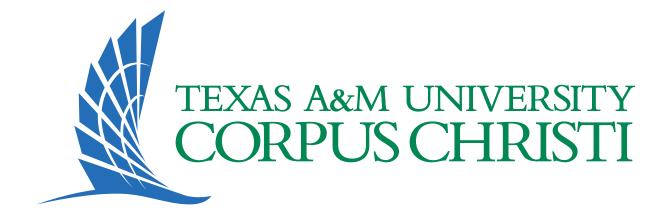


McNAIR SCHOLARS

RESEARCH JOURNAL

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BIOGRAPHY OF DR. RONALD E. McNAIR

HE OVERCAME OBSTACLES.

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

HE ACHIEVED ACADEMIC EXCELLENCE.

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

HE BECAME A LEADER IN HIS FIELD.

Dr. McNair soon became a recognized expert in laser physics while working as a staff physicist with Hughes Research Laboratory. He was selected by NASA for the space shuttle program in 1978 and was a mission specialist aboard the 1984 flight of the shuttle Challenger.

HE WAS RESPECTED AND COMMENDED.

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



HE EXCELLED IN MANY ASPECTS OF LIFE.

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

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

Biography courtesy of the University of Nevada, Las Vegas

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PROVOST AND VICE PRESIDENT FOR ACADEMIC AFFAIRS

DR. CHRIS MARKWOOD



One of Texas A&M-Corpus Christi's goals has been to provide a quality education to underrepresented students through an individualized approach that nurtures professional development and scholarship. It is precisely because of that continuing mission that it is a great privilege to host the McNair Scholars Program in the Division of Academic Affairs

The quality of research presented in this journal represents the perseverance and devotion of our students in working toward their scholarly goals and the tireless dedication of their faculty mentors to helping achieve those goals. The McNair Journal demonstrates our university's commitment to creating a learning environment that centers on the individual student and fosters intellectual growth through professional guidance.

The excellence in scholarship that appears in this publication is a realization of Texas A&M-Corpus Christi's goal to equip underrepresented students with the necessary tools to become professionals in the field of their choice. I commend the McNair Scholars for their momentous achievements and extend my gratitude to all contributing faculty and the entire university community for its continued support of our student's scholarly endeavors.



ASSISTANT VICE PRESIDENT FOR STUDENT SUCCESS



DR. GERARDO MORENO

The McNair Scholars Program at Texas A&M University-Corpus Christi is dedicated to the high standards of achievement inspired by Dr. Ronald E. McNair. It is in his honor that the McNair Scholars Program seeks to involve undergraduate students in scholarly activities that will prepare them for graduate studies and rewarding professional careers.

The McNair Journal epitomizes our university's goal of endowing underrepresented, low-income and first generation students with the skills necessary to realize their professional goals and produce excellent research. The following scholarship represents an abundance of hard work and dedication, not only on the part of our students, but also our staff and faculty mentors, whose devotion and commitment have made the success of this program possible.

The achievements of the McNair Scholars exemplify the successes that can be realized when students are challenged and motivated to overcome obstacles and meet their professional goals. It is an honor to have these bright students, staff and dedicated faculty as a part of our campus community.

Sincerely,

Dr. Gerardo Moreno

Assistant Vice President for Student Success

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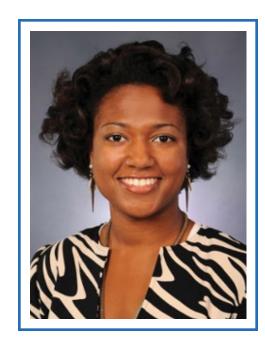
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2013 McNAIR RESEARCH ARTICLES

LOVE IT OR CHANGE IT: DYADIC LOCUS OF CONTROL AS A PREDICTOR OF SELFESTEEM, HAPPINESS, AND RELATIONSHIP SATISFACTION



by KEISHA-MARIE ALRIDGE

ABSTRACT

Julian Rotter created a concept called locus of control. He developed a method of gauging how much a person believes an outcome of their behavior is determined by personal effort versus fate (Rotter, 1990). This gauge is a scale that indicates two major extremes of individuals who are more external or internal. The external locus of control individual perceives what reinforces their behavior is left to fate or out of their control (Rotter, 1990). On the other extreme, an



MENTORS

Dr. Melissa Jarrell

Associate Professor Department of Social Science College of Liberal Arts



Dr. Steven Seidel

Professor of Psychology Department of Psychology College of Liberal Arts internal locus of control individual perceives their behavior is reinforced by personal effort or will (Rotter, 1990). This concept has been applied in a number of research areas; however, the need is present for a scale to measure the locus of control or in this case responsibility of behaviors in intimate relationships (Lefcourt, 1976, 1981). For this study, it was predicted that relationship partners scoring higher on an internal Dyadic Locus of Control scale would also exhibit higher self-esteem, relationship satisfaction, and subjective happiness as compared to participants scoring high on an external Dyadic Locus of Control scale. An online survey was distributed to 188 Texas A&M University-Corpus Christi undergraduate students. The Dyadic Locus of control scale was found to be reliable (alpha = .72). Internal locus of control was found to be positively associated with measures of self-esteem, happiness, and relationship satisfaction. No effects of age and ethnicity were found, but females were discovered to be slightly more internal than males.

Keywords: locus of control, romantic relationships, self-esteem, happiness, relationship satisfaction

INTRODUCTION

The perception of control while trying to bring about change in situations has long been a topic of research (Lefcourt, 1976, 1981). One method encapsulating this concept and creating an operational definition for it is called Locus of Control (LoC). Julian Rotter

pioneered the idea of putting the perception of control on a generalized continuum. On one end of the continuum is internal LoC and at the other is external LoC. Internal and external LoC indicate a relatively stable aspect of one's personality (Rotter, 1990). The internal LoC person perceives the outcome of their behaviors as in their control or determined by their personal efforts. The external LoC person perceives the outcome of their behaviors is out of their control or left to fate. As an assessment technique of mental health and personality the construct can branch out into other areas of research, such as relationship health (Wallston & Wallston, 1981). LoC is not a typology but could be utilized in conjunction to relationship assessment techniques to measure positive and negative perceptions of those in relationships (Rotter, 1990). Those perceptions in this study pertain to relationship satisfaction, subjective happiness, and self-esteem. Low relationship satisfaction is detrimental to the existence of a relationship on account of the necessity for partners to fulfill each other's needs. As a relatively new variable in studies, happiness can subjectively and objectively be seen as a reason to stay in a relationship. Moreover, the self-esteem partners achieve separately or because of the relationship could affect their mental health in terms of negative dependency or positive social growth. Molding LoC into a dyadic or relationship-oriented supplement to intimate relationship assessments could possibly be a new sociometer for healthy behaviors of couples. The present study provides an online survey format for voluntary participants in order to test the validity and reliability of a new Dyadic Locus of Control Scale (DYLoC) as a predictor of self-esteem, happiness, and relationship satisfaction.

LITERATURE REVIEW

Julian Rotter's concept of locus of control can be applied to healthy romantic relationships. Rotter's social learning theory defines personality as the interaction between two mandatory parts: a person and their environment (Mearns, 2000). In his theory, the idea of generalized expectancy—any specific expectancy for a situation has a corresponding general one—is the foundation for LoC, for these generalized expectancies are used on a continuum to reason what reinforces the life choices of an individual. The method of measuring the LoC construct was the creation of the

Internal-External locus of control scale, which became the first widely used instrument measuring behavior potentials (Lefcourt, 1976). The Internal-External locus of control scale (I-E) has been found to be a correlate of cognitive activity, achievement-related behaviors, resistance to influence, fatalism, and psychopathology (see Lefcourt's compilation of studies). As the concern of this study is pertinent to the healthy behaviors of intimate relationships, the focus of this literature review will be on psychopathological, health, and relationship correlates of LoC research.

External locus of control has been found to be associated with mental health deficits. Abromowitz (1969), for example, found that for college students, external locus of control was positively correlated with more reported incidents of depression. Moreover, investigators have expressed a relationship between the I-E scale and anxiety assessments in that people with external LoC expectancies admit to experiencing more anxiety than those who report internal expectancies (Harrow and Ferrante, 1969). Harrow and Ferrante (1969) examined the relationship between the I-E scale and types of disorders, primarily finding that patients diagnosed with schizophrenia tended to score more externally than all non-schizophrenic patients. In the same study, however, patients with mania scored more internally than did non-manic patients. Shybut (1968) found that severe pathology on the basis of disorders of thought, affect, behavior, and social adjustment were more external than in moderately disturbed patients and normal patients. Overall, the admission of anxiety or depression, the diagnosis of schizophrenia, and the rated severity of personal disorders are all related with LoC.

The aforementioned studies found their valid correlations, but as further research was conducted it appears that the I-E scale was being misused. The I-E scale is best suited for more domain specific LoC measures instead of testing a propensity of psychopathology. By focusing the development of the I-E Scale to certain domains relevant to LoC the measures will have increased predictive power (Rotter, 1990). Specifically, three main categories for the application of LoC in clinical settings are (1) the relationship between LoC and diagnostic categories (or a particularly interesting personality variable), (2) the utilization

of LoC as a treatment outcome measure (internality is related to healthy psychological function), (3) the process of treatment selection (matching a patient with the appropriate therapist or technique). One such study created two scales from the I-E scale: the Mental Health LoC scale and the Mental Health Locus of Origin scale (MHLO), each of which is more reliable in testing for LoC than the I-E scale because of its area specificity. The creators of those scales found the need for a measurement of expectancies, which could determine who would be responsible for changes in mental health treatment situations (the client or the mental health practitioners). In addition, they needed to be able to measure a client's belief system concerning the etiology of their psychological problems (Hill & Bale, 1981). In addition to this, Reid and Ziegler (1981) tweaked the I-E scale into a Desired Control scale measuring the personal control beliefs and psychological adjustment of senior citizens that has been found to be reliable and valid. LoC has also been found to be predictive of amount of control an alcoholic chooses to have over their addiction (Worrell & Tumilty, 1981). The Alcohol Responsibility scale was developed to provide a more detailed description of the external alcoholic than the I-E scale. For example, the Alcohol Responsibility scale would delve into behaviors such as being drunk on the job (as opposed to being an alcoholic but always being careful not to be drunk on the job), or being a spree rather than everyday drinker. Furthermore, the scale is mostly free of the contaminating influence of social desirability bias (the tendency to try to make oneself look better by lying on psychological tests). These domain specific scales proved that LoC can be applied in clinical settings, but then two further measures of health LoC were developed that combined its usage into a domain specific and a treatment outcome scale.

The world-renowned measures of health LoC created by Wallston and Wallston (1981) were the Health Locus of Control scale (HLC) and the Multidimensional Health Locus of Control scale (MHLC). The researchers noted the need for individualizing patient treatment based on LoC by separating the motivation to control one's health versus the expectancy that one's behavior either was or was not directly able to influence one's outcomes. Furthermore, the HLC scale was a generalized expectancy measure, although it has one goal area

(health) allowing the measure to be utilized across many health-related settings and behaviors. However, the HLC scale was remodeled into the MHLC scale after research found understanding and prediction could be improved by adding other dimensions (internality, chance externality, and powerful others externality) to the external disposition of LoC (Levenson, 1981). By adding dimensions the MHLC strayed away from Rotter's original social learning theory by modifying the expectancy-behavior relationship to creating the moderator, value of health, between internal beliefs about health status and the extent individuals value psychological or "mental" well-being (Wallston, 1992).

Another version of Rotter's I-E scale, which became a more powerful predictor of relapse, was the LoC of Behavior scale (Craig, Franklin & Andrews, 1984). The need for an instrument to measure the extent to which people perceive responsibility for their personal problem behavior was resolved. The LoC of Behavior scale is independent of sex, age, or social desirability bias. Furthermore, the scale's results were found to be stable over time in the absence of treatment and able to distinguish between persons with or without chronic conditions. Although the LoC of Behavior scale is sound and valid, in reality a person's LoC can change under certain circumstances for it is possible to learn how to become more external or vice versa.

Thus far, the research presents LoC as a relatively stable aspect of personality about which meaningful predictions of generalized expectancies to perceived reinforcements, either as contingent upon one's own behaviors or as the result of forces beyond one's control, can be made across a variety of situations. Expectations from romantic relationships can be placed on the same continuum of generalized expectancies. These expectations were defined within questions as to whether a partner believes he or she can make desired changes in the relationship (Bradbury & Karney, 2010). Significant others obtain knowledge of their partners and choose the proper actions to take when a situation arises from previously reinforced interactions. The Miller Marital Locus of Control Scale (MMLoC) delivers reliably the extent to which partners perceive reinforcements in marital domains calculated upon internal abilities or external circumstances (Miller, Lefcourt & Ware, 1983). The aforementioned scale accurately predicted lower

levels of self-reported marital satisfaction and intimacy in external LoC couples. In another study, a revised version of the MMLoC discovered that associations of the most satisfactory and least conflicting marriages were found among spouses who were internals and had high levels of LoC directly and indirectly influencing marital quality (possibly by preventing marital strains). The scale's consideration of structural factors-including education and income-known to influence marriages strengthened the MMLoC's efficacy (Myers & Booth, 1999). LoC can produce reliable and consistent results for pertinent relationship factors and thus was relevant to the estimation of the mental health of a romantic relationship. According to Doherty (1981) in the first year of marriage, internal husbands and external wives have the most dissatisfaction due to wives needing more external cues of love and support than their internal partners. Romantic relationship LoC scales place internality (personal efforts) as an indication of healthy intimate relationships instead of externality (events occurring because of chance); however, finding relationship LoC scales was difficult.

