 169-170; see also Sartre 1992.

lvi Baldwin 1998, 68

lvii Ibid., 69

lviii Fanon 2008, 95

lix It was not until nineteen-twenties to the early two-thousands that the U.S. saw a shift in its color line “from a predominantly biracial society with a large White majority and relatively small Black minority to a society composed of multiple racial and ethnic groups” (Lee & Bean 2004, 222). Along with this shift in the color line was a related to rises in bi-racial marriages (Bean & Stevens 2003). These various changes in the color line brought about an increase in the awareness of colorism as a system of discrimination.

lx Fanon 2008, 97

lxi Ibid., 97

lxii Bean & Stevens 2003

lxiii Walker 1967, 290

lxiv Ibid., 290

lxv Ibid., 290

lxvi Ibid., 295

lxvii Hunter 2007

lxviii Ibid., 237

lix Hunter provides a series of examples in which skin tone alone is the main factor in the discriminatory practices with the aim of proving that colorism is a discriminatory process which is not strictly practiced by people of color. Hunter claims that “Given the opportunity, many people will hire a light-skinned person before a dark-skinned person of the same race (Espino and Franz 2002; Hill 2000; and Hertel 1990; Mason 2004; Telles and Murgia 1990), or choose to marry a lighter-skinned woman rather than a darker-skinned woman (Hunter 1998; Rondilla and Spickard 2007; Udry et al 1971).” Hunter ends by claiming that many of these practices are the result of unawareness to the preferences for lighter skin resulting from societal conception that white equates beauty (Hunter 2007, 238).

lxx DJokic explains the aim to her account: “*Essa pequena introdução dos efeitos do colorismo nas vidas das pessoas negras no Brasil mostra como ele afeta horrendamente a autoestima, os relacionamentos afetivos e a exercício de uma cidadania plena das pessoas negras.*” Which can be translated as: “This small introduction of the effects of colorism on the lives of black people in Brazil shows how it horrendously affects self-esteem, affective relationships

and the exercise of full citizenship of black people.” (DJokic 2015, translation my own).

^{lxxi} DJokic’s definition of colorism “*ou a pigmentocracia é a discriminação pela cor da pele e é muito comum em países que sofreram a colonização europeia e em países pós-escravocratas,*” can be translated as “colorism is a pigmentocracy or discrimination based on skin color and is very common in countries that have undergone European colonization and/or are post-slavery countries.” (DJokic 2015, translation my own).

^{lxxii} DJokic explicates her definition of colorism further, “*De uma maneira simplificada, o termo quer dizer que, quanto mais pigmentada ima pessoa, mais exclusão essa perssoa irá sofrer.*” Her explanation can be roughly translated as, “In a simplified way, the term means that the more pigmented a person is, the more exclusion that the person will suffer.” (DJokic 2015, translation my own).

^{lxxiii} DJokic explores a distinction between racism and colorism: “*Ao contrário do racism, que se orienta na identificação do sujeito como pertencente a certa raça para poder exercer a discriminação, o colorismo se orienta somente na cor da pele da pessoa.*” This distinction between racism and colorism can be roughly translated as, “Contrary to racism, which focuses on the identification of an individual as belonging to a certain race as the grounds for discrimination, colorism is oriented only in the color of the person's skin [colorism discriminates only based on the person’s skin].” (DJokic 2015, translation my own).

^{lxxiv} DJokic explains that colorism is not only found in interactions between whiteness and the black subject: “*O colorismo contundo não é um problema exclusivo da interação entre a branquitude e o sujeito negro dos mais variados tons na sociedade, ele gera conflito também dentro da comunidade negra.*” Which can be translated as: “Striking colorism is not a problem exclusive to the interaction between whiteness and the black subject - the most varied tones in society - it also generates conflict within the black community.” (DJokic 2015, translation my own).

^{lxxv} Cases like the one explored in this section of the paper, which underscore the problems of placing mixed-race individuals in racial categories have spurred important research into intersectionality.

^{lxxvi} Hunter 2007, 249

^{lxxvii} Ibid., 250

^{lxxviii} Ibid.; see also Charles 2003, 711

^{lxxix} See Alcoff 2000.

^{lxxx} Hunter 2007, 250

An Empirical View of No Child Left Behind in Bexar County

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The role of education has been changing in the twenty-first century. Public schools have undergone various policy changes in different presidential administrations. Over the last few decades, failure after failure have occurred within educational reform. New presidential administrations come and go and with them comes new ideology. No matter what the presidential administration is, neither party can get a reform to work. This study analyzes President Bush's past reform No Child Left Behind in relation to Bexar County, Texas. The purpose of the study is to determine whether public schools in high-income areas in Bexar County, Texas are affected differently by the national policy of No Child Left Behind compared to select public schools in lower income areas. The study finds that schools with greater resources in higher income areas used the policy of No Child Left Behind to mitigate educational achievement better than schools with lesser resources in low-income areas. The study critiques the legislation requirements passed by approaching it in diverse ways. The study carefully defines what the legislation intended for schools to do. The study looks at the short-term effects that have impacted students while tackling the long-term effects that have affected the nation. The limitations of this research lie on the scale of the research. This research reinforces past literature with a local analysis in select Bexar County, Texas public schools.

Education has been a crucial step towards advancement in this country and throughout the world. Even today, people can see that education is still a key piece for advancement. In the U.S, the needs that education must fulfill are the demands of society and have caused education to evolve. The presented ideology and educational philosophies continues to change with every new presidential administration.

Education has been in a crisis for a while now. It seems like every presidential administration tries to dismantle the efforts of the previous one and is constantly pointing out new failures. This phenomenon has evolved into a great obsession that has come about from decades of failures. The goals of an evolving economy are getting tougher to achieve while presidential administrations are backpedaling when it comes to education. Education is no longer about skills like reading and writing at its core, but now encompasses real-life skills that help students produce once they join the job market. (Lipman 2015)

This changing economy has led to a change of what the role of schools should be. Since the beginning of the twenty-first century, the U.S has abandoned traditional education reforms for corporately driven reforms. These reforms are heavily reliant on test-based evaluations, teacher quality, and privatization of schools. (Ali 2017)

Time and time again, the U.S has dealt with education policies that have failed to benefit the society. Instead, the U.S has chosen to ignore its mistakes and has led to a spiraling downfall of the education system. Economic stagnation has caused a state of emergency in public education. (Foster 2011). Education reforms like "No Child Left Behind" and "Common Core" cause backlash because of the negative results in education and specifically in marginalized groups. On one side we see giant corporations like Microsoft pushing for these types of reforms, while teachers and students alike are facing the consequences.

The spirit capitalism in education is not something new but has been evolving. Since the beginning of the twenty-first century, the U.S has abandoned traditional education reforms for reforms driven by corporations. A study shows that economic stagnation and rapid concentration/monopolization of capital on a global scale have sparked an increase of corporate driven reforms. (Foster2015) What this means is corporations are searching for new markets to invest aside from the traditional markets. One of the main targets is education because it has been left unexploited until recently.

The U.S needs to take a step back and rethink its strategy towards education. Right now, the U.S heads toward a “produce or imprisonment” mentality that has divided the U.S between races and levels of income. (Grinstein-Weiss 2016) This mentality means that either you add on to the workforce or stay trapped in the cycle of poverty. The corporate reforms only add to the educational debt, while not in any major way improving educational outcomes. Without taking a step back and rethinking education policy strategies, the U.S is at risk of dramatic economic decline and even economic collapse.

This paper addresses one major question by looking at No Child Left Behind. What were the effects of No Child Left Behind in specific high-income and low-income public schools that adopted and incorporated the law in Bexar County, Texas? The prediction is that the disparities between low-income and high-income schools will be demonstrated and dramatic. Not only will the disparities be demonstrated, but also from what the legislation required for each school.

Digesting the Legislation

Since the study is centered around No Child left behind, it only makes sense to know exactly what the requirements of the programs are. It's also important to note that while No Child Left Behind was meant to increase competitiveness internationally, special focus was placed on special education, low-income

students, and minority children. These were the groups that were supposed to see the most benefits from the program. (No Child Left Behind, 2002)

No Child Left Behind enforced strict mandates on states based on standardized testing. States were tasked to raise all students to levels that were proficient. The law allowed for each individual state to decide what tests should be enforced and what is considered proficient. The first way No child Left behind tracked progress was through the AYP or “adequate yearly progress”. (No Child Left Behind, 2002) AYP is measured based reading/language arts, mathematics, graduation rates, and at least one other academic indicator chosen by the state. In Texas, the added indicator is attendance rates.

Multiple sanctions are in place if a school missed meeting AYP. If a school failed to meet AYP for two years in a row, the school has to allow students to transfer to a better-performing school in the same district. If it misses AYP three times, free tutoring must be offered to all students. If a school missed it continuously, the state has the option to intervene and even shut down the school and convert it into a charter school.

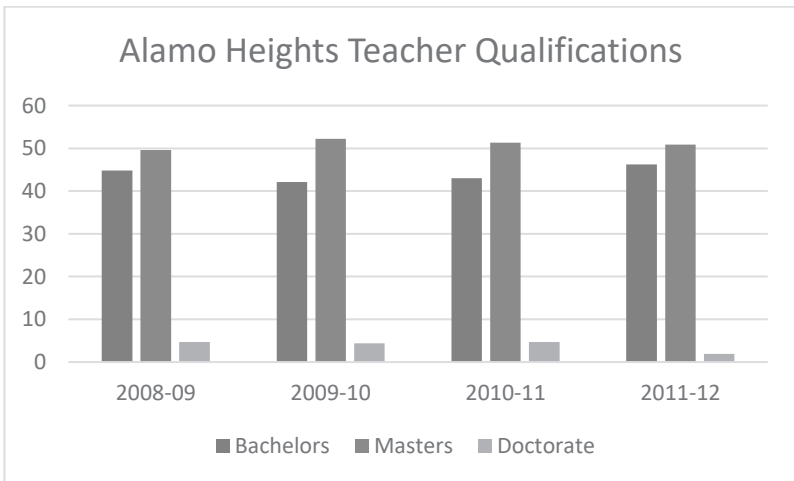
The last major mandated rule was that states are required to ensure that teachers are “highly qualified”. This term is vaguely defined as having a bachelor’s degree and state certification in the subject they teach. (No Child Left Behind, 2002) These qualified individuals are also supposed to be evenly dispersed among schools with high concentrations of poverty and wealthier schools. This was set in place to deter qualified individuals to work in nicer areas for better pay. All these statistics had to be made public property for anyone to access. Thus, requiring schools to post a No Child Left Behind specific report card. This report card included everything for AYP, to teacher qualification, and more. (No Child Left Behind, 2002)

Methods/Design

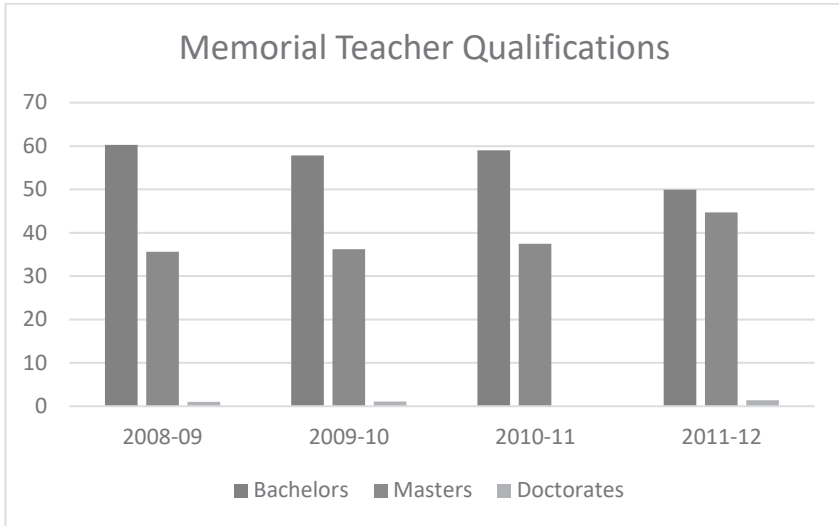
This paper will examine the effect of No Child Left behind on two schools in Bexar County, Texas. The sampling size of the study is two schools, a high-income school, Alamo Heights, and a low-income school, Memorial. The timeframe that the study analyzes is from 2008-2012. The effects of No Child Left behind were in effect until 2013. Using the last 4 years that No Child Left Behind was still active allows for the most recent data on the past reform. The data collected comes from the Texas Education Agency. This data includes official No Child Left Behind report cards from both schools during the timeframe.