In a recent compilation of LoC domain specific measures, LoC relationships scales were not present, which reveals how little research has been conducted and how much a relationship measurement tool is needed how little research has been conducted to illuminate this domain, and the need for a measure (Halpert & Hill, 2011). DYLoC fills the void for a concise measure for the individual perception of healthy romantic relationship behaviors. A healthy relationship must have respect and communication, not power and control. Good communication, trust, and separate identities can be essential fuel for the potential to enrich lives (Nikole, 2007). Manipulation, feeling pressured by a partner, and abusive behaviors can lead to harmful levels of stress and tension leading to problems in other areas of a person's life. The DYLoC scale would be a short supplementary scale counselors, clinicians, primarycare physicians, and other professionals can use for patients to directly see how unhealthy their relationship is, instead of handing out pamphlets or recommending a website. The only established LoC scale for intimate couples relationships is the MMLoC scale that can only be used for one population: married couples. The DYLoC scale was meant for any kind of relationship status, for it measures how one generally experiences intimate relationships. Likewise, the MMLOC scale mainly measures dissatisfaction, while the DYLoC scale gauges healthy relationship behaviors. The present study will fill the need for a non-marital LoC scale observing more factors than dissatisfaction.

The associations between relationship and LoC can be examined in factors like relationship satisfaction, happiness, and self-esteem for my experiment. A mentally healthy relationship should contain moderate levels of LoC in order for a couple to rely on personal effort rather than luck or chance to resolve issues in their relationship. Secondly, high ratings of satisfaction are necessary to fulfill the psychological needs of companionship or belonging. Hendrick's (1988) relationship satisfaction scale taps into several dimensions of relationships— such as love, problems, and expectations-and was general enough for use amongst a wide range of couple types. The satisfaction scale was appropriate to correlate with the desired expectations of a person's continually reinforced choices in a relationship. Furthermore, the devised DYLoC scale attempts to measure the mental health of how one experience's his or her relationship in terms of scaled behaviors, which is not an equivalent to relationship satisfaction but may influence it. Also, elevated levels of happiness should increase the chances of better partner support, communication, and honesty. The subjective happiness scale is a valid short assessment of the self-reported evaluation that someone is a happy or unhappy person (Lyubomirsky & Lepper, 1999). Happiness can be a goal for people, especially, to attain a happy loving relationship as displayed in many media outlets. The desired changes one decides were necessary for their relationship usually correspond to what would make a person happier in said relationship; moreover, happy interactions in the relationship reinforce a couple's beliefs that they will be able to bring about wanted adjustments. Finally, self-esteem encourages separate identities in a relationship, which decrease the possibilities of manipulation and pressure. Rosenberg's well-validated self-esteem scale measuring personal worth, self-confidence, self-satisfaction, self-respect, and self-deprecation was seldomly tested against LoC (Rosenberg, 1965). The cliché of "loving yourself before loving someone else" was relevant because

without self-confidence in day-to-day life, a romantic partner may not feel confident to initiate changes in their relationship.

The purpose of the DYLoC scale was to measure the extent to which participants perceive control or responsibility over behaviors or situations in the context of an intimate relationship. I predicted DYLoC would correlate with self-esteem, happiness, and relationship satisfaction. Moreover, internal LoC ratings would be predictive of stronger correlations of self-esteem, happiness, and relationships satisfaction than with external LoC ratings. Self-esteem was predicted to be strongly correlated to happiness and relationship satisfaction.

METHODS

Participants

The survey was completed by 188 participants (51 male and 137 female) in an online format. The participants were asked to identify their sex, age, ethnicity, and relationship status. Participant ages ranged from 18 years to 49 years, with a mean age of 21.57 years. A majority of the participant's ethnicities were White (91) and Hispanic (72), while the remaining 25 subjects were Asian/ Pacific Islander, Black, or Native American/First Nation. Participants had five "yes or no" relationship status questions: currently single, currently in a committed relationship, have ever been or currently are married, have ever been or currently are divorced, and widowed. Over 50% of the participants were currently not single and were in a committed relationship, while less than 10% were married, divorced, or widowed.

Survey Development

The Dyadic Locus of Control Scale was developed from the Locus of Control of Behavior Scale (LOCB) developed by Craig, Franklin, and Andrews in 1984. The 17-item likert-scaled LOCB scale was scored such that more points accumulated indicated externality and fewer points indicated internality (6 = strongly agree, 5 = generally agree, 4 = somewhat agree, 3 = somewhat disagree, 2 = generally disagree, 1 = strongly disagree). The LOCB scale had ten items relating to externality and seven items relating to internality. The DYLoC scale removed four original LoCB scale questions,

for purposes of easier understanding for participants andrelevancy to the task at hand: the cronbach alpha increased after item removal. Furthermore, scale items were converted from first person to third person phrasing. For example, an LOCB item "My problem(s) will dominate me for all my life," turned into "Our problem(s) will dominate us all our lives." In the DLOC scale there were seven scale items indicating externality and numbers 1, 4, 6, 7, 11, and 12 that were transposed for reverse scoring to indicate internality. The measures used to validate the DYLoC scale, which all have demonstrated reliability and validity, were Rosenberg's Self-Esteem Scale, Hendrick's Relationship Satisfaction Scale, and Lyubomirsky's Subjective Happiness Scale are included in the research survey.

Procedure

The anonymous online survey web-link was distributed in large lecture courses at Texas A&M University-Corpus Christi, and was available for completion for a total of three months. All 188 participants were undergraduate students. After the deadline for completion passed, the data was analyzed by the Statistical Package for the Social Sciences (SPSS).

RESULTS

No significant age or ethnicity differences were found for the DYLOC scale. The DYLOC scale (alpha=.72), self-esteem scale (alpha=.89), relationship satisfaction scale (alpha=.94), and the happiness scale (alpha=.77) varied in reliability with the majority of the findings over the alpha = .7 standard. To investigate whether DYLoC scores had a curvilinear relationship with self-esteem, happiness, and relationship satisfaction, DYLoC scores were first standardized and then the absolute values of the standardized scores were calculated. Contrary to expectations, these converted DYLOC scores were not found to be significantly correlated with self-esteem (r(n)= 188) = -.039, p = .30), happiness (r(n = 188) = .010, p= .443), and relationship satisfaction (r(n = 188) = -.008, p = .458). Linear relationships, however, were found between DYLOC scores and self-esteem (r (n=188) = .26, p < .001), happiness (r (n=188) = .29, p < .001), and relationship satisfaction (r (n=188) = .35, p <.001), indicating the influence of internals—participants having overall higher happiness, satisfaction, and selfesteem exhibited signs of responsibility for/control

over their behaviors in life—within the participant population (see Table 1). The happiness measure was a strong predictor of self-esteem (r (n=188) = .63, p <.001). Relationship satisfaction predicted a moderate correlation with self-esteem as well (r (n=188) = .42, p <.001). A positive relationship was found between happiness and relationship satisfaction (r (n=188) = .32, p <.001). The only demographic factor that had statistical significance was for sex. The results indicated females were slightly more internal than males, t(186) = 1.962, p = .051.

DISCUSSION

The predictions made in this study were that DYLoC would be correlated with self-esteem, relationship satisfaction, and subjective happiness; furthermore, a strong association between self-esteem and happiness should be present. The third prediction was that internal LoC scores would be more strongly correlated with relationship satisfaction, happiness, and selfesteem when compared to external LoC scorers. The results have confirmed correlations between all scales and validated all predictions. In addition, female participants were found to be more internal than males. These findings indicate more females believe they may be likely to make desired changes in their intimate relationships. This result was consistent with the revised Miller Marital Locus of Control Scale's finding that internal spouses could use their LoC tendencies to likely prevent marital strain, or in this case believe they may possibly be able to prevent/solve romantic relationship problems (Bradbury & Karney, 2010). The DYLoC scale can be considered consistent with other previously described domain-specific measures connected to mental health because of its reliability (alpha=.72) and its strong to moderate correlations to relevant scales. The results of this experiment should be important to the psychological community because it proves this measure can be used as a sociometer for how much people perceive outcomes in their relationships as internally controllable by their own efforts and actions or as externally controllede by chance or outside forces. The DYLoC scale could be used to indicate which significant other needs to change their thinking to more internal modes to improve the psychological health of the relationship. Moreover, the scale can be used to alert anyone, in a relationship or not, to the type of control by which he or she governs a romantic relationship in less than ten minutes.

The main limitations of this experiment pertain to its delivery and its sample. The online medium was particularly convenient for participants to complete in their own time and comfort; however, the possibilities for distractions while taking the survey were endless. In addition, a participant could have been taking the survey with their partner or multitasking with other projects. was Also, the definition of a "committed" relationship was not defined for participants who were not married, which may have influenced the clarity of the survey for some participants. The majority of the sample population was female, which could have influenced the results, especially the finding of females tending to have more internal LoC than males. If the ratio of males to females were balanced, males could have possibly been the more internal LoC gender. The average age of participants was 21, and this could have biased the results in terms of participants not being old enough to have a full grasp on what they believe they can control in a relationship and if that perception is mentally healthy or not. Future research could test both individuals in the romantic relationship to compile and compare the results for a greater influence on participants. Likewise, a survey could be conducted that separates participants into groups of singles, committed relationships, and married couples to clearly see differences in the results.

The results of the present study support the use of DYLoC measure in relationship research. scores were found to be an excellent predictor of selfesteem, happiness, and relationship satisfaction. Thus far, LoC research has no predictors of these relevant traits to relationship health. The void of a concise scale measuring the extent to which one believes he or she can make desired changes in an intimate relationship has been filled. The DYLoC scale was unique because it had no predecessors. All health or marital scales were only for the tested domain population, not for general beliefs of perceived internal or external reinforcements for romantic relationships. The DYLoC scale can become a new page in the multitude of LoC research for further study and use as a predictor of self-esteem, happiness, and relationship satisfaction.

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APPENDIX A. Correlations between Dyadic Locus of Control, Self Esteem, Subjective Happiness, and Relationship Satisfaction

	Self-Esteem	Subjective Happiness	Relationship Satisfaction
Dyadic Locus of control	.263*	.285*	.350*
Self-Esteem	1	.628*	.415*
Subjective Happiness		1	.317*

NOTE: * = p < .001

APPENDIX B: Dyadic Locus of Control Scale

DIRECTIONS: Below are a number of statements interested in how various topics can affect your personal beliefs about your romantic relationships in general, not in just current romantic relationships. There are no right or wrong answers. For every item there are a large number of people in a romantic relationship who agree or disagree. Could you please put in the appropriate space the choice you believe to be true? Answer all the questions.

0	1	2	3	4	5
Strongly disagree	Generally disagree	Somewhat disagree	Somewhat agree	Generally agree	Strongly agree

- We can anticipate difficulties and take action to avoid them
- Everyone knows that luck or chance determine a couple's future
- 3. ____ We can control our problem(s) only if we have outside support
- 4. ____ When we make plans for our relationship, we are almost certain that we can make them work
- 5. ____ Our problem(s) will dominate us all our lives
- 6. Our mistakes and problems made during the relationship are our responsibility to deal with
- Becoming a successful couple is a matter of hard work, luck has little or nothing to do with it.
- 8. ____ Our lives are controlled by outside actions and events.
- 9. ____ Couples are victims of circumstance beyond their control.
- 10. ____ To continually manage our problems we need professional help
- 11. ____ We understand why our problem(s) vary so much from one occasion to the next.
- 12. ____ We are confident of being able to deal successfully with our future problems.
- 13. ____ In our case maintaining control over our problem(s) is due mostly to luck

MULTIPLE PERSPECTIVES CONCERNING THE INCLUSION OF MIDDLE SCHOOL STUDENTS IN SPECIAL EDUCATION ADMISSION, REVIEW, AND DISMISSAL MEETINGS



by CRYSTAL BERTADILLO

ABSTRACT

In this research we interviewed college students, parents, and teachers who had prior knowledge about or who had attended an Admission, Review, and Dismissal (ARD) meeting and who had experienced the inclusion of the student in the meeting, as well. Participants shared their experiences of what it was like to be a part of an ARD meeting and discussed the benefits that these meetings gave to students with disabilities, especially if the students were included in the meetings. Interviews were 30 minutes in length, and participants responded to five questions about the ARD meeting. Results were somewhat mixed, as some participants stated that all students should be included, but most thought that inclusion depended upon the age of the student. The overall finding of this research was that the age of the student should be considered when deciding to include him or her in the ARD meeting, and that student

participation should begin in middle school, as the study participants noted that it is at this age that the student begins to develop an understanding of the purpose of the ARD meeting.

Keywords: Admission, Review, and Dismissal (ARD), disabilities, inclusion

INTRODUCTION

Education, what is the meaning of it? Education is the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally preparing oneself or others intellectually for mature life (Dictionary.com, n. d.). Speaking from experience, education is one of the most important assets in a child's life while growing up. Education is the ability for children to gain knowledge and develop basic skills in multiple ways, whether it's a hands-on activity, written or oral given information. Skills are lessons learned that help in school as well as in everyday life situations. Lessons are sometimes hard to learn for some people, because there is always that one thing they cannot comprehend, or they just don't generally understand it. Sometimes the reason a student has difficulty understanding a lesson in class is because the student may have a minor or even a major learning disability.



MENTOR

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When a student has a disability, according to the publication of The Arc and Disability Rights Texas, A Guide to the Admission, Review, and Dismissal Process, (2012, September), there are many procedures that need to come into play, one of which is setting an Individual Education Plan (IEP) for the student. To further this goal, an Admission, Review, and Dismissal (ARD) meeting is held annually by a committee which includes school staff and the student's family, in which the IEPs are written, based on the student's needs and on the progress of the student's previous school year.

The focus of this research was (a) to discover the perspectives of those who have held or sat in an ARD meeting, with or without their child, (b) to listen to their feedback about this type of meeting, (c) to uncover their perceptions of how the inclusion of students at the ARD meeting affects students in making decisions about their education and progress in their educational learning, and (d) to see if there are any outcome benefits for the students from sitting in on their own ARD meetings.

LITERATURE REVIEW

Here the identification of the entire name of the law (IDEA) guarantees every eligible student a "free appropriate public education" (FAPE)" (The Arc and Disability Rights, Texas, 2012, p. 9). In other words, when it comes to education, every student should be allowed the same rights and services, whether in a general education classroom, in a special education classroom, or in school settings where there is a mix of students with and without disabilities. Middle school is not only a step closer to high school, but also another step closer to the real world and living life independently. Students with disabilities face many obstacles, and one way to help them overcome those obstacles is to allow them to take part in the decisions made for their future education. To convey the context in which this research was conducted, the following is a brief history of Special Education legislation. According to IDEA: The Manual for Parents and Students about the *Special Education Services in Texas*(DATE),

In 1975, Congress first passed a federal law to ensure that local schools served the educational needs of students with disabilities. The law that was originally passed was called the Education for All Handicapped Children Act. That first law has been updated several times over the years. In 1990 Congress renamed the law the Individuals with Disabilities Education Act (IDEA). The most recent version of the IDEA was passed by Congress in 2004 as the Individuals with Disabilities Education Improvement Act (IDEIA). (p. 9)

The same manual describes how schools proceeded to serve the education of those with disabilities by monitoring the students' educational progress. According to the legislation, one way that a student's educational progress is monitored is by having a mandatory ARD meeting, at least annually. The purpose of this meeting is to talk about the student's progress in the current school year and to set new standards for the following school year.

The individuals included in an ARD meeting are the parent or guardian, a general education teacher (if the student is included in a general education class), a special education teacher, a representative of the school (most likely the principal or counselor), an interpreter, if needed both for language and to explain the assessments the student has taken, and anyone else who has a part in the child's education or in dealing with the student's disability. In addition, parents or guardians must be given a written notice prior to the meeting at least five school days before the school can hold an ARD for their child. This notice informs the parents and guardians about the details of the upcoming meeting, with the date, time, and location of the meeting, the names of who will be present, and the purpose of the meeting. The ARD meeting must occur at least once a year, but any member of the ARD committee may request a meeting at any time.

During the ARD meeting, committee members will determine the student's Individual Education Plan (IEP), which is a written plan that is made for the individual student, and determines how they will be educated within the school year. This plan is agreed upon by the parent(s) or guardians of the students and the decision-makers at the school. The IEP must be specifically designed for that one unique student, and must incorporate what best fits their disability. By definition, the IEP should only concern the individual student; it is not a cookie-cutter plan for a group of

students with similar disabilities, as every student is different and learns in different ways. Most important, children are affected by the disability in different ways. Federal law (IDEA) stipulated that the IEP is to be reviewed at least annually for the current school year so the ARD committee can view the student's educational progress and determine if the plan meets the individual needs of the student or if changes are needed. This information can be used to inform the following year's IEP. In *A Guide to the Individualized Education Program* Kupper (2000) describes the requirements for the writing of IEPs as included in the following list of the required statements information.

- Current performance. The IEP must state how the child is currently doing in school (known as present levels of educational performance). This information usually comes from evaluation results such as classroom tests and assignments, individual tests given to decide eligibility for services or during reevaluation, and observations made by parents, teachers, related service providers, and other school staff. The statement about "current performance" includes how the child's disability affects his or her involvement and progress in the general curriculum.
- Annual goals. These are goals that the child can reasonably accomplish in a year. The goals are broken down into short-term objectives or benchmarks. Goals may be academic, address social or behavioral needs, relate to physical needs, or address other educational needs. The goals must be measurablemeaning that it must be possible to measure whether the student has achieved the goals.
- Special education and related services. The IEP must list the special education and related services to be provided to the child or on behalf of the child. This includes supplementary aids and services that the child needs. It also includes modifications (changes) to the program or supports for school personnel-such as training or professional development-that will be provided to assist the child.
- Participation with nondisabled children. The IEP must explain the extent (if any) to which the child will not participate with nondisabled children in the regular class and other school activities.

- Participation in state and district-wide tests. Most states and districts give achievement tests to children in certain grades or age groups. The IEP must state what modifications in the administration of these tests the child will need. If a test is not appropriate for the child, the IEP must state why the test is not appropriate and how the child will be tested instead.
- Dates and places. The IEP must state when services will begin, how often they will be provided, where they will be provided, and how long they will last.
- Transition service needs. Beginning when the child is age 14 (or younger, if appropriate), the IEP must address (within the applicable parts of the IEP) the courses he or she needs to take to reach his or her post-school goals. A statement of transition services needs must also be included in each of the child's subsequent IEPs. Needed transition services. Beginning when the child is age 16 (or younger, if appropriate), the IEP must state what transition services are needed to help the child prepare for leaving school.
- Age of majority. Beginning at least one year before the child reaches the age of majority; the IEP must include a statement that the student has been told of any rights that will transfer to him or her at the age of majority. (This statement would be needed only in states that transfer rights at the age of majority.)
- Measuring progress. The IEP must state how the child's progress will be measured and how parents will be informed of that progress (p. 5-6).

The ARD meeting plays such a major role in the student's education, and the members have different perspectives. As described in *Parent Perspectives on Team Meetings* (Whitty, 2010), a parent shares what skills he or she uses to make a balanced communication between the parent and the school staff. Also, parents are given the chance to share their experiences and personal thoughts at the ARD meetings. One student's family shared, "One thing that we like about having such a variety of persons at these meetings is that everyone has input and ideas in problem-solving that are invaluable" (Whitty, 2010, p. 1). With many sets of eyes and a number of views and opinions, everything is reviewed more than once within that first round. As emphasized in one response from a parent,

The overall benefits of team meetings have been invaluable to us as a family. We have learned so much from these professionals who work with our son. Most of all, the team meetings have opened the door to a much higher level of communication between teachers, therapists, aides and family members. It is a greater understanding of how everyone is working with our son to become independent and successful. (Whitty, 2010, p. 2)

In summary, ARD meetings occur to determine goals and objectives for the IEP, to decide which supports are necessary, and to monitor the student's educational progress. As previously stated, the student is included in the meeting only when appropriate; however, from the researchers' experiences, students are the only ones who can really know themselves and know what can and cannot work to help them. Although some students do have a severe and profound disability such that they might not know what the purpose of the meeting is, or how to understand and help, researchers believe that students who do not have severe and profound disabilities can add value to the meeting. The researchers have experienced this when one researcher was a mentor for a student with special needs. He understood what the researcher was saying; he just had trouble explaining himself at times.

There are ways that student, particularly those who are generally included in the regular school day, such as those with specific learning disabilities, can be helped to be self-determining and actively involved in their own education. One of these ways is to be included in at least some portion of their ARD meeting. These students are capable of being a part of their own ARD committee and are capable of discussing their thoughts. This may require facilitation on the part of the school staff. For example, students can be prepared by the case manager as to what might be expected and discussed in the meeting. The IEP process can be explained, and the student's perspective can assist in making any decisions. This is especially important during middle school years, the context of this study, because the student has transitioned from elementary school into middle school and begins to have a little more to say than in the previous years. Also, inclusion is important because students are a step closer to high school where they will have to begin thinking about post-high-school goals and what they would like to pursue in life.

There are different ways in which a student can be included in the development of his or her IEP. One way is through student-led IEPs, in which self-determination is important. As stated in Student-led IEPs: Take the First Step (Mason & , 2005), "Self-determination, as typically understood in the professional literature, embraces cultural values of autonomy, choice, goal-directedness, and action, as well as a belief that acquiring these traits signals maturation" (p. 52). Self-determination means that not only can students mature and embrace what is going on, but they can also live life without having someone plan every single thing they do or have to do. Having input into their own IEP is just a start to helping them improve the quality and relevance of the IEP goals piece by piece. In fact, "educators have recommended the IEP as a natural vehicle for teaching students to be more self-determined" (Mason & McGahee, et al., 2005, p. 52).

For example, throughout the IEP, there are some parts whose purpose the student might be able to comprehend. As stated in Eisenman and Myers (2005) in *Student-Led IEPs: Take the First Step*, "They all use the transition section framework for student involvement, including soliciting students' ideas about their interests, strengths, and needs" (p. 53). In other words some teachers help prepare their students to understand what terms, statements, and set standards will be in their IEP.

However, this approach can be problematic. For example, as this strategy was being played out, Eisenman and Myers (2005) noted that the teachers they interviewed encountered some issues. "First, they [teachers] expressed concerns about how to talk with their students about their disabilities in terms that the students would understand and accept" (p. 53). The teachers described that in talking to a student with a disability, their feelings and level of understanding need to be considered, because they are young and their level of understanding may not be advanced enough to understand the vocabulary or the purpose of making this plan for their education. The teachers feared that it would be difficult for them to facilitate such understanding. Second, "few of the students had defined or knew how to create their own goals."

Nevertheless, Eisenman and Myer (2005) write that "by facilitating access to information, adult guidance, and opportunities for dialogue, the teachers supported students in identifying and refining their own goals" (p. 54).

Other ways students can be helped is to prepare them to participate in a portion of the ARD. For example, when preparing them for attending and participating in a portion of the ARD, questioning them at their level of understanding is helpful. Questions can be asked by the teachers, diagnostician, or by the person requesting the meeting. Some questions that can be asked and addressed are "How does your disability affect you in school, at home, and in the community? What things are harder because of your disability? What do you think is important for others to know about your disability?" (Mason & McGahee, et al., 2001, p. 31).

These ARD meetings take many things into consideration when it is time to create a student's IEP, because the IEP sets the standards and goals the student has to meet for the following school year. From personal experience the researchers note that, most important, what always needs to be remembered is that the entire ARD process is all about that one individual student and his or her education, so everything needs to be made relevant and realistic to the students.

METHOD

Research Design

This qualitative research shares the perspectives of those who have held or sat in an ARD meeting with or without their child. Participants shared personal experiences and their personal feedback and opinions on ARD meetings. The first step in this study was to determine a strong research question for the project. Then, five semi-structured interview questions were designed to elicit the personal narratives of the participants. The questions were as follows:

- 1. "Do you know what an ARD meeting is? If yes, tell me what you know about an ARD meeting."
- 2. "If no, researcher would give the following short definition of ARD meetings and their function of developing IEPs.

In IDEA: The Manual for Parents and Students about Special Education Services in Texas, (2012), an ARD meeting, also known as an "IEP meeting, is a meeting that occurs once a year to develop, review, and revise your child's IEP" (p. 36). "The Individual Education Program (IEP) is a written plan designed just for one student. It is an agreement between the school and parents on how the student will be educated" (p.43). The IEP will consist of making the student current performance, annual goals set for the school year, what special education services they will need, participation they will take part in, the assessments they will take, and if any transitions. This meeting consists of one general education teacher, one special education teacher, a representative of the school (most likely the principal or counselor), and an interpreter, if needed, both for language and to explain the assessments the student is going to be taking (p. 38-40, & p. 45)."

- 3. "Have you ever sat in on an ARD meeting?"
- 4. "How do you think student participation in an ARD meeting would affect their education?"
- 5. "How would you suggest that students be informed of any decisions that were made regarding your Individual Education Plan (IEP)?"
- 6. "Describe any occasions of student inclusion in their ARD meetings that you are aware of."

PARTICIPANTS

Participants were a purposive sample of a maximum number of five adults, including college students and/ or public school/university teachers who are familiar with Special Education ARD meetings for students with general learning disabilities and have either held or sat in an ARD meeting, whether their child was or was not included and took part in the educational decision making for their following school year Individual Educational Plan (IEP).