The study critically compares the results of No Child Left Behind through the APY. Graduation rates, attendance rates, and the standardized testing that the state enforced are examined. The study also analyzes if the state enforced mandatory requirements of No Child Left behind on the school. These focus mostly on the types of sanctions that were put in place, any state intervention that may have happened, and how well the state diversified the teaching population. These are included in the study because they are a heavily criticized part of No Child Left Behind.

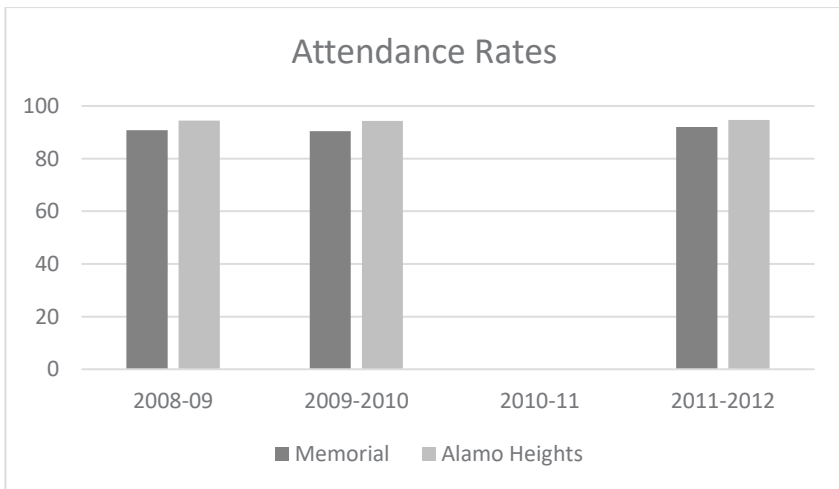
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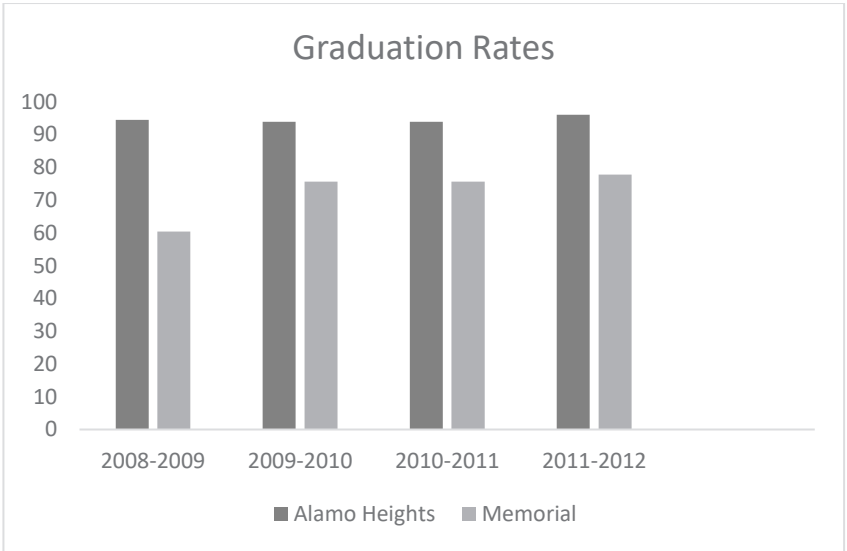
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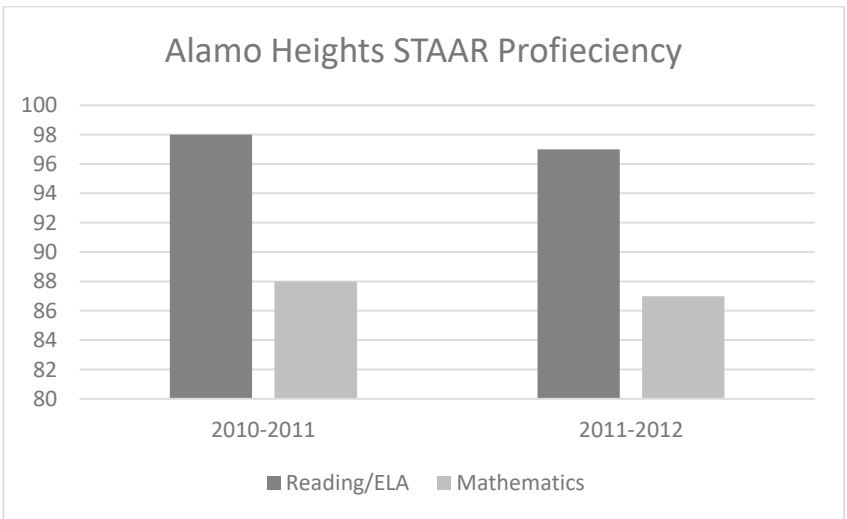
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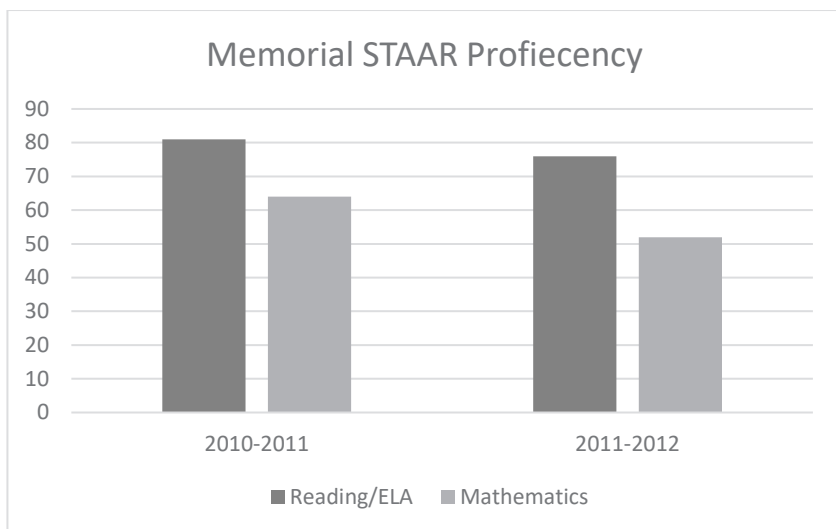
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Data gathered from (Texas Education Agency, 2010-2013)



Data gathered from (Texas Education Agency, 2010-2013)

Comparisons

Teacher Qualifications

The first thing that was noticeable in the data was the distribution of highly qualified teachers. From 2008-2012, the average percentage of teachers with a bachelors in Memorial was 56.75 compared to 44.03 percent at Alamo Heights. At first glance, this number shows that the diversification of teachers mandated by No Child Left Behind was a success. The problem is that highly qualified was defined as only having a bachelor's degree. The law did not mandate a diversification in teachers with higher credentials in schools. Memorial had 38.5 percent of teachers on average have a master's degree compared to Alamo Height's whopping 51 percent on average. (Texas Education agency, 2010-2012)

The efforts to diversify teacher credentials around school could not overcome the differences in pay. While No Child Left Behind tried to cover expenses, the main funding for the program, Title 1, failed to meet its funding by over 10 billion dollars.

(Klein, 2015) This failure within the program itself was detrimental and cost the program to lose merit. After the failure to reach an adequate amount of funding, the requirement of teacher diversification was ignored and was played down.

Students from low-income schools were left with less qualified teachers because of this miscalculation. Contrariwise, Students in high-income schools were hardly affected because they can afford to pay teachers with higher qualifications. This puts Memorial High School at a disadvantage from the earliest implementation of No Child Left Behind because efforts to meet AYP is difficult when teachers are less qualified. There was a push during the 2011-12 year in which Memorial closed the gap between the percentage of teachers with master's to 4.7 percent, but No Child Left Behind was waived the following year and the results were left inconclusive because teacher qualification data was no longer collected. (Texas Education Agency, 2012)

Attendance Rates

The attendance rate is what Texas chose as its extra indicator for the AYP. No Child Left Behind did not directly impact attendance rates. Attendance stayed in about the same level for both Alamo Heights and Memorial. Alamo Height's attendance rate is higher, but this has no correlation to the impacts of No Child Left Behind. It is important to state that both schools met the marks needed for attendance.

Graduation Rates

Graduation rates are the one bright spot for the low-income schools. From 2008-2012, Memorial has been able to close the gap between the graduation rate differences. While the gap is still separated by over 20 percent, the progress made has been a positive outcome from No Child Left Behind. Despite the lack of funding and teacher diversification, graduation rates continue to rise throughout Memorial.

The main leap happens between 2008-2009 which was the first year of President Obama's term. This raises the question of

whether No Child Left Behind was responsible for the increase or not? (Texas Education Agency, 2010) Education policy did not change that year though and Memorial's graduation rate is still rising slowly in the years that follow. They also did not revert back to previous numbers meaning that change did occur.

One reason this may have happened is that of the fear of state intervention. AT this point, Memorial had already missed AYP 3 years in a row and while state intervention was unlikely, the fear that it could happen may have pushed the school to reach new limits. As for Alamo Heights, their graduation rates were high but stagnant. (Texas Education Agency, 2010)

Proficiency Testing

Standardized testing has been heavily critiqued over the years. Students do not like them, and teachers have failed to be able to prep students for them. With that in mind, this area of the AYP has been the hardest to meet. The problem starts back with the diversification of teachers in low-income schools. Unqualified teachers have been struggling to make ends meet and the statistics show it.

The gaps between Memorial and Alamo Heights are significantly larger here than the other indicators without any signs of closing. Tutoring is supposed to be offered if a school fails to meet AYP 3 times in a row, but even then, Memorial showed no improvement. Like the teacher qualification problem, tutoring is also supposed to be funded by Title 1. The lack of funding may be the cause for the disparity in testing. If that is the case it only exacerbates the differences between a high-income school when compared to a low-income school. Without proper funding, schools like Memorial cannot catch up or compete with schools like Alamo Heights.

Discussion/Limitations

The biggest limitations of the study are sample size and lack of specificity of the legislation in general. There are over one dozen school districts in whole or in part in Bexar County. Using

only two schools to discuss Bexar County may not be representative of schools within other districts, the state of Texas, or nationally. This combined with the vague details of what is considered a highly qualified teacher makes outcomes be a bit sporadic. A clear and concise definition for highly qualified teachers could have helped demonstrate clearer disparities among the schools.