MATERIALS

The only material needed was an information sheet that explained the interview and research process, which each participant signed indicating that they understood the information provided and consented to participate in the study. The participants were also given a copy of the information sheet.

PROCEDURES

Once interview questions were made, the researcher began talking with a classmate who she knew had family that applied to this study, and made contact to see if they would be able to participate. Using the snowball approach, the researcher also found other participants through those participants and through people she communicated with in the past. Participants consisted of one student and four teachers, two of which were also parents who had a child with a disability. The researcher then set up individual meetings to first have them read and sign the information sheet. Then the meeting was followed by a 30 minute interview over the questions provided above to obtain the data needed.

RESULTS

When the researcher was done with all interviews, the data was then analyzed and it all came to conclusion how much all participants input into an ARD meeting.

1. Do you know what an ARD meeting is? If yes, tell me what you know about an ARD meeting.

Five out 5 participants knew what an ARD meeting was. Participant 1, "The acronym 'ARD' stands for Admission, Review and Dismissal." An ARD is held periodically throughout the school year as needed. An initial ARD is held when a student enters the special education system (admission). Another ARD is held at the end of the year (review), but, as already stated, more ARD meetings can be called based on student need. An ARD meeting is also held when a student is exited (Dismissal) from the special education program." Participant 2, "The ARD meeting is the annual review and dismissal that is held by the school district to talk about placement and goals for children in special education, including setting the Individual Education Plan (IEP) goals and measurements." Participants 3, "An ARD meeting is held once a year to discuss progress and to determine if any changes are needed on his IEP to help my child succeed in his education." Participant 4, "an ARD meeting is a meeting where the parent meets with the child's teacher's, along with the specialist(s) and a school representative. This meeting is to discuss the

child's needs for special education services in a special education setting." *Participant 5*, "an ARD meeting is Admission, Review, and Dismissal and what that is, is a meeting between school professionals and parent or guardians to create an Individual Education Plan (IEP) for a child with disabilities that is in a schools special education program."

2. If no, researcher would give a short definition of ARD meetings and their function of developing IEPs.

All 5 participants knew what an ARD meeting was.

3. Have you ever sat in on an ARD meeting? If yes, briefly explain what you have experienced during the ARD meeting.

Four out 5 participants have sat in an ARD meeting, either with their child, as a parent, or as another member of the Admission, Review, and Dismissal (ARD) committee. Also each participant has experienced many different things as they have sat in the meeting. Participant 1, has sat in with her child and has also sat in the meeting as a teacher. "Concerning my son's ARD meetings, they have all been, for the most part, positive, constructive experiences. I am always impressed by the number of professionals who attend and give input about what would best meet my son's educational needs." Participant 2, "I have two children who are special needs and I have had ARD meetings every year for the last 8 years." Participant 3, "I have sat through many ARD meetings over the course of my child's education, the meeting consisted of my son, me, at least three teachers and a counselor, the diagnostician. We began by reviewing his past performance, and he was always included and encouraged to participate and voice his opinions on how staff could help him improve study habits and therefore improve academically. I always had a positive experience during these meetings, mainly due to the fact that my son played an active role within his education; this was always promoted by staff." Participant 4, "I've been the case manager in which I've prepared the paper work for the meetings. I've experienced end-to -end situations, such as the dismissal process where a child is getting close to dismissal out of a certain subject because she/he has reached their goals. Also I've experienced where neither th child nor parents were involved in the student's IEP decisions, decisions were left upon the ARD committee."

4. "How do you think student participation in an ARD meeting would affect their education?"

Participant 1, "I do not think very young children would be influenced at such a meeting. I do think starting at middle school (or earlier depending on the child's abilities); he or she should attend the ARDs. It would give the child some sense of control over his/her own education." Participant 2, "the age of the student and level of understanding would affect this question. High school students are part of the ARD process already." Participant 3, "As a parent I believe that for a child to be successful they must learn to advocate for themselves, and by allowing them to actively participate in the ARD meeting we are allowing them to develop the skills necessary to be successful in the real world." Participant 4, "it is extremely positive. In one district I have worked in, it's mandatory to have a student lead the meeting. Students have a voice in taking part in making their own IEP, and with them being a part of it they will own it more. The student will work harder to reach the goals they took part in making than having someone else makes them." Participant 5, "I strongly believe that a student should participate in their ARD meetings. I understand that some children would only last one to five minutes, but I still believe they should be taken out and then brought back in when they have settled down. I think this should start at a young at age, and by the time they are in middle school, it would be natural for them. This gives the child choice in their future, which I believe is very important. They will feel that they have some presence in their life."

5. How would you suggest that students be informed of any decisions that were made regarding your Individual Education Plan (IEP)?

Each participant had their own way in how they could inform students of taking part in making decisions set for their IEP. For example, *Participant 1* stated, "Students should be told directly what to expect from the teacher by way of modifications." According to *Participant 2*, "High school students are part of the meeting; the younger children it is up to the parents and educators to handle passing the information on to them. Again depending on their developmental level would depend on how

and what information is given to them." Participant 3 stated, "Having my son at every meeting since he was in second grade allowed him to become more aware of his disability and how to address those needs. I always made sure that he understood exactly what was being said and more so, what we could do to ensure his success." Participant 4 discussed his perception that, "A student should be a part of the IEP plan; goals shouldn't be set by someone else based on what they believe a student should reach. Talking to the student and seeing where they are at, how they feel about their studies and where they might need help before setting their goals in the IEP." Participant 5 observed, "I think they should be present in the meetings. That is their right. I understand that some children do not understand what's going on, (or we think they don't) but I firmly believe regardless they should be present."

6. Describe any occasions of student inclusion in their ARD meetings that you are aware of.

Four out of the 5 participants experienced some sort of unexpected situation while sitting in an ARD meeting. For example, *Participant 1* said, "One specific ARD I recall, a senior student was attending (the child was 18 so a parent was not included). This was the senior ARD to help him transition from high school into college or a possible job/career path. The student had taken an aptitude test (I forget the name of the test), and he was informed that he was best suited for security or to be a police officer. He laughed at this and said he would rather not follow that route. He said he wanted to be a welder, and he was given information about how to pursue this career (he was already in the welding class at the high school). He was also informed that he needed to complete the Selective Service act.

According to *Participant 2*, "It is required in High School; they will not hold an ARD without the student participation." *Participant 3*,

When my son reached the 8th grade, we began preparing for his transition into high school; this was done by him and his case worker (special education teacher). They carefully considered what my son's weaknesses as well as strengths were and how these both played into his future goals. His teacher helped him align his schedule to meet his interest and needs academically. At the end of the

year ARD meeting, the usual team was there but also included was the high school counselor. My son was allowed to work with this team to ensure his transition into high school was being met to satisfy his needs.

Participant 4 explained,

One major [strategy] that occurred and has seemed to be a good strategy, is preparing a script as to how the meeting would go. Such as an introduction, for an example the student would say their name, age, what classes they like, their plans while in school or even after high school. But one most important topic was what students should know about themselves, such as what they like to do, what helps and doesn't help them learn, and where they are having trouble on a subject."

DISCUSSION

Again, these interviews were conducted with college students, and/or public school/university teachers who are familiar with Special Education Admission, Review, and Dismissal (ARD) meetings. Participants shared their perspectives as individuals who have sat in an ARD meeting, either as a parent or as another member on the committee. ARD meetings are very beneficial to students, especially if the students are present and actually have some input into the decisions that are being made regarding their education. As shared by one teacher-participant, "Age and grade level does has an effect on whether they would be able to be included, but also having a child begin at a young age will have them become engaged as to what to expect later on in their future meetings."

In summary, the participants in this study felt that the benefits of students being included in ARD meetings will take them a long way toward ownership of their education, even if it is just simply giving and/or getting some feedback about what is being discussed or being fully included, as in participating in a student-led meeting. Participants felt that, depending on the child's disability, it may be impossible for the child to understand what is going on in an ARD meeting, but the effort must be made, at least in the case of the student who is included in the general education classroom, to see how they respond, which gives the parent, along with the rest of the committee, an idea of how successful

the participation of the student will be. If the child is able to comprehend what is going on and can participate in making his or her IEP, then he or she should be allowed to participate in his or her own ARD meeting. In that way self-determination can be encourage and developed in disabled students, which will increase their ability to meet goals that they have helped to make, and they will get practice in decision-making and see that soon they will be able to do it on their own in the future. Overall , based on the age of the student, and especially by the time the student is in middle school, survey participants thought that student attendance at ARD meetings is beneficial, because the student is getting involved in deciding and/or observing how his or her special services are determined, and this helps the student succeed in his or her education.

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IS THERE A RELATIONSHIP BETWEEN COMMUNICATION LEVEL AND EXTERNALIZING BEHAVIOR IN CHILDREN WITH AUTISM SPECTRUM DISORDER?



by JANE HILL BROWN

ABSTRACT

In this study, the relationship between communication level and externalizing behaviors in autism spectrum disorder (ASD) was studied. The research used existing data that was collected at The Developmental/Behavioral Clinic at Driscoll Children's Hospital in Corpus Christi, Texas. There was no contact between the researcher and the participants. Sam S. Hill III, Psy.D. LSSP, who collected the original data, "sanitized" all identifying information. The data was collected over a period of ten years. The psychological test results were from the Vineland Behavior Scale (VABS-II) and the Achenbach Child Behavior Checklist (CBCL). The data was coded and entered in a two-tailed co-relational data analysis, using SPSS. The results indicated that individuals with ASD have external behavior problems because they lack communication ability. The findings were consistent with the reports in other studies that communication abilities affect one's external behavior.



MENTOR

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INTRODUCTION

An increasing number of children are referred to mental health services because of disruptive behavior. Studies show that the most severe forms of disruptive behavior are found predominantly among males with a range of neurodevelopmental vulnerabilities. Many of these children who are identified with maladaptive behavior issues actually have a primary deficit in language skills (Bishop & Baird, 2001). They are, consequently, not receiving language instruction that would help improve overall behavior and socialization skills.

The number and degree of neurotypical children with both behavior problems and a deficit in language skill is similar to that of children with autistic spectrum disorder (ASD). Unfortunately, educators too often focus on improving the behavior of children with ASD without remediating the underlying problem of poor communication skills. Much research has been focused on the maladaptive behaviors in children, whether the child has ASD or not, but little has been done concerning the link between language deficit and behavior issues. What research that has been conducted has usually occurred in a clinical setting. In such artificial settings, the child with ASD will not behave as he/she would in a natural environment. A review of literature reveals the serious issue of maladaptive behavior in children with ASD linked with poor communication skills and underscores the further need of research in a natural,

non-clinical setting (Gilmour, Hill, Place, & Skuse, 2004).

Many studies link a connection between maladaptive behaviors with poor communication skills. Gilmour et al. (2004) showed that parent and teacher ratings indicated that two-thirds of those with conduct disorders had pragmatic language impairments and other behavioral features similar in nature and degree to those of children with autism, independent of IQ. Gilmore et al. (2004) showed that of 54 children who had been excluded from elementary schools in a socioeconomically disadvantaged inner-London borough, two-thirds had comparable deficits. These findings have both theoretical and practical implications. They show the presence of communication problems in a sub-group of children in whom behavior rather than speech had been a concern. In boys especially, severe deficits in pragmatic abilities and autistic-like behaviors can coexist with psychiatric conditions other than autism. They imply that the management of many disruptive children could be profitably addressed by helping them to improve their social and communication skills deficits (Gilmour et al., 2004).

One particular maladaptive behavior, self-injurious behavior, has been reported to be associated with poor communication skills (Carr & Durand, 1985). The association of self-injurious behavior (SIB) and poor communication skills has been linked with a wide range of medical conditions suggesting the role of neurotransmission disturbances in such behaviors (Schroeder, Rohjan, Mulick, & Schroeder, 1990; Rohjan, Tasse, & Morin, 1998). Behavioral theories also suggest that SIB is related to external and/or internal factors. Problematic behavior may be detrimental to the development of appropriate social skills (Duncan, Matson, Bamburg, Cherry, & Buckley, 1999). Moreover, SIB may pose management problems, and its effects on the individual's quality of life are often serious as well.

Furthermore, there is strong evidence that children with ASD have generally higher levels of emotional and behavioral problems such as physical aggression, hostility, temper tantrums, and self-injurious behaviors. This may be related to their social and communication impairments. Restricted, repetitive behaviors are also associated with higher rates of co-morbidity of ASD with mental disorders. One specific social deficit in people with ASD is comprehension of emotions. It

has been suggested that children with ASD have difficulties in both identifying their own emotions and in recognizing other people's facial expressions, in particular expression of anger (Hines, and Simonsen, 2008). In typically developing children, the ability or inability to recognize important social cues of emotions is directly related to appropriate social behaviors and inversely related to behavioral problems.

Based on a review of the research literature, it has also been concluded that young children with autism are at significant risk of developing problematic behaviors such as self-injury, physical aggression, property destruction, and without intervention, problem behaviors that are more likely to worsen than improve; the impact of problem behaviors on educational, social, and community opportunities is dramatic and detrimental. Thus, interventions for young students diagnosed with autism should address problem behaviors (Horner, Carr, Strain, Todd, & Reed, 2002).

For any child, problem behaviors are maintained because they are normal for the individual and are not likely to decrease without intervention. For children with ASD, problem behaviors are frequently due to communication issues. In other words, a student with autism may use inappropriate speech to communicate wants and needs. Rather than asking for space, a child may hit his caregiver to communicate that he wants the caregiver to go away (Iovannone, Dunlap, Huber, & Kincaid, 2003). This is especially likely if the child cannot communicate verbally.

Sipes, Matson, Horovitz, & Shoemaker, (2011) showed that in the relationship between ASD and symptoms of behavior problems as a result of communication disorder, those with ASD exhibited greater externalizing behavior symptoms of tantrum/conduct problems, which is consistent with previous research. It seems that the relationship with communication as a moderator may differ in young children, as their language skills are still in the early stages of development (Sipes et al., 2008).

Although the link between anti-social behavior and communication disorder is evident, children on the ASD spectrum are often not identified early enough to provide remediation. Autism is a developmental disorder characterized by qualitative impairments in social interaction, communication, and restricted

or repetitive behaviors (APA, 1994). Individuals with autism often show deficits in their adaptive and cognitive abilities, and it is estimated that over 75% are functioning within the range associated with serious cognitive deficits (APA, 1994). Although symptoms of the disorder may be present within the first year of life, many children with ASD receive their diagnosis late, while others remain undiagnosed or are misdiagnosed despite early symptoms or parental concern (Tomanik, Pearson, Loveland, Lane & Shaw, 2007). Late or inaccurate diagnoses have long-term implications for outcome, as several studies have demonstrated the importance of early intervention for children with autism (Dawson & Osterling, 1997; Lovaas, 1987; McEachin, Smith & Lovaas, 1997; Smith, Eikeseth, Klevstrand, & Lovaas, 1997).

A study conducted by Ho, Stephenson & Carter (2012) also investigated the effect of age on communication and maladaptive behavior in mentally retarded children and children with ASD. Forty-seven autistic and 128 mentally retarded children in a special school served as subjects. The cross-sectional method was used to compare junior and senior groups, and ratings on communication skills and maladaptive behaviors were obtained from teachers. It was found that skills of comprehension and conversation in autistic children improved significantly with age, and speech improved somewhat. In spite of this improvement in communication skills, maladaptive behaviors (other than hyperactivity) in the autistic children did not change significantly with age. Withdrawal improved significantly with age in the mentally retarded children but not in the autistic children (Ho, Stephenson and Carter, 2012).

The connection between behavior issues and poor communication skills has been researched, but the use of adaptive behaviors by children with developmental disabilities to communicate has received little attention. Keen (2003) shows that children with autism experience more severe communication issues than their developing peers. This is because children with autism have impairments such as joint attention deficit, impaired theory of mind, and the reliance on prelinguistic forms of communication. These children also have fewer strategies available to them to repair the communication breakdowns. There are three achievements that are necessary to repair a communication breakdown (1) the effort to communicate intentionally or goal

directedness, (2) to be able to take the perspective of the person he/she is communicating with, be able to recognize that a breakdown has occurred and to be able to understand the needs of the person they are communicating with. (3) To have developed effective verbal and/or non-verbal communication abilities. Keen (2003) reviews the research in this area and discusses possible links between communication deficits and the emergence of problem behavior. Theoretical and practical implications are considered and areas for future research are highlighted. There is no doubt a need exists further research that addresses the relationship between externalizing behavior, repair strategies, and early communication effecting behavior in children with developmental disabilities. Future research needs to consider how caregivers and other people these children communicate with respond to problematic and non-problematic communicative forms, especially those forms that are attempts to repair the communication breakdown. (Keen. 2003).

Kanne and Mazurek (2011) explained that another characteristic demonstrated by children with ASD that is the direct result of poor communication skills is aggression. The prevalence of and risk factors for aggression were examined in 1,380 children and adolescents with ASD. Prevalence for aggression was high, with parents reporting that 68% had demonstrated aggression to a caregiver and 49% to non-caregivers. Overall, aggression was not associated with clinician observed severity of ASD symptoms, intellectual functioning, gender, marital status, parental educational level, or aspects of communication. Individuals who are younger, come from a higher income family, have more parent reported social/communication problems, or engage in repetitive behaviors were more likely to demonstrate aggression (Kanne & Mazurek, 2011).

Kanne and Mazurek (2011) concluded that in a stressful situation, such as the drawing of blood, individuals with ASD release their stress through behaviors such as Other-Injurious Behaviors (OIB). Typically developing individuals, however, regulate and express their stress through cognitive skills such as mental coping strategies, symbolization skills with representation, and anticipation of the stressful situation, and verbal or non-verbal communication. The findings also underline the key role of the environment in assessing OIB and developing therapeutic perspectives with an individual who regulates his/her behavior according to

the environment, and an environment that perceives this behavior and reacts to it with different strengths of tolerance according to the observers (Bronsard, Botbol, & Tordjman, 2010).

Ganz, Parker, & Benson (2009) investigated the impact of Picture Exchange Communication (PEC) on communication, including use of pictures and intelligible words or word approximations, and to determine if there was an effect on maladaptive behaviors for three preschool and kindergarten-aged boys with autism. In this study, the researchers systematically collected and analyzed such data along with data about more direct behaviors that were targets of this intervention (Ganz, et al., 2009). One might expect improvement in maladaptive behavior as an additional outcome of PECS intervention, although such behaviors have not frequently been tracked in previous PECS studies.

Gianoumis, Seiverling & Sturmey (2012) systematically collected and analyzed such data along with more direct behaviors that were targets of this intervention. Another language intervention for children with ASD is Natural Language Paradigm (NLP), which is a naturalistic teaching strategy for children with autism that increases immediate and delayed imitative utterances, spontaneous utterances and new words, and production of utterances. Natural Paradigm includes increasing child choice, varying stimulus items, and loose shaping contingencies for attempts to communicate, and provides reinforcements with a direct relationship to the response. Only Ward-Horner & Sturmey (2008) had previously investigated the effects of behavioral skills training (BST) on staff acquisition and generalization of implementation of NLP and child behavior. A BST package of instructions, with modeling rehearsal and feedback, was used to train teachers to implement NLP teaching procedures with three pre-school children with autism spectrum disorder (Seiverling, Pantelides, Ruiz, & Sturmey, 2010).

Despite the lack of research of different approaches to facilitating an intervention aimed at communication and social skills of the children with ASD, Snowden, Perkins, & Clegg (2011) found that intervening in the child's ability to communicate helped some of his/her social skills. The study followed eight children ranging in ages from 2 years and one month and to 3 years and 6 months old. The children were followed during a

program of interventions which provided 21 hours of video data. The findings showed how practitioners implemented different strategies with the children participating in the study. The two strategies used were *Directiveness* (this term refers to the degree in which the adult dominates the interaction), and the other strategy used was *Framework*, which refers to the supporting interaction, often introduced through simple question and answer sequences where repetition is an essential component. The study showed that when prompted by the staff members, some children with autism ignored the staff members and some responded (Snowden et al., 2011).

The current study uses the data to examine if there is a relationship between the ability of children with ASD to effectively communicate with their primary caregivers and the presentation of problematic behavior. The research question for this paper is: Is there a relationship between communication level and externalizing behaviors in Autism Spectrum Disorder, (ASD)?

METHODOLOGY

Using existing data collected during the diagnosing of ASD, which was collected at The Developmental/ Behavioral Clinic at Driscoll Children's Hospital in Corpus Christi, Texas, Dr. Sam S. Hill III, Psy.D., LSSP, collected the original data, and "sanitized" the data by removing all identifying information before it was turned over to the principal investigator. There was no contact between the researcher and the participants. The data was collected over a period of ten years by Sam S. Hill III Psy.D., LSSP. The psychological test results were coded and entered into a statistical program to be analyzed. The data has been analyzed in a two-tailed co-relational analysis between the communications and external behavioral domains of the Vineland Adaptive Behavior Scale (VABS-II) and the Achenbach Child Behavior Checklist (CBCL). A Pearson r correlation was used to measure the relationship between communication and externalizing behavior.

RESULTS

A Pearson r correlation was calculated examining the relationship between overall communication and parent total problems. A strong relationship and significance was found (r (2) = .689 p > 0.05). The number of participants were thirteen (N=13).

A Pearson correlation was calculated examining the relationship between overall communication and overall parent problems. A strong relationship and a statistical significance were found (r (2) = -.123 < 0.05).

TABLE 1. Is There a Relationship between Communication Level and Externalizing Behaviors in Children with Autism?

	Overall Communication	Behavior Problems	
Overall Communication	Pearson Correlation Sig. (2-tailed) N	1	123 .689 13
Behavior Problems	Pearson Correlation Sig. (2-tailed) N	123 .689 13	1 13

DISCUSSION

The existing historical data indicated that behavior was affected by the communication ability of children with ASD. Overall communication was highly significant in the ability to communicate and behavior problems. (Baghdadi, Picot, Pry, Michelon, Burzstejn, Lazartigues, & Aussilloux, 2008).

The data analysis revealed that the maladaptive behavior and self-injurious behavior was associated with poor communication skills, and is consistent with the research done by (Ho, Stephenson and Carter 2012). The child with ASD will act out, (for example, hit someone) if he wants them to go away because he cannot communicate his wishes.

The data analysis also revealed that communication and some behavior problems such as the age of the child with ASD was not significant. Other than those findings, overall communication in every category of the VABS-II and the CBCL was significant in the problematic behavior of a child with ASD.

Psychologist's and educators have developed many techniques for teaching children with autism. Currently all children diagnosed with ASD go to Speech Language Therapy.

Universities require all general education teachers to take a specific special education course which gives them knowledge of all disabilities covered under special education and the rights of the child with disabilities. Universities have also changed the way they teach the Special Education Teacher. There are required courses for just behavior, autism and learning how to communicate with each individual child and teaching the individual. General education teachers are being bombarded with inclusion and are being forced to learned how to teach children with disabilities. They are being held accountable for the goals on their Individual Education Plan (IEP). We have come a long way with learning how to communicate with children with disabilities so we can teach them, but we have a long way to go. Further research is important to recognize the antecedents of the behaviors of a child with autism.

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MEXICAN AMERICAN PORTRAYALS IN U.S. HISTORY TEXTBOOKS

by SABRINA DEL MORAL



ABSTRACT

With previous research showing that textbooks are not without bias information and historical stories are, at times, one sided in history textbooks, this research aimed to see how Mexicans and Mexican Americans are portrayed in nationally used United States history textbooks. While focusing on three major textbooks used in United States history classes, the researcher coded the textbooks for words that discussed, referred to, or mention Mexicans and Mexicans Americans. From the findings, it was concluded that Mexican Americans are mainly framed in five categories, including soldiers, laborers, immigrants, activist, and living in harsh condition/inequalities. Overall, they were also found to be discussed mostly in a negative manner, rather than a positive one, even though there were a number of small sections that did frame Mexican Americans positively.



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PROBLEM STATEMENT

From past research it has been revealed that textbooks are not completely free from biased information. In fact, historical events have been found to be one-sided, usually favoring the majority and their point-of-view (Anyon 1979). Additionally, educational institutions come with socialization process that students experience, and textbooks can be used as a tool in these socialization processes (Jackson 1966). With this in mind, it questions how certain minority groups are being represented in these textbooks, which can then influence students' experiences and perceptions of these groups. The goal for this research is to determine how Mexican Americans specifically are being presented in nationally used United States history textbooks.

LITERATURE REVIEW

Schools as social agents

Each school comes with unique teachers, students, and education. With all of this come social experiences that affect the students and their perspectives on multiple issues. In fact, school is one of the initial social agents we interact with. However, much like all social influences, the students are unaware that these social agents are shaping them (Jackson 1966). Jackson discusses how the "student's world" is formed mainly by the education

system. The time, resources, and information all come from what the institution says (1966). With all of this surrounding the students' lives, it's obvious that it will have some social influences on the students, in addition to the educational impact it's meant to have. In fact, even when compared to the parental impact on the child's socialization, school is shown to have a bigger effect on the children when focusing on how they interacted with students of different ethnicities (Hello et al. 2004). Therefore, the student's perception of the world and how they should interact with others (or how they are socialized) is mainly from the educational institutions they enter and attend.

"Because socialization is reflexive, behavior in a given social interaction sets off a chain of reactions that has cumulative effects" (Peters 1990). This quote helps explain that the automatic process of socialization has much to do with what others are doing around them. Therefore, everyone goes through socialization processes in institutions, including educational institutions. And since students spend many hours together, this effect is deeper, making the social process at school stronger for the students.