What is next for this study is to improve on the sample size. Comparing entire districts in Bexar County, Texas will help see a larger trend between disparities. This will help map out trends at a larger scale. There is also the thought of comparing No Child Left behind and the reform done by President Obama. A more complete understanding on No Child Left behind could be learned by comparing President Obama's educational reform policy that begins in 2009.

Conclusion

Overall, this study shows some of the differences between how No Child Left Behind affected one high-income school compared to one low-income schools. Whether it was testing, academics, or attendance rates, high-income schools tend to do better. This may seem obvious or self-evident, but the purpose of the study was to show a clearer understanding of what those effects are and how far apart the difference may be. No Child Left Behind had its benefits but was consumed by the flaws of the legislation.

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Portrayal of Identical Twins In Movies: Myths and Facts

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Identical twins or monozygotic (MZ) twins have long been a source of fascination to the public and, as such, there are several stereotypes about attributes and abilities associated with MZ twins that are not supported by current scientific thought. As an example, the stereotype that one twin in a MZ pair is good while the other is evil is challenged by research that finds MZ twins are more alike than different in personality. Anecdotal reports suggest that portrayals of MZ twins in popular movies serve as one source of these misinformed stereotypes. As these reports lack empirical validation, it is the purpose of this study to provide a content analysis of movies as to portrayal of MZ twins with reference to stereotypes, both informed and misinformed, about attributes and abilities. Results show that both misinformed and informed stereotypes about MZ twins are found in movies. The results were discussed with reference to the importance of educating the public about stereotyped misinformation that movies can portray in their depiction of MZ twins.

Identical twins or monozygotic (MZ) twins are defined as the product of a single fertilized egg that splits into two separate eggs while in utero. MZ twins express the same genotype and are a relatively rare phenomenon with the twinning rate at only .3%-.4% worldwide (Segal, 2017). The phenomenon that two

individuals look alike and may be difficult to distinguish physically has generated considerable speculation to both origins of monozygosity and associated psychological characteristics of MZ twins. Historically, supernatural characteristics have been attributed to MZ twins. As an example, in the folklore of the South American Bakairi Indians tribe, MZ twins were viewed as the “shapers of the world” in which they use their supernatural abilities to steal the sun and moon, separate Earth and sky, and form rivers (Métraux, 1946). Supernatural characteristics were also ascribed to the conception of twins. In Greek mythology, it is believed that twins were the product of a “divine impregnation” and were given powers of healing and fertility (Hankoff, 1977). In addition to MZ twin supernatural characteristics, contrasting personalities in MZ twins have been emphasized in myth and legend. In the folklore of the tribes of Guiana, one MZ twin, Tuminikar, is viewed as a perfect entity while his twin brother, Duid, is a “good-for-nothing” prankster (Métraux, 1946). The good and evil stereotypes are exemplified in the legends of Native Americans in which one MZ twin, Makunaima, periodically indulges in mischief or harmful activities and must be brought back to life by his twin brother Pia (Métraux, 1946).

Although the legends surrounding MZ twins have been discredited in contemporary times, MZ twins have continued to intrigue researchers. Much of the research on MZ twins has focused on the investigations of the heritability of physiological and psychological traits in attempts to distinguish how much of a trait is nature versus nurture. Physiologically, MZ twins are considered as more susceptible of “heritability as an etiological factor” for diseases such as Chron’s-disease (Tysk, Lindberg, Järnerot, & Foderus-Myrhed, 1988), diabetes (Barnett, Eff, Leslie, & Pyke, 1981), schizophrenia (Sullivan, Kendler & Neale, 2003), and bipolar disorder (Dempster et al., 2011). Though less is known about the heritability of psychological features, researchers have investigated MZ twin similarities as to personality traits. Jang, Livesley and Vernon (1996) investigated the Big 5 personality dimensions of neuroticism, extraversion,

openness, agreeableness, and conscientiousness and found substantial heritability with the genetic influence estimated at ranging from 41-61%.

Despite current scientific findings relevant to attributes of MZ twins, the public holds to several MZ stereotypes, many of which are misinformed (Fierro, 2018). One commonly held yet misinformed stereotype is the belief that twins have telepathic abilities. According to Segal (2017), the basis for the myth of “twin telepathy” may originate from observations that MZ twins do indeed exhibit similar behaviors, abilities, and temperament. For example, twins are often accused of cheating on class assignments or exams as their answers are too similar. This similarity, however, may be a result of twins sharing genetics and experiences. As Segal (2017) explains, MZs “psychic connection” may be more appropriately explained by the constant interaction and communication one twin has with the cotwin for an extended period of time.

Another misinformed stereotypical belief is that MZ twins perceive themselves as one unit rather than two distinct individuals, a perception that is reinforced by MZ twins dressing alike and behaving alike (Jones, 2008). Although it is true that over half of child MZ twins wear identical clothing and hairstyles, Le Maner-Idrissi and Corroyer (1998) suggest that the purpose is not to reinforce perceptions of being a unit but rather represent a desire on the part of twins (or their parents) to establish the “external signs of twinship.” And as MZ twins become older, dressing differently becomes a priority to promote their individualization.

With reference to similarities or dissimilarities in MZ twin personality, a commonly held but misinformed stereotype is that of the good twin versus the bad or evil twin within the MZ pair. Segal (2017) explains that this stereotype is derived from those who assign the good-evil dichotomy as a way of telling MZ twins apart. In reality, MZ twins’ personalities are more similar than not (Segal, 2017) and it is unlikely for MZ twins to have completely distinct personality traits (e.g, good and evil). For MZ twins

reared together, genetics, environment and experiences are shared and personality traits are mostly matched. Other stereotypes about MZ twins involve twin language and twin switching. Twin language is defined as speech that is acquired from the language in the home environment and only makes sense to the two that are learning the language at the same time (Segal, 2017). Twin switching is defined as the action of pretending to be the cotwin for fun or personal gain. It is unclear how frequently twin switching occurs in real life as no empirical data can be found about this topic.

Given that there is considerable misinformation about characteristics and attributes of MZ twins, one source for this misinformation may lie with the media. It has been established that media portrayals of diverse groups of people can exert influence on beliefs and attitudes about that group, especially if viewers have little experience with group members. In a content analysis of contemporary movies featuring characters diagnosed with schizophrenia, Owen (2012) found that many of the movies portrayed inaccuracy and misinformation about schizophrenia, and suggested these inaccuracies influenced negative stereotypes about schizophrenia held by the general public. Other studies have also found that attitudes towards transgender people are significantly influenced by their portrayal in popular movies and tv shows (Gillig, Rosenthal, Murphy & Folb, 2017). When transgender portrayals are negative and stereotypical, there is a negative effect on the attitudes viewers and when portrayals are positive then the viewers attitudes towards transgender people are positively influenced (Solomon & Kurtz-Costes, 2017).

Although (to the best of the author's knowledge) there are no published empirical studies providing analysis of media portrayals of MZ twins, anecdotal accounts suggest that stereotypical portrayals of twins in movies, TV shows and in literature cue viewers and readers to believe that MZ twins are "magical and mysterious" (Flais, 2010) and that one MZ twin can show a dramatically different personality from his or her twin. The purpose then of this study to provide a content analysis

of movies as to portrayal of MZ twins with reference to stereotypes, both informed and misinformed, about attributes and abilities.

Method

Sample

Full-length feature movies that featured MZ twins as central characters were viewed in their entirety. All movies were released in the United States between the years 1980 to 2018 and all movies were available via online streaming services, rental or purchase. Movies were identified through the public library system and different online databases and lists. Key words for Internet searches were “movies with identical twins, movies about twins, twin movies.”

Coding

Each movie was coded for the presence of variables found in four general categories: MZ twins are similar, MZ twins are dissimilar, MZ twins possess supernatural or special abilities, and MZ twins engage in behavior unique to their MZ status. In the category of MZ twins are alike, MZ twins were coded if they looked alike with reference to clothing, hair and individual features. MZ twins were also coded for similarity in personality features. In the category of MZ twins are dissimilar, contrasting personality characteristics (e.g, dominant and passive; good and evil) were coded. Behaviors such as twin telepathy and display of super powers or special abilities were coded and the unique MZ twin attributes of twin switching, twin language and birth order issues were coded. One-third of the movies were coded independently by two researchers to assess inter-rater reliability. Reliabilities were high and disagreements were resolved through discussion.

Results

A total of 28 movies featuring 30 MZ twins were viewed. With reference to physical similarity of MZ twins, almost half ($n = 12$, 40%) of the movies portrayed twins as looking alike. These twins dressed in the same style and styled their hair in the same. In some cases, these twins appeared indistinguishable. With

reference to personality characteristics of the MZ twins, personality traits matched in almost half ($n = 12$, 40%) of the movies. For example, if one MZ twin exhibited leadership qualities, the cotwin as well exhibited leadership qualities. MZ twins showed distinct physical appearance in 60% ($n = 18$) of the movies, as noted by different hairstyle, dress or other physical characteristics (e.g, only one of the pair would wear glasses). In 60% ($n = 18$) of the movies, MZ twins exhibited distinct and often oppositional personality traits. For example, if one MZ twin exhibited dominant qualities, the cotwin exhibited submissive qualities. Within these distinct pairs the good-evil stereotype was displayed in 20% ($n = 6$) of the movies. In 33% ($n = 10$) of the movies MZ twins possessed supernatural or special abilities. Of these 10 movies, four MZ twin pairs exhibited telepathic powers and two MZ twin pairs exhibited mythical powers as vampires and witches. Four MZ twin pairs exhibited special abilities such as superior fencing skills and professional fighting skills. With reference to attributes unique to MZ twins, almost half ($n = 14$, 47%) engaged in twin switching behavior. Twin language and birth order were infrequently noted in the movies, as only three featured twin language and two alluded to birth order issues.

Other interesting results emerged from the content analysis of movies. It was noted that half ($n = 15$) of the movies ended with a positive outcome for both of the MZ twins, as exemplified in many movies by the reconciliation of troubled families. One-half ($n = 15$) of the movies ended with an adverse outcome for either one or both of the MZ twins, with most of these endings involving the death of one of the twins. The genre of MZ twin movies was also noted. Almost one-third featured graphic violence ($n = 10$, 30%) as a prominent theme and 20% ($n = 6$) contained themes related to supernatural elements. Almost one-fourth ($n = 7$, 23%) of the movies were comedic with many portraying twin-switching as a key plot device.

Discussion

The purpose of this study is to examine the extent to which popular movies perpetuate common stereotypes about

identical twins. Results indicated that the accurate stereotype that MZ twins are dissimilar in appearance was supported by many of the movies, which showed the twins with distinct dress and physical attributes. However, almost half of the movies portrayed the MZ twins as identical in appearance, thereby promoting the inaccurate stereotype that MZ twins are physically alike. Over half of the movies featured the MZ twins as having distinctly different personalities, reinforcing the myth that MZ twins are more different than alike in personality. Some of these MZ twins were portrayed with distinctly opposite personality traits. As an example, in *Dead Ringers*, one MZ twin was extremely extroverted and the other was introverted. In *Twins of Evil*, one MZ twin was kindly while her cotwin was malevolent and murderous. As research indicates, this polarity of personalities in MZ twins is unlikely, as MZ twins' personality is more alike than different. The misinformed stereotype that MZ twins possess supernatural or special abilities was not supported, as only four movies referred to twin telepathy, and only four movies referred to MZ twins having supernatural powers. Twin switching occurred in almost half of the movies even though it is unknown how frequently this occurs in real life. It was interesting to note that twin switching was utilized in the movies narrative to either solve a problem or to gain an advantage or avoid adverse consequences. It is also interesting to note with reference to outcome of a movies' narrative that MZ twins were used as plot devices to engage in either nefarious behavior with consequent adverse outcome or to engage in constructive problem solving with consequent beneficial outcome.

One limitation of this study concerns the time constraints that allowed for only a limited number of movies to be viewed which could limit generalizability. Another limitation concerns difficulty in locating movies that featured MZ twins. There are hundreds of MZ twin movies listed in movie databases but many were not available for purchase, rental or online streaming. Recommendations for future research include locating and viewing more movies that feature MZ twins and statistically

analyzing results via chi-square tests. As a final point, the quality of the majority of the movies that were viewed was poor with reference to script, acting, editing, and cinematography. Also, many of the movies featured considerable graphic violence. It is recommended that a well-crafted movie that presents accurate information about MZ twins be produced.

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Incarceration to Salvation: How to Bring the Gospel to the Ones Held Captive

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Once someone is convicted of a crime and sentenced, the public tends to forget about that individual. People might think of them as being stripped of all dignity for what they have done. What does Catholic Social Teaching say about the dignity of human beings regardless of perceived merit? What kind of obligations do Catholic Christians have towards those who are serving time in prison, and what kind of limitations on faith do inmates face while incarcerated? This study will further analyze what kind of limitations there are and explore what Catholic Christians are doing to bring the message of the Gospel and the Sacraments to Catholic inmates who are incarcerated. Although there is little existing scholarship on this topic, this paper addresses the importance of the United States Conference of Catholic Bishops (USCCB) and the statements they have put out for the public. These statements inform Catholics on various issues and how to respond. This paper will examine how Catholics are responding to the Church's call to prison ministry and offer a detailed glimpse of how some people have responded to the call of serving prisoners. The goal of this research, which has identified a gap in current scholarship on Catholics and incarceration, is to show that prisoners are not being tended to as fellow Catholic Christians and to offer some suggestions for future action. Lay Catholics can become involved in prison ministry by introducing the idea to their parish priest. From there the priest can make the

decision to promote the ministry and encourage lay Catholics to become involved in serving prisoners.

Having faith in God can come with a set of expectations about good action, but imagine if someone committed a crime deemed unforgivable and all their religious rights are now at risk of being nearly eliminated. Not only is that risk possible, but there is also a risk of being forgotten by the religious community. Individuals that are convicted and sentenced face this problem, the problem of losing their freedom of religion. In particular, Catholics in prison are at risk of losing their opportunity to receive the Sacraments. The case of Brian Nelson is an example of what Catholic inmates endure while being incarcerated. Nelson was in solitary confinement at Tamms Correctional center and was frequently denied his religious rights: attending mass, receiving the Sacraments, his bible, and his rosary. There were many times he was mocked for fasting, or abstaining from meat.¹ Nelson's case is one of many that the public is not aware of. It is important for scholars, the American public, and lay Catholics to understand the religious limitations people who are incarcerated face on a daily basis.

Religious and legal concerns is both at stake. American civil rights dictate that no one should be denied the freedom to practice his or her religion. However, considering the prisoner's lack of access to religion from the perspective of Catholic Social Teaching raises additional concerns and may suggest additional courses of action. There are seven principles in Catholic Social Teaching, but the two that will be focused on for this study are the life and dignity of the human person, and rights and responsibilities. Rights and responsibilities is a phrase used in Catholic Social Teaching that ensures people's rights are protected and responsibilities are met to one another.² For

¹ Katie Rose Quandt, "We Are One Body: Catholics Raise Voices against the Use of Solitary Confinement" (July 2013). Accessed June 27, 2018.

² USCCB, "Rights and Responsibilities." Catholic Bishops Launch Major Catholic Campaign to End the Use of the Death Penalty. Accessed June 28, 2018.

Catholics, Sacraments are sacred rituals that bring them closer to Christ, and the Holy Spirit gives God's grace. Not being able to participate in the Sacraments can be catastrophic to Catholic inmates. Receiving the Body of Christ unites all as one Body, but if inmates are not able to participate in the celebration of the Mass, they cannot receive the Body of Christ.³ *Imago Dei* is a theological term applied uniquely to humans and means Image of God.⁴ Its roots come from Genesis 1:27 where God "made mankind in his image and likeness."⁵ This term is universal for all humans, including the outcast and the forgotten. Therefore, prisoners will never be exiled from being made in the Image of God because of their past or current situation. The image of God is in everyone, including prisoners. By their crime, they have fallen short of their full potential, but the right to be known as *Imago Dei* will never cease.

This paper examines the roles that people of faith (chaplains, vowed religious, lay people) play in the lives of inmates who are in a maximum-security prison and the restrictions the prison system places on prisoners' access to religious support. I will apply the lens of Catholic Social Teaching to this aspect of the criminal justice system, demonstrating that the Catholic position insists no crime committed can or should separate the criminal from people of faith who reach out to them with love and understanding. Furthermore, I argue that the Church has not fully succeeded in fulfilling their stated obligations to the incarcerated people they consider brothers and sisters. Research reveals that few Catholics

<http://www.usccb.org/beliefs-and-teachings/what-we-believe/catholic-social-teaching/rights-and-responsibilities.cfm>.

³Thomas Izbicki, "The Real Presence of Christ, the Minister, and the Materials of the Sacrament." *The Eucharist in Medieval Canon Law*: 21-85. doi:10.1017/cbo9781316408148.005. See also *Catechism of the Catholic Church* 1353. Accessed June 27, 2018.

⁴USCCB, "Communion and Stewardship: Human Persons Created in the Image of God." Accessed June 27, 2018.

⁵*The New American Bible*. Wichita, Kan.: Fireside Catholic Publishers, 2005. All biblical quotations in this paper come from *New American Bible* translation.

are involved in prison ministry. To conclude, I offer a few suggestions for actions that could be taken to more closely align theological teachings and real practice.

State of Affairs

The United States has less than five percent of the world's population but has the highest incarceration rate, with the United States housing more inmates than any other nation in the world.⁶ Although the number of Catholic inmates is growing, Protestants make up more than half the percentage of incarcerated adults.⁷ Many factors contribute to the strong presence of Protestant faith in the prison system.⁸ Several groups provide prisoners with an immense amount of resources and support from the outside Protestant community.⁹ Support groups of Protestant faith offer worship resources that are not regularly available for Catholic inmates.¹⁰ This is difficult for Catholic inmates because a lack of these resources can take away from their Catholic identity.¹¹ There is a Mass celebrated in the unit weekly by one priest and one deacon. However, the number of outside attendees is poor.¹² The drive itself can be unappealing to Catholics who entertain the thought of prison ministry. The individuals involved in putting together this Mass are doing exactly the work that is expressed in 25:36 of Matthew's Gospel: "I was in prison and you visited me." The United States Conference of Catholic Bishops (USCCB),

⁶Adam Liptak, "Inmate Count in U.S. Dwarfs Other Nations' - New York Times." *New York Times*, n.d., 5. (April 2008) Accessed June 28, 2018

⁷ "Religious Affiliation of Inmates in U.S. Prisons, 2011." *Statista*. Accessed June 18, 2018. <https://www.statista.com/statistics/234653/religious-affiliation-of-us-prisoners/>

⁸ Aaron Griffith, "Prisoners and the Least of These in American *Protestantism*," *The Christian Century* (April 2014).

⁹ Teresa Malcolm, "Dismas Brings Bibles, Faith Study to Catholics behind Bars." *National Catholic Reporter* 40, no. 40 (September 17, 2004), 1.

¹⁰ Malcolm, "Dismas brings Bibles," 1.

¹¹ Malcolm, "Dismas brings Bibles," 1.

¹² Valerie Schultz, "Prison Breakthrough: The Surprising Rewards of Detention Ministry." Blume Library. (July 2012)

through statements released for the outside Catholic community, does the outreach that is done for Catholic inmates. Catholic inmates have the right to partake in the sacred mysteries of the Mass. Although the presence of lay Catholics is sparse in the walls of many prisons, a small number do understand the need for their support in the prison system.

The statements put out by the USCCB are helpful for Catholics on the outside, but what is the Church doing for Catholics inside the walls of the many prisons in the United States? Inmates are not receiving the support in faith that they need. Catholics are still not recognizing prisoners as the “*least of these*.”¹³ Catholic Social Teaching provides a framework for reflection and guidance for a list of issues in reference to the criminal justice system. In a statement given out by the bishops called “Responsibility, Rehabilitation, and Restoration: A Catholic perspective on Crime and Criminal Justice” the most applicable principles of Catholic Social Teaching are discussed.¹⁴ The focus is on the common good and dignity of the person. First, it calls for a strong support of victims who are all too often neglected. By first addressing the victim and their needs, they can go forward with their suggestions regarding what is lacking in society that leads to these acts of crime. Prisoners are not given the resources they need to be productive in society following time served. The USCCB address these many issues in their statements and concludes that there is much to be done in terms of support for Catholic prisoners as they grow in their faith. The Church expresses why compassion is needed towards inmates through Catholic Social Teaching.

¹³ The least of these is a term known in Christianity as people who are homeless, vulnerable, and marginalized. They are recognized as people who have a special love from God.

¹⁴ USCCB, “Responsibility, Rehabilitation, and Restoration: A Catholic Perspective on Crime and Criminal Justice.” Accessed June 25, 2018.

Catholic Social Teaching

Catholic Social Teaching is a central and essential element of Catholic teaching.¹⁵ Its roots come from the Hebrew prophets who express God’s special love for the poor, work for justice, and love in the world.¹⁶ Catholics understand that God’s nature is communal and social, thus helping others to understand the work God has laid out for His people. Catholics are called to give to the “least of these,” especially the most vulnerable; they believe that humans are not created to be alone or in deliberate isolation from others. It goes against the very nature of God. This is why the USCCB has reached out in statements expressing their beliefs on how the U.S. prison system should treat prisoners.

Catholic Social Teaching proclaims that life and dignity of a person is to be respected, protected, and recognized as holy and sacred. The corporal works of mercy are actions that can be performed for others who are in need. Some examples are feeding the hungry, sheltering the homeless and visiting the imprisoned. Spiritual works of mercy are actions of compassion.¹⁷ Such examples are to be of advice, to console, and to forgive. Both works of mercy are needed in the prison system. Catholic Social Teaching shapes existing Catholic responses.

Catholic response

In the past seventeen years, there have been many influential statements given by the USCCB that help shape a framework for Catholics to reflect on. In “Responsibility, Rehabilitation, and Restoration: A Catholic perspective on Crime and Criminal Justice” the statement is unapologetically critical of the American criminal justice system.¹⁸ The bishops maintained their stance on rehabilitation of prisoners and their rights regardless of whether they are serving a light sentence or a sentence to death. The Catechism of the Catholic Church teaches

¹⁵ USCCB, "Catholic Social Teaching Beliefs and Teachings, What we Believe." Accessed June 28, 2018.

¹⁶ USCCB, "Catholic Social", 1.

¹⁷ James F Keenan. *The Works of Mercy: The Heart of Catholicism*. (Rowman & Littlefield, 2017).