However, as Kapferer's piece shows us, each school comes with different social agents and thus, the socialization comes with different outcomes. When looking at private school specifically, Kapferer found that children in these schools held high school spirit and more solidarity with each other (1981). The school was the focus for the students; and therefore, was held constant in their daily lives. At these schools it was important to stay concentrated on the school itself and close to the students at those particular schools (Kapferer 1981). Yet this was believed to be because the students were socialized in a certain way and they learned to value the school from the social agents at the institution.

Hidden Curriculum

The purpose of history textbooks is to inform students of historical and political events, in order to prepare them for other social institutions. For this reason, textbooks are thought to be informative and unbiased (Anyon 1979). Additionally, it was proven earlier that school aid in the socialization process of student. With this in mind, textbooks could be used as a tool to

certain socializations and frame students' experiences in particular ways. However, previous research has revealed that history textbooks are not without biased information and even serves to favor particular groups. Jean Anyon asserts that textbooks give power to elite groups by telling stories that favor them in the long run (1979). For example, many of the textbooks Anyon examined told stories in history that technically were true, but only shared one side of important historical events, such as accounts of union actions (1979). Furthermore, events such as strikes that challenged power elites were not discussed very much in the textbooks she examined. Furthermore, when they were described, it was in violent words and without the striker's point of view (Anyon 1979). Her research shows that not only have history textbooks previously been written from the point of view of the majority, but they have also weakened the voices of the minority. Moreover, Apple states that social studies, in many schools, show some of the "most explicit instances of the hidden teaching." This then shows that other studies have found evidence of hidden curriculum in textbooks (2004). With these issues coming to light, studying these textbooks is especially important.

It is important to note, though, that history textbooks are not the only textbooks that come with these kinds of flaws. One study found that the English as Second Language (ESL) textbooks showed clear sign of sexism (Porreca 1984). Since the students using these textbooks are learning a second language, we can assume that most of them are also learning a second culture. Therefore, these textbooks using sexism are socializing the students into the culture and are teaching them this sexism in the new culture. This is also a clear example of how stereotypes in textbooks could influence the student's perspective on those certain groups. The information they learn from these textbooks stays with the students for many years, and if they are seeing stereotypical information about certain groups they could easily carry it with them past the end of the class.

While hidden teachings are often due to information being left out or misrepresented in textbooks, the "hidden curriculum" also refers to the socialization of norms and values learned in school (Jackson 1996). Evidence of this information is visible, as discussed in the beginning of this paper; however, the goals are not

meant to be an official part of the education system. Nonetheless, they still continue to impact the students (Apple 2004).

In addition to this information, Loewen provides some insight into how this false or misrepresented information impacts student's perceptions of historical events (1995). These historical events played a huge part in the making of our country and how our political system works and has worked, but much of the information provided in textbooks leaves out conflict that arose during these events, as well as important leadership from minorities. Due to this information, the researchers predict the same results when focusing on portrayals of Mexican Americans in these history textbooks.

Stereotyping and Discrimination of Mexican Americans

Stereotypes, as described by Rinehart are "sets of beliefs, usually stated as categorical generalizations, that people hold about the members of their own and other groups" (1963). They usually describe a group's appearance, intelligence, or personality (Rinehart 1963). Stereotypes can have a lasting effect on people's perceptions.

Stereotypes are extremely influential in societies, and often shape the way individuals think about certain groups (and about themselves). Just like many other groups, Mexican Americans have been assigned certain stereotypes, including laziness and incompetence (Rothman 2005). In fact, Rothman says that media during the twentieth century describe Mexican Americans as "unclean sombrero-wearing caricatures that were either enjoying a siesta or engaging in criminal behavior" (2005). Another form of stereotyping was seen in a major airline's manual for their pilots. It stated that Latin American passengers were rude, drunk, and often called-in fake bomb threats so they could catch a plane when running late (Rothman 2005). In this case we can conclude that these stereotypes are meant to affect the pilots' perspectives on this minority group since the manual is meant to be read and taken seriously by the pilots.

Stereotypes have been shown to influence other people's opinions, as well as the stereotyped group's opinion of themselves. A study by James Cooper and Kathryn Steen Brooks compared Mexican American and Anglo-American's expectations of themselves on academic performance (1979). While Anglo-Americans showed more accuracy, the differences between the two academically were non-significant. Moreover, Ortiz and Telles discuss how race and stereotypes impact Mexican American lives through education and social interactions (2012). The authors found that darker skinned Mexican Americans were more likely to face some kind of discrimination due to stereotypes, since their darker skin color allowed them to be easily identified as a Hispanic. In addition to this, they also found more highly educated Mexican Americans faced more discrimination than those who were less educated (Ortiz and Telles 2012). The researchers believed this to be due to the fact that they spent more time with whites than with the less educated Mexican Americans. Regardless of their education, the stereotypes still resulted in discriminatory behaviors against the minority group.

Past research has shown that stereotypes do have an impact on how Mexican Americans are viewed and treated and that textbooks are a way that students learn and are socialized in schools. But the question still remains whether Mexican American stereotypes and discrimination are appearing in United States history textbooks, which can significantly influence student's views on Mexican Americans, especially if they have no other educational frame on the ethnicity. With this being said, this paper aims to study how Mexican Americans are portrayed in national popular history textbooks. It is predicted that the research will find some stereotypes of Mexican Americans and that most discussion on Mexican Americans will focus on work and labor, rather than any type of education or leadership focus.

METHODS

Sample

Since this study aimed to look at the how Mexican Americans were presented in nationally used history textbooks, finding these textbooks was the first goal. Our information was gathered from the American Textbook Council, which list widely adopted and used history textbooks on their website (American Textbook Council 2013). Along with this information, they tell us that this information is not easily acquired since educational publishers like to keep this information secret. On their

website they state, "The Council's database, developed since 1986, survey publishers' websites, key states and large school districts to determine what are the nation's most widely adopted textbooks in history and social studies" (American Textbook Council 2013). The Council used multiple factors to create their list of most frequently used history textbooks in the United States, and therefore, should be considered when reviewing the findings.

The following chart is a list of the most-used history textbooks in the United States that were used in this study. We have listed the textbooks' title, primary author, and publisher. Since the list was updated for the 2011-2012 school year, the most up-to-date editions of the textbooks were used. While the American Textbook Council gives textbooks for three different placement levels, advanced placement, general level, and eighthgrade U. S. history textbooks that are used as easy readers in some high schools, only three general level textbooks were used in this study. They are presented below.

Coding

Once the textbooks were gathered, the researchers searched through their indices, highlighting anything that might be related to Mexican Americans or Hispanics. These pages were then noted and organized so they could be copied and printed for coding. This included the page before and after that stated in the index, to ensure that all the information was gathered.

Once all the pages were copied, the researcher started with open coding by highlighting all sentences that talked about, mention, or referred to Mexicans Americans. This step was to simple mark up all sentences that included Mexican Americans and to get an idea of what would be found. Next the researcher went through the pages again to collect axial codes or any word or phrases that portray Mexican Americans and their lives. This step was performed so the researcher could see any concepts that led to how Mexican Americans were being portrayed in the textbooks. During the axial coding patterns started to become apparent almost immediately.

After the axial codes were collected, the coded words became the focus point during the selective coding, the final coding step. During the selective coding the researchers went through the collected codes three more times to see what patterns emerged. Through this step the researcher created five different categories from the patterns found. These categories are presented in the findings.

FINDINGS

This qualitative study aimed to look at how Mexican Americans are portrayed in nationally used high school history textbooks. Throughout the codes collected, five patterns were found in the textbooks, with Mexican Americans as a group portrayed as soldiers, laborers, immigrants, activist, and victims of inequalities. While two of the three books included more sections about Mexican Americans, one of the textbooks didn't spend as much time on this specific ethnic group.

Mexican Americans as Soldiers

Since these textbooks' ultimate goal was to teach students about history, each textbook that was examined discussed wars between the United States and Mexico or Spain. Throughout these sections of the textbooks, Mexicans Americans are focused on as soldiers in battle. None are singled out, but rather they are united together as soldiers that fight together against the United States. They were framed as the "Mexican government", "Mexican Authority", "Mexican force", or just "Mexico". Mexicans, as people, were discussed only as soldiers during sections about the war.

"Mexican soldiers ordered the Texans to surrender their arms. In response, the rebels pointed cannon at the Mexican force... Having no orders to attack, the Mexicans retreated to San Antonio."

— American Vision, Pg. 301

This textbook shows Mexicans only as soldiers and grouped them together, or something that has to do with the war. In the passage, it is clear that even when they are simply referred to as "Mexicans" it is meant as troops or soldiers working together. Even after the Mexican-Texas border was established Mexican Americans were still portrayed as soldiers. For example, the passage below still frames Mexican Americans as willing soldiers many years later, during World War II.

"Racial hostility against Mexican Americans did not deter them from joining the war effort (World War II). Approximately 500,000 Hispanic Americans served in the armed forces during the war. Most – about 400,000 – were Mexican Americans."

— American Vision, Pg. 752

This passage show that even with the racial violence Mexican Americans faced, they still came back as soldiers during times of war, such as World War II as described in the above passage. In fact, there were a good number of soldiers. This passage suggests that even during times of racial aggression against them, they still became soldiers in war and helped the United States. Mexican Americans as soldiers was a common pattern at the beginning of the textbooks. But later in textbooks, these images gave way to images of Mexican Americans as laborers.

Mexican Americans as Laborers

In addition to soldiers, another common portrayal of Mexican Americans was as laborers. All three textbooks discuss the Bracero Program, in which Mexicans were permitted to work in the United States in order for them to find laborers to do more difficult jobs, that were also very much in need.

"To help farmers in the Southwest overcome labor shortage, the government introduced the Bracero Program in 1942. Bracero is Spanish for worker. The federal government arranged for Mexican farmworkers to help in the harvest. Over 200,000 Mexicans came to the United States to help harvest fruit and vegetable in the Southwest. Many also helped to build and maintain railroads. The Bracero Program continued until 1964. Migrant farmworkers became an important part of the Southwest's agricultural system."

- American Vision, Pg. 750

The passage explains why Mexican workers were allowed to come into the United States. The program was arranged for Mexicans to become workers, or farmworkers, more specifically. This work was very hard labor, yet according to one textbook they were sought out for that purpose, as the next passage suggest.

"Mexican Americans were accustomed to the region's hot, dry climate. But the work was grueling, and the

railroads made them work for less money than other ethnic groups"

— The Americans, Pg. 289

Here Mexican Americans are said to be acceptable for the hard labor in a hot climate because they are accustomed to it. The textbooks states that they can take the hard labor, but also mentions the lower wages that Mexican Americans had to deal with. The textbooks are connecting the hard labor and the small wages together to show that they are related when it doesn't make sense that they are. Harder work should allow for higher wages, but that wasn't the case with the Mexican American farmworkers.

Mexican Americans as Immigrants

Another common identity for Mexican Americans was the immigrant identity. Due to the Bracero Program many Mexican Americans came to the United States to find work or better paying work. From the first passage in the section "Mexican Americans as laborers," it is clear that the Bracero Program help the United States as much as it helped Mexican Americans find work in the U.S. Since the United States gained from the program by finding laborers to do this demanding, much needed work, the program ultimately allowed them to gain from it. However, the program also helped Mexicans to become known as workers, which then led to immigrants as they tried to find work in the United States.

"By 1990 there were over 13 million Mexican Americans in the United States and thousands more were entering the country every year... Their language and their culture give a special rich flavor to the food and shape the music, the architecture, and the literature in the whole region."

— A History of the United States, Pg. 864

This passage allows the readers to see that Mexican Americans are a big part of the immigration population in the United States. Ever since the 1920s large numbers of Mexican Americans have come into the United States. But this passage shows that even in 1990 there was a significant number of Mexican Americans in the United States, with more entering the nation every year. Overall, it shows clearly that Mexican Americans in the United States were a large population of the newest

immigrants in the country. However, many other passages about Mexican American immigrants were much more negative than neutral, such as this passage.

"Many Mexicans and Mexican Americans worked as poorly paid farm laborers. Some of these barceros (a Spanish world meaning laborers) came north under contracts to work in the fields. Others entered the country illegally by slipping across the long and difficult-to-patrol border between Mexico and the United States. They were 'wetbacks' because some of them swam or waded across the Rio Grande."

— A History of the United States, Pg. 865

From this passage the reader get a completely different idea of Mexican American immigrants. The passage goes onto show that Mexican Americans crossed the border illegally and were able to do so since the border was hard to patrol. The passage also discusses the derogatory term "wetback" and describes why Mexican Americans are called that term, but doesn't discuss how or why the word is known as a derogatory term.

"Latinos – mainly Mexicans and Mexican Americans living in the Southwest – were also targets. Whites demanded that Latinos be deported, or expelled from the country, even though many had been born in America. By the late 1930s, hundreds or thousands of people of Mexican descent relocated to Mexico. Some left voluntarily; others were deported by the federal government."

— The Americans, Pg. 473

As time went on it became clear that Mexican American immigrants had become a strong issue in the United States and that others wanted them to leave the country. The passage states that Whites targeted them and wanted to kick them out of the country. The passage suggests what they actually did to many Mexican Americans. It got to the point where Whites didn't care if a Mexican American was born in the United States or not. The reader begins to understand that Mexican American immigrants became a point of immigrant population frustration in the United States.