¹⁸ USCCB, "Responsibility, Rehabilitation," 1.

that punishment for crimes must serve three principle purposes, “the preservation and protection of the common good of society, the restoration of public order, and the restoration or conversion of the offender.”¹⁹ Regardless of merit, inmates are beloved by God. Though this can be a challenging task for lay Catholics, visiting inmates will show them that they still have a community that provides them with mercy and love. A number of Catholic inmates have no one other than the USCCB looking out for their best interest. However, the bishops cannot celebrate mass or bring the sacraments to those incarcerated every week. This is a mission that has to be carried out by lay Catholics. Many people who are incarcerated have no one but their small Catholic community in prison. Jim Gilroy talks about his experience interviewing inmates at the Jamesville Corrections Facility.²⁰ Gilroy names the four people who were the most influential for Catholics that were on the unit. Fr. Ed Reimer, Sr. Maura Rhode and two former priests regularly visited the unit to help inmates with their needs such as providing a listening ear or giving advice. My findings have led me to see that the majority of inmates are visited only by Chaplains, deacons, or vowed religious. The number of lay Catholics that visit inmates is minimal.

Visiting the imprisoned and making them feel like they are in solidarity with other Catholics will not eliminate crime, but showing mercy to the condemned is something Christ did at his very death. Christ forgave the thief from the cross and did not condemn the man for his crimes, but showed the world what forgiveness should exemplify and how Christians are to live out their life (Luke 23:39-43). The bishops expressed that though the number of people incarcerated is jumping, crime is not slowing down. The way prisoners are treated by the general Catholic

¹⁹Fred Kammer, "Catholic Social Teaching and Criminal Justice." An Introduction to Catholic Social Thought. 2009.

²⁰ Jack Gilroy, "My Time in Prison Reveals Caring behind Bars." *National Catholic Reporter*. (April 18, 2015.)
<https://www.ncronline.org/news/people/my-time-prison-reveals-caring-behind-bars>.

community is not consistent with the message of the Gospel. This should alarm Catholics because each Catholic is united by the Body of Christ. If a piece of the Body is hurt, it affects the rest of the Body. Christ did not give the option to his followers; he showed the way of salvation through works and mercy. Catholics should not focus on the crime of an individual, but instead should focus on the rehabilitation of that person. Why did the individual commit this crime and how are they currently being treated? What can be done to make sure they do not become a repeat offender? This recognizes the personal dignity of the individual without the crime staining their image.

American society tends to focus on the overriding emphasis of punishment. Inmates live in harsh and dehumanizing conditions. In the statement “Responsibility, Rehabilitation, and Restoration: A Catholic perspective on Crime and Criminal Justice” the bishops emphasized the importance of family and the right for prisoners to be able to have access to religious community support.²¹ There are only so many priests in the US that can devote some of their spare time to inmates. Prisons are usually in rural areas which means that the commute alone can take hours to complete. *America Magazine* published an article called; “Catholic Prison Ministry” by John Coleman.²² He found on a Catholic web page that out of the twenty-three jails and prisons in the diocese, only thirteen of the facilities had visits from Catholic volunteers. Of those thirteen, only five had regular masses.²³ Priests run parishes, hospitals, seminaries, and finding time to visit the imprisoned can be impossible. If they do visit prisons they give the Sacraments and celebrate Mass, but many inmates might seek more of a community feel with other lay Catholics. The support is spreading thin, and as the number of inmates rises, the number of priests dwindles.

²¹ USCCB, "Responsibility, Rehabilitation, 1.

²² John A. Coleman, “Catholic Prison Ministry.” *America Magazine*, (February 4, 2014.)

²³ Coleman, Prison Ministry 1.

In the last fifteen years, the numbers of priests in the United States has dropped tremendously.²⁴ This has had a profound effect for incarcerated Catholics. In certain respects lay Catholics have an advantage over priests. They are able to give advice to the inmates on how to keep their family together. They also are able to teach religious education, train volunteers, and a number of beneficial tasks that can help the inmates thrive given the situation. The one thing that they cannot do is celebrate mass, anoint the sick, and absolve the inmates. These Sacraments can only be celebrated with an ordained chaplain.²⁵ Given the harsh living conditions, it is important for inmates to have access at any given moment to receive anointing of the sick. The anointing of the sick is administered to Catholics during an illness, or near the time of death. Catholics believe that the grace of the Sacrament unites the sick individual to the Passion of Christ. The lack of being able to receive the Sacrament of reconciliation can be detrimental to inmates. Through the priest, God absolves the person of their sins. If no priest is available, the inmates cannot receive absolution and this can be burdensome for Catholic inmates. Many inmates are ready to seek forgiveness once they have come to terms with their actions. The lack of access to the Sacraments can make inmates feel like they are not one with the Body of Christ.

Priests hold the authority of the parish they are assigned to. Being that the priests have a heavy influence on the activities and ministries that go on in the parish, they should do a better job of promoting prison ministry so that lay Catholics can recognize the importance of this ministry. Ministries and organizations must seek the approval of the priest before deciding to move forward with tasks and goals. The characteristics and attitude of the priest can have a profound effect on the parishioners.²⁶ In a study done

²⁴ Kathleen Ragen, "Are Catholics Being Locked Out." *Information Standards Quarterly* 23, no. 2 (2011): 31. doi:10.3789/isqv23n2.2011.07.

²⁵ *Catechism of the Catholic Church* 1575, 1576.

²⁶ Thoroddur Bjarnason, and Michael R. Welch, "Father Knows Best: Parishes, Priests, and American Catholic

by Thoroddur Bjarnason and Michael Welch, it was discovered that the more priests interact with informing parishioners on issues such as capital punishment, the more likely it would have a profound effect on their decision to support or oppose the issue. If a priest opposes an issue and expresses that to his parishioners regularly, the more likely parishioners will feel an obligation to side with the priest. The same can be said for when a Pope gives a statement concerning an issue that is not always addressed in parishes such as capital punishment or the dignity of prisoners.

Human Dignity and the Debate over Capital Punishment

Catholic Social Teaching does not exclude any individual from the value of human dignity. Even when applied to the most heinous crime committed, the dignity of the person is not forfeited. The crime can have such a profound effect on the community that some people might think about the offender as being less than human so that such a punishment is justified. The most heinous crime cannot separate someone from the Body of Christ. Pope John Paul II called for an end to capital punishment and openly spoke out on behalf of US inmates condemned to death, asking that they be given clemency. The bishops addressed capital punishment in a general meeting in 1974.²⁷ Prior to this, many American bishops refused to call attention to the abolition of the death penalty. Previously the Church supported capital punishment, even to the point of commanding it. Almost a century ago, the Catholic Church in the United States taught consistently that capital punishment could be lawfully applied to certain individuals. The individuals they spoke of had to be fairly convicted of a serious crime, though what constitutes “fair” is subjective. They expressed that it was necessary for enforcing the law and protecting the good of the community.²⁸ In 1980, the

Parishioners’ Attitudes toward Capital Punishment.” *Journal for the Scientific Study of Religion*, no. 1 (2004): 103.

²⁷ Edward Feser, and Joseph M. Bessette. *By Man Shall His Blood Be Shed: A Catholic Defense of Capital Punishment*. San Francisco: Ignatius Press, 2017.

²⁸Feser and Bessette, *By Man Shall His Blood Be Shed*, 282.

bishops believed that capital punishment was compatible with Church Tradition. However, since 2007 they have argued that human life is sacred, and that faithful Catholics should oppose the death penalty.

However, Catholic support of the death penalty continues in some circles. Feser and Bessette are two Catholic proponents of the death penalty. In their book *By Man Shall His Blood Be Shed*, they address the fuzzy understanding of Church teaching concerning capital punishment. Their biblical argument is that Scripture is divinely inspired, so to disregard a piece of Scripture to fit with a development in Church teaching is considered heresy. They argue that whether capital punishment is permissible or not is a matter of one's personal morals and faith. If Scripture has always been understood as it is by the teachings of the Church and of the Church Fathers, then every faithful Catholic must maintain that this teaching is divinely inspired. Feser and Bessette argue that Catholic opponents of the death penalty do not bring the Old Testament passages into dialogue and instead do not bring them up. A compelling argument that Feser and Bessette present is from a passage in Genesis 9, which states, "Whoever sheds the blood of man, by man shall his blood be shed" (Gen 9:6). This would seem to be a clear indication that God not only allows the death penalty, he requires it. Feser and Bessette also say that today, Catholics mistakenly believe that the Christian message of forgiveness and mercy trumps the legitimate role of the state to carry out executions. They continue by saying public officials have the authority to carry out the executions and when they do so, they act as "the servant of God to execute his wrath on the wrongdoer" (Rom 13:4). Christians can forgive, but that does not absolve the offender from his just punishment. These are all arguments given by Feser and Bessette and in no way does it bring the full completion of the message of forgiveness.

E. Christian Brugger is a Catholic theologian who opposes capital punishment. In an article called "Capital Punishment is Intrinsically Wrong: A Reply to Feser and Bessette," Brugger

expresses his opposition to the arguments of Feser and Bessete.²⁹ In the article, he addresses his main concern: did the Church ever teach the legitimacy of capital punishment as an infallible statement? The answer is no, and not only did the Church never infallibly declare on capital punishment, no ecumenical council ever addressed it. Another compelling argument he posits is *his* interpretation of Genesis 9:6. Brugger argues that this passage should be classified as proverb and not as a strict divine command of moral instructions.³⁰ Meaning, Genesis 9:6 does not instruct its readers to believe that a state has the right to intentionally take the life of an individual. It is not a biblical warrant for state sanctioned killing, as Brugger explains.³¹ The teachings on capital punishment have shifted in the Church because of the developing understanding of the sanctity and dignity of all human life. Opposing capital punishment is not heresy because there was never an infallible statement made concerning the legitimacy of the act.

This is a part of Church teaching that has grown considerably, but today there is still more room for growth. Catholics are learning that inmates are as much a part of the Body of Christ as the person next to them in a pew. However, Catholic inmates are still disregarded and are not identified as *the least of these*. Arguments given by Feser and Bessette can mislead Catholics on the treatment of prisoners, especially if they are encouraging their death sentences. Today, American Catholic bishops have become leaders in the movement to abolish the death penalty. The Church claims that the right to life is universal, and no crime committed can separate a person from God's mercy. The USCCB has put out many statements calling for an end to capital punishment. One of the statements put out by the bishops is called "Catholic Campaign to End the Use of the Death

²⁹ Christian E Brugger, "Capital Punishment Is Intrinsicly Wrong: A Reply to Feser and Bessete." *Public Discourse*. October 22, 2017. <http://www.thepublicdiscourse.com/2017/10/20341/>.

³⁰ Brugger, Capital Punishment Is Intrinsicly Wrong.

³¹ Brugger, Capital Punishment Is Intrinsicly Wrong.

Penalty,” and it focuses on how the US has other means to protect society.³² Not only can society still be protected by not putting its citizens to death, the death penalty is deeply flawed and unfairly applied to people of color, quality and cost of defense.³³

Feser and Bessette bring up legitimate arguments and some may consider convincing, like Scripture and the Tradition of the Church. They are right; Catholics cannot disregard Scripture if they believe it to be divinely inspired. The problem with their argument is that it lacks understanding of Catholic Social Teaching. Brugger’s argument aligns with Catholic Social Teaching because it places value on understanding the life and dignity of the person. Inmates still have a value that cannot be forfeited even if the Catholic community believes their value has vanished after their crime. The Church teaches that the life and dignity of all people is to be recognized in any circumstance. This is introduced by one of the seven principles in Catholic Social Teaching. The book tells Catholics that being a proponent of a legal act that takes the life of another person is not deemed wrong. If “fairly” convicted of a crime, not only did the Church not oppose it, they understood it to be just not only in the eyes of the law but also in the eyes of God.

The arguments Feser and Bessette introduce are problematic to Catholic inmates because they shows them no mercy. Although they defend their position with recourse to Scripture, there are other biblical passages that suggest mercy triumphs over judgment. In John’s Gospel the Scribes and the Pharisees bring forth a woman who has committed adultery. The men are prepared to stone her, but Jesus says, “Let the one among you who is without sin be the first to throw the stone at her” (John 8:7). This is a clear indication of Christ’s mercy, and it is an act of mercy that Christians should mirror in their lives. Feser and Bessette are doing more harm by this book because it can give the assumption to Catholics that they have no obligations to people

³²Feser and Bessette, *By Man Shall His Blood Be Shed* 282.

³³ USCCB, "Catholic Campaign to End the Use of the Death Penalty." *Washington D.C.* Accessed June 27, 2018.

who are incarcerated. It can also give off the impression that Catholics owe no obligation to people who are condemned to death but only to the victim of the crime. According to Feser and Bessette, punishment and our desire to inflict it is a natural tendency and should be equal to the offense. It tells Catholics that casting people out is acceptable, and Catholics do not need to feel mercy for offenders who have condemned themselves by their actions. This can lead Catholics to believe that going to visit them would be a waste of time, because they have torn themselves away from the Catholic community by their crimes. However, there is a need to reach out to these prisoners despite what has been argued.

Reaching out to inmates is imperative because it can give them hope, make them feel in solidarity with the rest of the Church, and they feel the much-needed support that they might not have from anyone else. Allowing inmates to have the access to faith-based programs lowers the likelihood that they will return to prison.³⁴ This benefits society by focusing on rehabilitation and not just punishment. Jesus never refused to associate with anyone and in fact associated with people who are being cast out by society. Christ calls Christians to lead by his example and teachings and not to disregard anyone but to embrace them; to do otherwise would be to sin against those who are rejected.

It is not only beneficial for inmates to receive love and support from the outside Catholic community, but prison ministry is also beneficial for the ones visiting the imprisoned. Pope Francis says visitors are enriched by being close to those who suffer like Christ.³⁵ Valerie Schultz began prison ministry with her husband when they moved to a small town known for its state prison. She never expected herself to become part of the prison ministry at her parish. Schultz says she now feels more at home in

³⁴ Bryon Johnson, "Can a Faith-Based Prison Reduce Recidivism?" Baylor University. January 2012.

http://www.baylorisr.org/wp-content/uploads/Johnson_Jan2012-CT-3.pdf.

³⁵ Junno Arocho Esteves, "Catholic News Service." Timeline for the Life of Dorothy Day. November 09, 2016.

the prison chapel than she does at her home parish. Schultz believes that the ministry gives more to her than what she gives to them. Nothing has enriched her faith like prison ministry.³⁶ Catholic Christians are called to change and bring change to the lives of the prisoners. Failed, repeated attempts at rehabilitation are better than making no effort at all to work for their good. Inmates who are learning the Catholic faith might not understand grace and salvation. All salvation comes through Christ but first lay Catholics need to bring Christ to the prisons. If not physically through the Eucharist, Catholics can at least bring Christ through his love poured through lay Catholics who visit the imprisoned. If lay Catholics are not finding it in their heart to fight for *the least of these*, then the message of the gospel will fall short of its purpose.

For Catholics trying to live out their calling to a life of mercy, this lack of understanding can be an obstacle; they now have to explain and convince other Catholics why it is important not to forget the imprisoned. No matter the crime committed, prisoners do not lose their dignity and are still deserving of love, respect, and forgiveness from the Catholic community. If the state does away with a convicted individual's life, Catholics should look for mercy in their heart, the kind of mercy Christ shows in the gospels. Feser and Bessette argue that Catholics cannot forget passages in the Old Testament, but *they* should not forget the stories in the Gospels that show love and mercy.

Living Out the Works of Mercy

The teachings of the Church offer guidelines on how the life and dignity of others should be not only respected but also valued. Some individuals serve as models for how to live out these guidelines. Sr. Helen Prejean, C.S.J. has been an example of both corporal and spiritual works of mercy by her life. She has visited the imprisoned and been a spiritual advisor to men on death row. Sr. Helen's life epitomizes the duty of solidarity with inmates to which all Christians are bound. Sr. Helen is the author of *Dead Man Walking* that became an Academy Award winning

³⁶Valerie Schultz, *Prison Breakthrough* 4.

film where she is played by Susan Sarandon.³⁷ Her newest book is called *The Death of Innocence: An Eye Witness Account of Wrongful Convictions* where she tells the story of two men who she believed were innocent and executed.³⁸

Sr. Helen says seeing the execution changed her life because no one was going to witness it as she did.³⁹ Sr. Helen has made it her mission to educate the public about capital punishment.⁴⁰ Educating the public was not the only factor that drove Sr. Helen to her activism. She believes that capital punishment is not an expression of the Gospel. She believes that someone's worst action does not define who they are, and she sticks to her belief in the commandment "thou shall not kill."⁴¹ Whether it be legally justified or not, it is always wrong to take someone's life.⁴²

Sr. Helen Prejean is a Catholic nun who is a part of the Congregation of St. Joseph. She is known for her work in fighting to end capital punishment. Her journey began in 1981, when she moved to the projects in New Orleans and became pen pals with Patrick Sonnier. Sonnier was convicted of killing two teenagers and sentenced to die in the electric chair at Angola State Prison.⁴³ She would then become his spiritual advisor while on death row. On September 15, 1982 Sr. Helen made the drive from her home to the Prison to have her first visit with Sonnier.⁴⁴ Since he is on death row, Sr. Helen and Sonnier did not have a contact visitor.

³⁷ Michelle Bagoyo, "Audio and Video." Accessed June 26, 2018.

<https://www.sisterhelen.org/audiovideo/>

³⁸ "Prejean Discusses 'The Death of Innocents.'" *NPR*. Accessed June 25, 2018.

<https://www.npr.org/templates/story/story.php?storyId=4280885>

³⁹ Bagoyo, "Audio and Video."

⁴⁰ Bagoyo, "Audio and video".

⁴¹ Helen Prejean, "Would Jesus Pull the Switch?" DioSCG. Accessed June 28, 2018. <http://dioscg.org/index.php/would-jesus-pull-the-switch/>. The commandment comes from the Hebrew Bible known as the Decalogue or the Ten Commandment. It appears in Exodus 20:30.

⁴² Prejean, *Dead Man* 21.

⁴³ Prejean, *Dead Man* 16.

⁴⁴ Prejean, *Dead Man* 26.

While on death row, prisoners are not allowed contact visits. In some rare cases, the warden can waive that. Sonnier had a priest to consecrate and distribute the sacraments, but he enjoyed the friendship of Sr. Helen. He had no other visitors while incarcerated because his mother was elderly, and his father had passed away previously. His brother was serving a life sentence for the same crime.

It is one thing to send and receive letters from a convicted killer, but to be face-to-face with one is entirely different. Not only was this the first time Sr. Helen was going to be face-to-face with a convicted killer, she was going to converse with Sonnier for two hours. She did not know what to expect but was ready for whatever was to come.⁴⁵ Patrick was not what she expected: clean shaven, hair combed, handsome, and greeting her with a smile on his face, expressing his happiness at meeting her.⁴⁶ She saw how human he really was when she saw his face.⁴⁷ The first visit led to many others between Sr. Helen and Sonnier. What she was not prepared for was for him to die. This is because Louisiana had not executed someone in many years, and she did not believe the state would actually go through with the execution. The day was never in her mind because she did not expect a date to be set. It was April 5, 1984 when Sr. Helen was forced to confront the day she dreaded; the day they executed Patrick Sonnier.⁴⁸ She was with him until guards escorted him out to the electric chair. There she witnessed an event that she could not keep silent about.

Sr. Helen was sure that if more people saw executions, they would oppose them.⁴⁹ Human beings were not created to be able to witness a murder, legal or not, and feel comfortable. She

⁴⁵ Prejean, *Dead Man* 28.

⁴⁶ Prejean, *Dead Man* 28.

⁴⁷ Prejean, *Dead Man* 31.

⁴⁸ James Hodge, "Sonnier Executed for Double Murder" *Times-Picayune*/4-5. Accessed June 26, 2018.

<https://www.pbs.org/wgbh/pages/frontline/angel/articles/timespicayune45.html>.

⁴⁹ Bagoyo, "Audio and Video"

knew the public was not as aware as they should be concerning the justice system and how they handle death penalty cases. Sr. Helen was determined to devote her life to informing the public and putting an end to capital punishment.⁵⁰ As for her days as a spiritual advisor for inmates, that was done. She did not want to be a spiritual advisor to another person on death row.⁵¹ It was not until a friend of hers who aided in Sonnier's case approached her asking if she would agree to be a spiritual advisor to another man on death row named Robert Lee Willie.⁵² She hesitated but agreed.⁵³ This motivated Sr. Helen to try to be the face of Christ to these men she has encountered on death row. There was never supposed to be another Patrick Sonnier in her life, but he was the first of the now five Sr. Helen has advised. If it were not for her friend, Chava Colon, for proposing the idea to her, she would not be the figure she is today, not only in the Catholic Church, but in the world.

The work Sr. Helen has done has caught the attention of many Catholics, especially those in the Vatican. She was able to express her gratitude in a letter to Pope St. John Paul II for intervening for the life of a man named Joseph O'Dell.⁵⁴ In the letter to the Pope, Sr. Helen told him that there was no doubt in her mind that because he had spoken out against the execution, Joseph O'Dell's life was spared.⁵⁵ She explains the fear O'Dell experienced right before he was granted the stay of execution. She went on writing about the horror he felt watching his fellow inmates shower and put on execution clothes. The only people who know the date and time of their death are the inmates on death row.

⁵⁰ "Biography." Accessed June 25, 2018

⁵¹ Prejean, *Dead Man* 117.

⁵² Prejean, *Dead Man* 117.

⁵³ Prejean, *Dead Man* 117.

⁵⁴ Helen Prejean, "Letter from Sr. Helen Prejean to Pope John Paul II, 1997." *DePaul University Special Collections and Archives*, <https://dpspecialcollections.omeka.net/items/show/79>.

⁵⁵ Prejean, "Letter from Sr. Helen" 1.

Currently, Sr. Helen has the support of the Catholic bishops and of Pope Francis, who has openly opposed the use of the death penalty.⁵⁶ She continues her work for an end to capital punishment because she believes her ministry is a part of God's divine plan.⁵⁷ Sr. Helen explains that she is trying her best to live out her faith.⁵⁸ She is no longer a spiritual advisor for death row inmates, but she is now one of the most well-known death penalty opposition activists. She is not just a religious figure writing statements as to why Catholics should be against the death penalty, she is the voice for the people who no longer have a say in what their life could be. She went into the prisons, she took the time to get to know the inmates on a personal level, and she was there to witness the executions. Other than the one priest who distributes the sacraments, she was a piece of the Church that chose to go in the walls of a prison when no one else did.