Mexican Americans and Inequalities

The subject of Mexican Americans also came up often in sections that discussed poverty and inequalities. Each textbook had some discussion about this; however, two of the three went more into depth about these issues. Immigration had already caused some tension in the nation, yet conflict about Mexican Americans was present in other areas as well.

"They attacked Mexican American teenagers, cut their hair, and tore off their zoot suits. The police did not intervene, and the violence continued for several days. The city of Los Angeles responded by banning the zoot suits."

— American Vision, Pg. 752

One major event that caused Mexican American issues to come to light were the Zoot Suit Riots. In this incident Mexican Americans were targeted when misleading information led others to believe that Mexican American youth, who were known for wearing zoot suits, were attacking Whites. This led to the attacks described in the passage above. The textbooks explain to the readers that police, who are meant to protect us, actually allowed the attacks to continue and to control the issue they frame the issue in a way that still made the Mexican Americans look guilty for being the cause of the attacks.

"Away from the fields, many Mexican families lived in small, crudely built shacks, while some did not even have a roof over their heads. 'They sleep where they can, some in the open,' Harrington noted about one group of migrant workers. 'They eat when they can (and sometimes what they can).' The nation would pay little attention to the plight of Mexican farm laborers until the 1960s, when the workers began to organize for greater rights."

- American Vision, Pg. 830

In addition to being described as the victims of hateful attacks, Mexican Americans were also described as living in poverty. The passage above lays out how some Mexican families lived in order to survive. They were clearly living in poverty from the low wages they earned for their work in the fields. The textbooks also make it known that others in the nation were able to ignore the poverty Mexican Americans faced, and start to suggest that some activism will come from their action.

"Despite such unhappy experiences with racism, many Mexican Americans believed that their sacrifices during wartime would lead to a better future."

— The Americans, Pg. 593

Even when faced with poverty and constant inequalities in their daily lives, the textbook tells the readers that Mexican Americans were still hoping that the nation could move past it someday and be able to make a life in America without these issues. The passage frames them as still hopeful and optimist about the future however; later in the textbooks we see them continue to face discrimination because of their ethnicity.

Mexican Americans as Activist

Mexican American activists were included in all the textbooks. While all three of the textbooks discussed some specific people that took part in Mexican American activism, two of the three textbooks spend more time talking about activism within Mexican American culture.

"González used his radio program to condemn discrimination against Mexicans and Mexican Americans, who were often made scapegoats for social and economic problems during the Depression. González became a hero to many Mexican Americans and a symbol of Mexican cultural pride. His life reflected some of the difficulties faced by Mexicans and other minority groups in the United States during the New Deal Era."

— The Americans, Pg. 504

González was only discussed in one of the textbooks, but was shown to be very important to Mexican Americans during this era. In this particular textbook, González was the first Mexican American activist to be discussed. The passage tells us that Mexican Americans were again targeted for problems during the Depression and González became a symbol for them in a positive way. In this textbook, González is framed as one of the first Mexican American activists who used his radio program to talk and create conversation about Mexican American issues.

"Young Mexican Americans started to call themselves Chicanos or Chicanas — short for 'Mexicanos' that expressed pride in their ethnic heritage... In 1968, the Brown Beret's organized walkout in East Los Angeles High Schools. About 15,000 Chicano students walked out of class demanding smaller classes, more Chicano teachers and administrators and programs designed to reduce the high Latino dropout rate.

Militant Mexican-Americans students also won the establishment of Chicano studies programs at colleges and universities."

— The Americans, Pg. 770

Mexican American youth also became involved with Mexican American issues. The passage above describes the walk out that took place in Los Angeles in reaction to Latino issues in the high schools. While one or two paragraphs in each textbook discuss these events, they state how young students played a part in the walk out, making it clear they were able to make changes to their own education.

"The future union leader (César Chávez, as a teenager) sat down in the white-only section (in a segregated theater) and stayed until he was arrested."

— The Americans, Pg. 770

Cesar Chavez was also in each of the textbooks examined, but not discussed as much as other minority activist. Cesar Chavez is one of the best known Mexican American activists, so he was in all three of the textbooks in this study. However, in this passage an incident that happened when Chavez was a teenager was described in which he refused to get up from a segregated theater and didn't leave until he was arrested. This event is much like what happened to Rosa Parks, when she refused to leave the front of the bus to go to the back for a white individual. While the Rosa Parks story is familiar and discussed many times in schools, the same cannot be said for Chavez. In fact, the theater event was only included in one of the three textbooks.

DISCUSSION

The goal for this study was to determine how Mexican Americans are portrayed in nationally used high school history textbooks. The results shown in the findings held some consistency with the hypothesis, but also showed more than was expected. It was predicted that Mexican Americans would mainly be seen as workers or laborers, and more vulnerable to those in power. The findings showed Mexican Americans represented as soldiers, laborers, immigrants, activists, and living in harsh conditions/ inequalities. Overall, the findings did support the initial hypothesis, but it also showed more than what was hypothesized.

For example, being seen as laborers and dealing with inequalities was seen as predicted, since Mexican Americans are presented as being suppressed by those in power. Yet, when it comes to being represented as activists, Mexican Americans are shown to either have been or be fighting for power over their lives. Even when those Mexican Americans faced inequality issues, becoming activists showed that they were willing face those issues and those in power to make conditions better for themselves. Mexican Americans here are portrayed as being stronger, since they are able and willing to stand up for those oppressing them and change their situation. This then shows that they are not completely portrayed in a weakened state in the textbooks. Yet, Mexican Americans weren't discussed in this frame as much as other minorities, especially African Americans. In fact, one textbook examined in this study only included about a page and half about Mexican Americans as activists, which also happened to be the longest entry about them in the textbook. Additionally, when it comes to teaching this textbook in an actual classroom these few pages could be easily missed, especially since the majority of the discussion on civil rights focuses on other perspectives.

However, this does not change the fact that most of the views on Mexican Americans were negative and portrayed them as weak compared to those who had power over them. While being described as immigrants was not included in the hypothesis, it can still be considered more negative than positive since many of the textbooks talked about how many other Americans wanted Mexicans and Mexican Americans to leave, even though some were actually born in the United States. While one of the textbooks did discuss how they brought a new culture to the nation, the overall feel of Mexican Americans as immigrants was definitely more negative than positive. Moreover, the overall picture of Mexican Americans was more weak and negative than positive since they were often shown as poor, laborers, and often discriminated against even into more recent years.

The small amount of information on Mexicans or Mexican Americans in high school U.S. history textbooks is crucial for those who may never have had the chance to meet and know someone from this ethnicity. Even if a student may gather other information about Mexican

Americans from other sources, such as media, this information ought to be more reliable for the students since it is an educational reference. However, from this study it is shown that Mexican Americans are portrayed more negatively than positively in these textbooks. Therefore, for students with limited access to this ethnicity, this could be the most reliable information they would be able to gather about them and may even easily influence their perspective on Mexican Americans as a group as well as the issues they have faced in the United States.

These findings are also consistent with previous research that has examined hidden curriculum and stereotypes in textbooks. Other studies have found that textbooks have a pattern of telling stories from elite groups' perspectives and keeping other perspectives out of the stories (Anyon 1979). This gives the elite groups more power to control and direct what American students learn in their United States History classes. Other studies showed evidence of favoring the majority, but trying to lessen what is said for the minority. Much like the other studies, this study found that portrayals of Mexican Americans were far more negative than positive.

LIMITATIONS

This study had a few limitations, including the fact that only a small number of textbooks were used to gather the findings. Since timing was limited during the production of this study only three textbooks could be examined during the timeframe. Furthermore, only general U.S. History textbooks were involved for this research. There wasn't a long enough time frame to include AP U.S. history and eighth grade U.S. history, which are sometimes used as easier readers for high school level U.S. history. Another limitation to the study is that the textbooks could only be examined by one researcher. With additional researchers looking at the textbooks and concluding their own findings, the results might be considered as more reliable, especially if the findings were similar.

DIRECTIONS FOR FUTURE RESEARCH

While this study did offer evidence that Mexican Americans are portrayed in a negative manner in U.S. public school and college textbooks, additional research that includes more textbooks and different

levels of U.S. history would also be very beneficial for future research. In addition, other minority groups, such as Native Americans and women, could also be examined to see how they are portrayed in these U.S. history textbooks to determine if there is more evidence of hidden curriculum in history textbooks.

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ESCAPISM FEATURING: KAHLO, CARRINGTON, AND VARO

by ARDIE GRADY



ABSTRACT

Few sources encompass Leonora Carrington, Remedios Varo, and Frida Kahlo's personal life and art. Carrington and Varo were acquaintances with Kahlo while living in Mexico. Frida Kahlo is a well-recognized Mexican artist who presents as authentic and does not acknowledge herself as a surrealist artist, although she is categorized as one. Her two female competitors, Varo, a Spanish native, and Carrington, an English native, were also surrealist artists but only refugees to Mexico. Currently, Carrington and Varo are not as famous as Kahlo, but they all share a common theme of social marginalization with their art in a 1930s -1960s male-dominated world.



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METHODOLOGY

Laurie Schneider Adams' book The Methodologies of Art: An Introduction was used to better understand the work and marginalized life of three female artists: Frida Kahlo, Leonora Carrington, and Remedios Varo. Iconography, Biography & Autobiography, and Contextual approaches II: Feminism would be the type of approaches utilized in this research. Iconography helps understand the subject meaning in the images. The study of the sources and images used by these three artists suggests some similarity in their work and comparable stylistic goals in a male dominated surrealist group. Carrington and Varo interacted with the Surrealist circle, and they both married famous artists as Frida Kahlo did. Approaches of Iconography with Biography & Autobiography explain why the women were given little credibility in Mexico and Europe. The male surrealists saw women as incapable and not creative. This male-dominated ideology would tie in with the Contextual Approaches II: Feminism. This approach shows their creative quest as female surrealist artists. The Feminist method helps understand the artists' cathartic ritual in art and the subject matters' relationship to subverting Surrealism machismo. There are two categories: "The Second Sex" and "Escapism". The "Second Sex" discusses what took place in each female's life while living in Mexico and abroad while "Escapism" touches on their subject matter.

"THE SECOND SEX"

For example, why have these two female surrealists been underrepresented in the literature, as compared to Frida Kahlo?

The time period played an important role for these female artists. They lived in a world where dependency was expected of women (the 1920s to the early 1960s). Europe's socio-economic situation was characterized by deprivation, male chauvinism, and discrimination. The Surrealist art movement in France capitalized on young, rich beauties who could sustain their livelihood and poor young women who were easily accessible. Women became "cult-objects for Surrealist men of genius, demanding nothing less than total enslavement-and obtaining it" (Brandon, 388). "But, being women, and poor, they were forced to achieve their ends indirectly, socially, through men. Such maneuverings are rarely admirable. They neither improve the character nor earn the world's approval" (Brandon, 388). According to Surrealist Lives: The Surrealists (1917-1945), one of Brandon's conclusions was that if the women were men, they would have already been established in business and the arts. Mexico's emphasis on "manliness" is evident by men being the authoritarians, the aggressors, and having the privilege of being promiscuous, while the women were submissive, sacrificial, and maternal. "Even though machismo is cultural in the sense that it is learned behavior and perception, by labeling machismo as natural, people perceive it as inescapable, a fact of life. Machismo is therefore a very powerful discourse that maintains the status quo in this male dominated industry" (Stobbe, 106). Kahlo, Varo, and Carrington expressed their own perspective on male superiority. My findings represent a dramatic twist in the battle of the sexes: where the woman turns the table on man's "socioeconomic expectations." In Varo's paintings such as Ladiess Suit, 1957 and Woman Leaving the Psychoanalyst, 1960 she puts man in his place. In Ladies' Suit, the tailor's sinister shadow is pinned to the ceiling, preventing it from pouncing on his female victim (Candenas, 462), and in Woman Leaving the Psychoanalyst, the woman decides the fate of her father. In Varo's Mimesis, 1960,

she touches on conformity or imitation. She appears to reflect a male surrealist ideology of females as objects and belongings. In Carrington's *Litany of the Philosophers* (1959), the artist depicts the marginalization of both of the sexes, females on one side while the males are on the other side. Carrington's questionable attitudes about her former partner Max Ernst can be seen in *Portrait of Max Ernst*, 1939: she depicted Ernst as a cold, distant person avoiding eye contact with the viewer. As for Kahlo, she and her collaborator Lucienne Bloch made drawings about the interchanging of the gender roles of Rivera and Kahlo. Kahlo's role playing can be seen in her *Self-Portrait with Cropped Hair*, 1940.