Conclusions and Recommendation

Scholars and theologians have much more work to do to address the situation of Catholic Christian inmates, and this could be the result of no one being aware of what prisoners go through. The idea many times is out of sight out of mind. If inmates are not getting the spiritual support they need while incarcerated, the chances of them returning to a community that disregarded them is unlikely. They will more than likely forget about the Catholic community outside the prison because they had already forgotten about them. All the motivation to practice their faith while incarcerated can be lost once entering the free world. God has a special love for the poor and vulnerable, he calls His followers to show the same compassion. The author of Psalms says, "For he rescues the poor when they cry out, the oppressed who have no one to help. He shows pity to the needy and the poor and saves

⁵⁶Pope Francis, "The Death Penalty Is Contrary to the Gospel." *America Magazine*. Accessed June 25, 2018. Pope Francis believes the death penalty fosters violence and brings no justice to the victims.

⁵⁷ David Yonke, "Nun Tireless in Bid to End Death Penalty", Accessed June 13, 2018. <https://www.sisterhelen.org/nun-tireless/>.

⁵⁸ Prejean, "Would Jesus" 1.

the lives of the poor. From extortion and violence he redeems them, for precious is their blood in his sight” (Psalm 72:12-14).

The lack of priests poses a real challenge for the Church. Not only is the number of lay Catholics plummeting, but also the number of priests is going down with it. Inmates are in desperate need for Catholics to reach out to them, but will the Church promote prison ministry? If no one is aware of the lack of outreach for Catholic prisoners, the answer is no. Lay Catholics need to be aware that there are Catholic inmates who need their support. Just knowing that they have a community that still cares about them can make all the difference. This cannot be done if lay Catholics do not intervene in the crisis happening for Catholic inmates. Whose responsibility is it in parishes to get prison ministry started? Many will argue that it is the responsibility of the parish priest to promote prison ministry. Every Sunday the faithful gather in the pews, listen to the Gospel, and receive the message that derives from the readings given by the priest. Many priests start and encourage ministries in their parishes but if they themselves or someone in the parish do not acknowledge the need for prison ministry, no one will set out to start it.

If Catholics are in search of a new ministry, they should look to the ones behind bars that are hardly considered the *“least of these.”* “Remember the prisoners, as though in prison with them, and those who are ill-treated, since you yourselves also are in the body” (Hebrews 13:3). The more aware the outside Catholic community is of the lack of resources inmates have, the more they might feel the call to be of support and help to inmates and their needs. The incarceration rate is rising and the need for Catholic prison ministry is higher now more than ever.

Catholics tend to think of inmates as being far away and separated from the Body of Christ. If parishioners were aware of the work that other lay Catholics are doing, they might want to give prison ministry a chance. Inmates are a marginalized group and Catholics know that God has a special love for the poor and marginalized. Inmates are part of the Body of Christ even if they do not have other Catholics treating them as such. A parishioner

at St. Mary Catholic Church in Fredericksburg Texas started Kolbe ministries in 2009 with the purpose to heal inmates and help them grow in their faith. Today, many inmates are able to attend retreats that help them come to terms with the choices and mistakes they have made that resulted in their incarceration – as well as to learn from them. Many inmates express their longing for fellow Catholics to bring them the Body of Christ.⁵⁹ The USCCB puts out statements regularly that help Catholics understand the demands that the Gospel and Church require. The goal of these statements is for Catholics to reflect on and apply to their life to promote the common good. No crime committed can separate an inmate from the Catholic community. The Church has its work cut out for the faithful but in time; Catholics can become more aware of the struggles inmates face and put faith into action in solidarity with the Body of Christ.

⁵⁹ From Michael Wise, incarcerated person. Source: <https://www.kolbepisonministries.com/>

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Analysis of Hispanic Serving Institutions Amongst Universities

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The history of the Hispanic-serving Institution designation reveals a central problem that beckons across the campuses carrying out its mission. Hispanic Serving Institutions were defined by the Federal Higher Education Act as a degree granting institution which has a full time equivalent undergraduate enrollment that consist of at least 25 percentage Hispanic students. These institutions have a history which began as a grassroots effort in the 1980s, Hispanic-Serving Institutions were recognized first by educators and policymakers as institutions that enroll a large number of Latinx students (Christopher & Valle, 2015). These institutions are represented by Hispanic Association of Colleges and Universities (HACU) which serves as the leader in the effort to persuade Congress to formally recognize HSI and target the federal appropriations to these institutions. Hispanic people are considered as the minority ethnic group in America which consist of immigrants, black African American and Latinos. This group is the fastest growing group of minority in the United States; however, it is grossly underrepresented in higher education (Garcia & Morgan 2017). The number of Hispanics in America has increased by 39 percent since 1980 and their

population has increased such that it now accounts for the 11 percent of the population. Therefore, this has led to the development of HSI.

Basic Premise

Something is better than nothing

These Hispanic institutions are created with the premise that “something is better than nothing”. This is because Hispanic students are thought to be weak with regards to their past achievement and aptitude. In reality, any weakness can be attributed to a lack of resources and funds. Therefore the basic premise states that since the Hispanic students are expected to be weaker, we cannot expect that they deserve to be at more elite schools nor would they be successful when they get there. Nevertheless, the presumed weaker students are thought to be undeserving of admission to more elite schools. As a result, HSI’s represent a place where they can be comfortable because they are geared towards their comfort and skills.

Cooling out

Hispanic students have showed low achievement rates, high dropout rates, and are less satisfied with school than non-Hispanic whites. According to Burton Clark (1960), community colleges gently guide weaker students out of the educational pipeline and toward low-tech careers. This is because not only do a low number of Hispanics go to college, but the retention of Hispanic students in colleges continues to be a problem because many of them drop out as a result of lack of funds.

According to Barbara, Martinez and Owens (2006), over 50 percent of Hispanic students who enroll in colleges do not graduate because they often experience multiple barriers to graduation such as lack of funds, lack of role models and fear of the unknown. Therefore, in order to reduce these barriers HSI’s were developed to gently guide these weaker students towards institutions that can provide them with low tech knowledge and give them scholarships and incentives that help them to remain in school. HSI’s provide the students with Hispanic teachers who are

their role models and eliminate bias and discrimination. As a result, HSI's such as colleges and vocational schools were designed for these students to gain work related skills.

With degree drift, there is now more pressure for students to get a four-year degree. Hence, the community college is no longer a politically acceptable stopping point for an entire ethnicity. Due to the lower achievement of Hispanics within the secondary school system, many Hispanics do not qualify to enter four-year colleges and universities because the elite universities have selective admission policies. Therefore, they end up enrolling in colleges because they lack precollege preparation that determines whether a student should get a four-year degree. Because Hispanic lack preparation they end up enrolling in community colleges which are an unstopable point (Barbara et al 2006). These two-year colleges and vocational institutions operate with lower resources and offer only certificates or associate degrees which affect Hispanic students when they want to transfer to higher institutions or when they are looking for jobs. This was described by Clark as the process of societal cooling out, which is a period when students who have unrealistically high aspirations are encouraged to be more realistic and seek terminal vocational programs.

Other supporters of vocational programs in secondary schools see enrolling in community colleges as beneficial to Hispanic students. Scholars like Cohen and Brawer (2015) argue that the community colleges are a viable option for Hispanic students because they provide a nurturing environment that allows them to grow and learn in an environment with people of their own skin color. Other scholars argue that this is not a good option as community colleges leave Hispanic students at lower levels. This is credible because they matriculate within these colleges but to do so when they want to attend to higher institutions, they are not be able because the accreditation of the Hispanic institutions is not recognized by more selective institutions. As a result, these two-year colleges provide an important link to higher level of

Hispanic institutions and degrees which are of low standards compared to PWI's. Therefore, HSIs are an appropriate place for Hispanic students because they can earn degrees without threatening to compete with Whites for more lucrative positions in society.

Bowles and Gintis (1976) also postulated that since the 19th century, the movement towards educating everyone and all the mass ethnic groups in United States had the interest of capitalist embedded in it. This is because those who are financially sound go to elite schools and the minority groups who are poor had HSI's created for them. However, there is a sorting function of schools that stratifies the outcomes of schools to meet capitalist goals. Bowles and Gintis (1976) viewed the purpose of schooling in America as being capitalist driven. An educational system that is based on meritocracy, individualism and opposes the initial intention of public education premised on equitable educational standards. Therefore, the establishment of HSI's reproduces social stratification and socialized capitalism. This makes HSI's an appropriate place for Hispanic students because they can earn degrees without threatening to compete with Whites for more lucrative positions in society

Hispanic students are sorted away from occupations that require the most schooling due to the financial difficulties they face. As a result, they do not stay on the fast track of education. This is because unlike their white counterparts who enroll into university straight after secondary school and get college degrees without interruption, Hispanic students often stop out or go to school part time as a way of dropping out of the college and make part-time money (Barbara et al, 2006). As a result, they end up taking programs that do not require the most schooling so that they can balance between part-time jobs and schooling. Although there are great occupational opportunities that exist for those students who graduate with bachelor's degrees, especially those who graduate from prestigious and selective universities, a few students such as Hispanics attend these institutions. This is

because there exist inequalities in admission to these elite colleges such as reliance in traditional entrance exams and test score interpretation that are used for admission decisions. These test scores are expensive and naturally select Hispanic because they cannot not afford to have the opportunity to be as prepared as their white counterparts. This results in the students being sorted away from occupations that require schooling.

The sorting function of schooling

If there was equality within their higher education for Hispanics, students will not be sorted ways from occupations that require the most schooling. This is because equality will keep minority students in the pipeline and help them move up the educational and occupational ladders. Once they complete their graduate schools, further help is needed to help graduating students into professional jobs. Therefore, this demands a higher education faculty which support and encourage a model of diversity. A model of diversity is important because even when the minority group of Hispanic students enroll in institutions which provide them with occupational opportunities, they often feel isolated, discriminated and unsupported. Being the only one of a few kind increases the dissatisfaction in schooling and possibilities of occupational stress (McGill, 2015). These dissatisfaction levels will cause the students to drop out thereby causing Hispanic students to be sorted away.

You're just as bad

A common rebuttal proffered by the pro-HSI crowd is that more elite institutions do as poor of a job serving Hispanic students as HSIs do. These arguments use a sophisticated statistical procedure called propensity score matching, which looks at what would have happened to one group if it had been exposed to the same intervention as another group. This argument is essentially trying to “fail to reject” the null hypothesis. In other words, there should be a responsibility to show value added, not that “we’re just as bad as you are”. Research carried out by Georgetown University found that at most elite institutions, only

14 percent of the students come from families with a low-income and this figure has not increased for the past two decades (Lindsey et al, 2013). This is an indication that top colleges do not make concentrated effort to hunt for qualified teenagers from poor families, or access applicants which needs aids. Therefore, they do not serve the interest of Hispanic individuals just as HSIs do not provide an education that makes it easy for Hispanic student skills to transfer to more elite higher institutions. Therefore, the elite institutions are as bad as Hispanic serving institutions in meeting the needs of Hispanic students, although this hardly an aspirational goal.

Faculty representation

There is an increasing number of Latinos and other racial and ethnic students who are enrolling in these HSI's. While this can be overallly true, it also stands true that about half of all HSI's are community colleges implying that a relatively low percentage of the Latino faculty has a chance to compete for tenure.

Faculty credentials

There has been no systematic examination of whether faculty at HSIs have equal credentials, however defined, as faculty at more elite PWIs. However, Torres Vast et al (2012) postulated that Hispanic serving institutions have low standards compared to the PWI. This implies that the credentials offered by HSIs are of low standards. A systematic examination of the total number of publications, proportion with a terminal degree, or some other metric would help to determine whether students at HSIs are exposed to faculty with the same credentials as they would have received had they attended a PWI.

Institutionalization

There is relatively little literature on how faculty are rewarded for bringing a Hispanic perspective to their teaching or their research. Likewise, little is known about whether tenure earning rates are higher for Latinos at HSIs than PWIs after controlling for base rates.

Chicano Studies

Chicano Studies are degree-granting programs that originated in the Chicano Movement of the late 1960s and the late 1970s. Chicano Studies focuses on the study of Chicanas, Latinos and Mexican- American studies. The topics draw upon different fields, including history, arts, sociology and Chicana/Chicano theories. In several universities programs are linked with interdisciplinary studies such as ethnic studies and other field such as Black studies, Asian American studies and Native American studies. Students of anthropology have also been involved in studying the Chicano studies. For example, at Ohlone College the vision of Chicano Studies is to prepare students to be able to address national and world wide issues and concerns. They aim at making students to be culturally responsive, competent and develop skills which will enable the students to deal with the changing demographics in American society.

Some major universities which concentrate on Chicano studies have a formal department of Chicano studies. By providing the classes with studies of ethnicity like Chicano studies, it helps the learning environment of Hispanic students and helps them to not feel prejudice and not to experience discrimination in college. Chicano Studies also helps White students to be politically active and know their strong positions amongst various ethnic identities. This explains why the proportion of national universities ranked in the top 25 by US News & World Report with Chicano Studies programs is higher than the proportion of HSIs that have Chicano Studies programs. Chicano Studies are taught in elite universities because there is a belief that discrimination against Hispanic students matriculating at those universities will be reduced. However there is no enough literature that examines how different faculties have used the better ecology of the HSI to help students develop stronger ethnic identities. If HSI's can get the advantage of teaching their students about their ethnic identities, the Hispanic students will

develop a strong cultural and political identity.

Mission statements

It has been noted that almost no HSI's not use the words Latino or Chicano in their mission statements. Bensimon, Malcom and Contreras (2008) rated their status through their mission statements. Their studies found out that none out of the ten institutions that they examined mentioned their HSI designation in their mission statements. Although the mission of the department of HACU and staff affiliates is to promote the access of Hispanic Students to education, increase their success in higher education and encourage diversity of the faculties, most of the Hispanic serving Institutions do not have the word Chicano, Hispanic or Latina in their mission statement. Bensimon (2008) further argued that the administrators believe that it would be bad for marketing since most people believe that only less rigorous institution have a high percentage of Latino students. This shows that the HSI's do not really serve their students because they are concerned about being labelled as a less rigorous institution.

Fence Metaphor

The education system in America promotes the success of elite schools than more Hispanic institutions. This lack of equity is explained by the metaphor which says if equity is helping a shorter person with a foot stool, and equality is giving the same sized stool to a shorter and taller person, the US educational system gives the foot stool only to the taller person. In other words, students who are in low income and are of communities of color and other marginalized communities such as the Hispanic groups need more resources in their institutions because they are less academically capable.

However, resources are channeled towards elite institutions which has students and parents who can afford to pay their school fees. This shows that if Hispanic serving institutions were doing their job to get enough resources and support their students, students at these institutions would be pushed even harder so that they could make up for the weak education they

received. On the contrary, students in HSI's are not necessarily graduating within the stipulated two year of their programs. These students are twice more likely to be persistent if there was equity and equality in American education which would provide enough resources for the less privileged HSIs (Green, Data et al 2012).

Know your place

Supreme Court Justice Anton Scalia believed that Black students would feel more comfortable at weaker schools because the weaker schools would be less rigorous and they would have a higher proportion of Black peers. Furthermore, a study by Taylor (2009) stated that HSI's promote cultural inclusion and encouraged students to be empowered in ways that cannot be done when Hispanic students are in elite colleges. HSI's advocates unwittingly push for the same scenario because they do not provide quality education which is easily transferable to higher institutions. The quality of educational standards provided shows that they push for the same logic as Scalia used when arguing that Black students must stay in weaker schools.

Benefits to students

Although HSI's have been designed to benefit students who are marginalized in America, it appears though that HISs do not continue to improve the proportion of Hispanic students once they earn 25 percent status. The reason may be because they do not earn Title V money based on the number of students, but rather based strictly on whether they have reached the 25% mark. Benson et al (2008) found out that HSIs do not produce equitable results for Hispanics who will be having bachelor's and accounts degrees as compared to white students learning in PWI's. Another study by Gracia et al (2017) found inequitable results in Hispanic serving institutions with regards to results in science, technology, math and engineering (STEM) fields. Their studies suggested that the HSIs invisibility in terms of mission statements and inequitable results in STEM leaves a reasonable doubt on their purpose and also their role with regards to benefitting Hispanics

group. This is especially surprising given the low selectivity of many of these schools.

Bensimon et al, (2008) also found out that despite the increase in enrollment numbers and obtaining the 25% status, few Hispanic serving institutions have demonstrated supportive and cultural initiatives for their students who are Latinas. For example, emerging HSI's provide very little supportive and cultural initiatives, which indicates that they have the potential to further increase their efforts of serving Hispanic students if they become official HSI's. They also found that existing HSI's provide programs which are not specifically aimed at the population or benefits of their students. For example, Luna Community College's Distance Education Program does not specifically target the Latina population of its schools, rather the benefits of these programs are taken advantage of by others.

HSI as gateway schools

There are some estimates in the literature about the proportion of doctoral degree earners who started out at HSI's (see, for example, Nunez, Hurtado, and Calderon Galdeano, 2015). HSI's as getaways schools means that HSI's are used to soften the blow for students and to help them feel valuable by earning a degree while they were gently "cooled out" of the educational pipeline. The problem with this way of thinking about HSIs as gateway institutions is that the numbers do not work in reverse. In other words, the proportion of students who attended HSI's and earn a PHD is lower than the proportion of Hispanic students at top 25 who went on to earn their PHDs (Fry,2002).

Limited social capital

One of the advantages of attending a more prestigious school is that the faculty have academic and professional networks that can benefit students. This advantage is largely absent at HSIs since the faculty are not deemed to be experts in much of anything. According to Garcia, Gina and Ramirez (2018), professional associations are an excellent way that can be used to network and give students an opportunity to learn about

the various fields of their interest. Although HSI's have a few Hispanic accomplished scholars, they do not benefit from the wide social capital network as compared to their fellow prestigious and professional schools.

Transfer rates

The transfer rate of Hispanics from two to four year colleges still remains extremely small and the number of students who go on to earn Ph.D.'s still remains small. This particularly hurts Hispanics because they depend on HSI's to access higher education. In addition to their limited information about the proportion of students who go on to earn PhDs, there is no reliable data on the proportion of students who transfer from HSIs to more prestigious PWIs.

The obstacles that hinders transfers of Hispanic students to PWI include lack of coordinated requirements, a lack of uniformity in course offerings and lack of consistence in policies for assessments. This lack of consistency makes transferring from an HSI community college to an HSI university a good step, but most likely not the same as transferring to a more prestigious PWI (Nunez et al, 2015).

Carnegie classifications

If a student were to attend an HSI, there is a good chance that they would be attending a community college because of the administrative and financial barriers to entry in four year degree colleges. Even if they attended a four-year institution, chances are good that the institution would not be highly selective. This is because HSI's are designed to cater students who are marginalized therefore there are not likely to be selective. Likewise, there is a good chance that the institution would not rank in the top 50 according to US News and World Report.

Comparison to HBCUs and Catholic institutions

Most HSIs were not founded to be HSIs, which means that their history is different from HBCUs and Catholic colleges and universities. Some argue that these historical differences explain why HSIs do not have a stronger Hispanic identity in terms of

their mission statements, course offerings, and faculty representation. According to Franceis (2016) HSIs are different from Catholic educational institutions because Catholic educational institutions play an important role in educating high achieving Latino students. The difference between HSIs and Catholic high schools, for example, that Latino students who are attending Catholic high schools are highly likely to transfer to college immediately after they finish school.

Failure to adapt to contemporary conditions

Many of these same HSIs have adapted to changes in technology, such as online education, but have not made similar changes to address changes in their student body. There is currently little motivation for Hispanic students to mindlessly give their tuition dollars for a minimally worthwhile degree. Therefore, the HSI's have failed to effectively adapt to contemporary conditions.

Alternative Metrics

Heritage Spanish

Many students come to school with fluency in Spanish. Oftentimes, this conversational Spanish is consistent with a language community from their region .HSIs tend to teach (and grade) peninsular Spanish, which signifies social class, privileges Europe, and neutralizes cultural capital. Students come to learn that their family and community cannot even speak properly, and that they have to become more European to survive in higher education. An alternative metric for the performance of HSIs would be the extent to which they were able to move students in the direction of US-Mexican Spanish.

Identity development

Consistent with the idea of heritage Spanish, students need to leave their undergraduate education with a stronger ethnic identity than they had when they first arrived on campus. The major public universities in the US, such as UC-Berkeley, Michigan, and UCLA teach students ethnic studies which helps

them to have a strong ethnic identity. White students attending these schools tend to be politically active because they have full knowledge of their political history and they understand that through politics they can advance their needs. According to Gonzalez (2017) Hispanic students are not educated for political power as compared to white students which is the reason why there are not routine demonstrations at HSI campuses.

Attribution tendencies

Students of all backgrounds typically enter their first year of college with a limited range of attributional tendencies. For the most part, they tend to blame individuals for their plight while failing to consider situational and structural factors. Students attending HSIs should begin to see their place in society when they enter their first year into college, and they should be able to see that their social class has largely been determined for them by the social structure. This will enable them to leave college with a bicultural identity that enables them to beat the system because they are no longer held back by their own self and culture-blaming tendencies.

Conclusion

Bowles and Gintis (1976) correctly observed that the educational system is used to sort people by race and social class into occupations. Because Hispanic students are not needed for upper tier occupations, there is little need to allow them access to top tier schools. Burton Clark also was correct that community colleges could be used to soften the blow for students and to help them feel valuable by earning a degree while they are gently “cooled out” of the educational pipeline. However, in modern times, the associate’s degree is no longer enough to help Hispanic students feel accomplished. Therefore, there is a need for academically weak four-year institutions. California’s tiered system of schools—UCs, Cal States, and community colleges have long served this same purpose. Although these HSI’s serve the purpose of making Hispanic students feel better, something is not necessarily better than nothing. This is because corralling

Hispanic students into HSIs fulfills the objective of keeping them happy while they are being sorted away from more lucrative occupations.

Furthermore, sorting stops them from accumulating material wealth at the same rate as White students and keeps them from occupying positions of power. Making matters worse, Hispanic students who attend HSIs are no more likely (and perhaps less likely) to develop a political consciousness during their four years of undergraduate education as they are not involved in Chicano Studies. Meanwhile, since college going rates remain high, and the desire to exclude Hispanic students from the more elite college and universities persists, the need for cooling out is as high as ever. Essentially, what pro-HSI advocates want is separate but equal system higher education. Unfortunately, they have yet to demonstrate the equality of PWIs and HSIs. In summary, HSIs serve a purpose: the keep Hispanic students economically and politically inert while undercutting protests of unequal educational access

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