The paintings examined are autobiographical, covering female experiences in a patriarchal society in Europe and Mexico. Carrington's and Varo's works are difficult to understand; therefore, the sources have not been descriptive on the meanings of their paintings. One of the reasons for this was that female artists were not taken seriously. As stated by Chadwick, "The work of women artists associated with Surrealism would not become a major topic of study until the emergence of feminist scholarship in the 1970s" (15). Also, not enough female art critics were available during the period from the 1920s to the 1960s to appreciate the work of female artists of the period; men filled those positions, creating a vicious cycle of limited artistic achievement for women. Chauvinism played a role in relationships, art dealers, or even acquaintances, making it tougher for female artists to network with private collectors, travel by themselves, or exhibit their work internationally. One of the earliest books written about Kahlo is titled Frida, a Biography of Frida Kahlo (1983) (Lint 70). The reviews about Kahlo have been written from different perspectives. Kahlo's work has been broken down and reproduced so many times that she has become a dramatic isolated figure in Mexico. In a way, Kahlo has become an international brand because of the tragic life story that is attached to her autobiographical paintings. Unfortunately, an artist is usually vilified in life, and then deified after death. Kahlo's death was in 1954; Varo's was in 1963, and Carrington's was in 2011. Kahlo was not widely accepted until the 1970s, two decades after she and her husband Rivera passed away (Tuer & King, 12). Carrington received recognition around the time of her death in her nineties in 2011. As for Varo,

she received her recognition in 1961 around the time of her death. The rarity of the artist's work is also the determinant of value. Kahlo was a marketable artist. She was the first to pass away, leaving behind a compelling life story and a limited number of artworks.

The three female Surrealist artists painted subject matter of strangeness and oddity, but it is Kahlo's paintings that are easiest to comprehend. One point to consider is Carrington's and Varo's decision to break off from the European Surrealist circle, for refuge as well as for artistic freedom. "They would have been a Nazi target for different reasons: Carrington because she was British and the lover of Max Ernst, who himself was a 'degenerate artist' in the eyes of the Nazis; Varo because she was a Republican in the Spanish Civil War with her lover Benjamin Peret, the left-wing writer and poet and close friend of the leader of the Surrealists, Andre Breton..." (Raay, 8). This decision could have hindered their chances of fame in the art world. Carrington completely cut herself off from Max Ernst, who was one of the leading figures in the Surrealist European art movement in Paris, as did Varo with Benjamin Peret, who became a well-recognized surrealist poet. Carrington and Varo made a brave decision to venture into another country and establish their own identity. Even though Kahlo and Rivera had a complex relationship, they stayed in contact, giving each other support in their political and cultural values of post-revolutionary Mexico (Tuer and King, 12). Both artists needed to compete with Kahlo, who was a Mexican native and a political figure who became internationalized after her death. Presently, she has reached a high level of fame that has surpassed Rivera in the art world. "Kahlo was self-taught and painstakingly measured, completing fewer than 200 small works before her death in 1954 at the age of forty-seven. While her art was embraced by the Surrealist movement in the late 1930s, her first solo exhibition in Mexico did not take place until 1953, and she remained largely unrecognized in the broader context of modern art until the 1970s" (Tuer and King, 15).

Has Frida Kahlo gained more notoriety due to her relationship with Diego Rivera?

"When Frida Kahlo married Diego Rivera on August 21, 1929, she was twenty-two years of age and a novice

painter; he was twenty years her senior and at the height of his creative powers as a muralist" (Tuer and King, 15). Rivera was a mentor to Kahlo, with connections in Mexican politics. He had ties to the communist party and befriended the greatest modern painters and private collectors. Rivera expanded Kahlo's horizon to become politically involved and networked and above all to learn how to appreciate her indigenous roots. She sought his advice when it came to her profession in painting. According to Tuer and King, during their partnership, Rivera's career and work overshadowed Kahlo's work because he was already an established artist and had furthermore received academic training (15). However, Frida Kahlo gained notoriety in her own right, and her subject matter and artistic themes were different from those in Rivera's work. To summarize Kahlo's oeuvre, her subject matter and artistic themes consist mostly of personal experiences of her own tribulations of miscarriages and multiple surgeries, dualities of self, and being maternal to animals and to Rivera. Also her personal reflection on indigenismo could be credited to Rivera's love of exposing Mexico's social life. Rivera was commissioned along with two other Mexican artists named David Alfaro Siqueiros and Jose Clemente Orozco to paint murals "that reflected Mexico's social transformation" from the Mexican Revolutionary War (1910-1920) (Tuer and King, 17). The three male artists were in the all-male Mexican muralist movement called the Los Tres Grandes. Their subject matter attempted to reinforce the effort in educating and reunifying the country with western and indigenous iconographies. Kahlo and Maria Izquierdo are examples of contemporaneous figures from the indigenismo movement who have been excluded from participating in the Mexican muralist movement (Taylor, 119). The society of Mexico was not yet ready for a young talent, especially from a female, hence, the country was stuck in that conservative mindset of machismo. Rivera supported his wife by encouraging her to submit the work she produced from 1937 and 1938 at a University gallery and later at Julien Levy's gallery (Burrus, 63). Kahlo's mass production in paintings allowed her to be self-sustaining and artistically independent, but she always sought her husband's criticism. Rivera's connections allowed Kahlo to sell her work to famous people and network with the Surrealist founder, Andre Breton.

Nefarious gender politics were displayed in the European Surrealist movement and set forth by its leader, Andre Breton. The Vichy government in France suppressed Breton's writings. He then suspected that the art movement would soon be diminished (Hertz, 89). As a result, Breton became open-minded to the "second sex". Breton's liberated decision to include young females was to prolong the Surrealist art movement. Breton chose young women who had potential and were already members of the European Surrealist movement.

In April of 1938, Breton went to Mexico to meet with Communist Leader Leon Trotsky and Rivera. "Breton sought Trotsky's counsel in aligning Surrealism's embrace of Freud's theory of the subconscious with Marxist revolution. Rivera, Breton, and Trotsky would write a manifesto, 'For an Independent Revolutionary Art,' declaring that good art was inherently revolutionary and that art should never be dictated by a political party" (Tuer and King, 64). While he was visiting Kahlo's family home in Coyoacan, Mexico, he became enchanted with Kahlo's work. In 1939, he promised to arrange a Surrealist exhibition for her in Paris, but the event did not go well with Kahlo because the "Surrealists were pretentious and bourgeois" (Tuer and King, 64). From Kahlo's perspective, Breton was unprofessional and inconsiderate because the exhibit was unprepared, which angered Kahlo. Her work was displayed with other artist's work and she only sold one piece, Kahlo's Self-Portrait: The Frame (1938).

"One exception was the artist Marcel Duchamp, whom she described as the only one 'with his feet on the ground.' Duchamp arranged for Kahlo's work to be shown in an exhibition titled *Mexique*, which resulted in the Louvre purchasing Kahlo's *Self-Portrait: The Frame* (1938) -- the first work in its collection by a twentieth-century Mexican artist" (Tuer and King, 64).

According to Burrus, in fall of 1938, the exhibit at Julien Levy's gallery in New York was more successful than her Parisian exhibit, *Mexique*. Wealthy people were invited and half of her works were sold, plus she received commissions (Burrus, 66-67). Not only did Kahlo network but she developed relationships with political figures, artists, gallery owners, and others who benefited her in some way. At her peak of success, a letter to her then lover, a Hungarian photographer,

Nickolas Murray, regarding money, she said, "You're the sweetest person I have ever known. But listen darling, I don't really need that money now. I got some from Mexico, and I am a real rich bitch, you know?" (Burrus, 67-68). In the beginning, Breton appeared to take Kahlo seriously in her art profession, but his efforts were inconsistent.

As for Carrington, Breton encouraged her to write about her recollections of being in the psychiatric ward in Spain during WWII. Regarding Breton, "The author becomes extremely concerned about the historical fate of Surrealism, and in Carrington, he finds someone who typifies all the Surrealist tenets as he elaborated them in his manifestoes; he also focuses on a Surrealist who lived out these ideas while grounded in some of the most important historical events of the twentieth century" (Hertz, 91). Carrington's book titled En Bas (Down Below, 1944) entails her personal experiences of being isolated in a country where she becomes increasingly mentally unstable. Carrington's testimonies in 1939 included being separated from her partner, Max Ernst, as he was taken to a Vichy France concentration camp. Soon after, she was incarcerated in a Spanish mental institution in Santander because of a nervous breakdown and experienced a variety of psychiatric experimentations while being institutionalized (Hertz, 91). The artist feared for her life. After she was released from the psychiatric hospital, Carrington's family tried to force her into a mental institution in South Africa. She escaped to Mexico, marrying Renato Leduc, a Mexican diplomat. This planned short-term marriage arrangement was Carrington's escapism. For Carrington to write about her private testimonies and for Kahlo to paint her realm of reality, they both displayed Breton's Surrealist aesthetics. These females represented the archetype of mad women embellishing the Surrealist art movement. As stated by Hertz, "If in his own writing Breton could only approximate the language of madness, if he could only relate stories about mad women that helped him refine his Surrealist aesthetics, then Carrington's account of her actual breakdown could be seen as the most authentic expression of Surrealism" (90). This statement also applies to other female Surrealist artists. Little information has been released about Varo's internment around 1940. Varo had not released any information about her detainment as

Carrington did, but her incarceration left Varo "terribly traumatized and shaken" (Kaplan, 71). According to Kaplan, Varo was arrested for being the companion of Peret and possibly served several months in the institution. Breton stereotyped Carrington, naming three of her best features: her youth, her beauty, and her madness (Hertz, 94-95). As for Kahlo, her unprepared exhibit was unsuccessful. These women were seemingly taken advantage of and then taken for granted. This could explain why Kahlo did not want to be labeled as a Surrealist or as an irrational individual. She preferred 'painting her own reality' (Tuer and King, 16). Kahlo's experience may have resulted in Carrington's and Varo's decision to split from the European Surrealist circle when they moved to Mexico, developing their own circle of émigrés.

What are their contributions to Surrealism in Mexico and abroad? How did their status as ex-patriot artists impact them in Mexico?

In 1942, Remedios Varo and her companion, Benjamin Peret, arrived safely in Mexico, and later in the year Leduc and Carrington followed (Raay, 43). Mexico was a safe haven for the exiled artists to escape the Nazi regime. This time period in Mexico was problematic for the native women and those who were transitioning into the country. The females entered another world of male establishment that was much different from the one they left. Regarding Mexico, "It has been difficult for women to find their space within these national projects: liberals often saw women and their gender interests as subsumed within the family, while revolutionaries prioritized national and class struggles over women's particular interests. Thus, what little space has been available has often been constrained by the needs of other projects, leaving women little opportunity to determine their own identities within the construction of nationhood" (Craske, 117). Craske explained how Mexico wanted to become modern but was stuck in its conservative ways, such as women taking on the reproductive roles and being domestic while the men were the bread-winners and had a political voice. "Although women were given the vote late (in the event of not gaining full enfranchisement until 1953), there were other ways in which early 20th-century Mexico demonstrated its modernity through gender policies evident in the rights granted women in the socioeconomic sphere" (Craske, 119). The "socio-economic expectations" allowed society to assert them on females, prohibiting them from being independent.

Varo was Spanish-born while Carrington was Britishborn; both artists adopted two countries: France and Mexico. Their art training from traditional European art academies would pay off, while being in Mexico provided artistic freedom and some sustainability. After they settled in Mexico, they immersed themselves in its culture, arts, and later politics. Carrington did not become a prominent figure until her paintings developed and matured in the 1930s and 1940s (Agosin, 18). Carrington's paintings dated between 1938 and 1947 showed a range from personal crisis to feminist consciousness (Chadwick, 37). Carrington was not politically involved until some years after she settled in Mexico. Raay's example of Carrington's political involvement was the 1968 Massacre in Mexico. In 1968, a catastrophic event occurred between the Mexican government and the University students in Mexico City. Students were proclaiming their country was just as inferior as third world countries and wanted the government to revolutionize it. The protest turned into a massacre. The Mexican troops murdered over 300 people and thousands were wounded and jailed (Brewster, 176). Carrington's political involvement in the country focused on communication and education among the Mexican and American women (Chadwick, 42). In the words of Raay, "she allowed protest meetings to be held in her home; she attended demonstrations; she was as supportive as possible towards the protestors" (89). The Mexican government discovered Carrington's position. She fled the country to United States for a few months until the opposition died down, living in New York for a decade or more. The artist became prosperous and independent as she networked with art intellectuals. "During the 1950s and 1960s, her reputation had been growing within Mexico; from the 1970s onwards, she was able to put herself on the map internationally and in particular in the USA" (Raay, 90). Carrington was also involved in feminist activity. According to Chadwick, "One of the founders of the Women's Liberation Movement in Mexico in the early 1970s, Carrington's insistence on woman's right to secret powers not shared by man and the development of a visionary imagery in her work have been documented by feminist scholar

Gloria Orenstein" (42). The artist became a political agitator, communicator, mother, and a full-time artist while living in Mexico. Carrington was an international role model for women saying they can work, have a family, and rebel against the male establishment and the male-dominated surrealist art movement.

"Varo has always dwelt in marginal spaces. Despite the fact that her most important and well-known work developed in Mexico, the country does not fully recognize her because she was not born there. The same occurs within the Surrealist movement to which she belonged" (Agosin, 18). According to Agosin and Kaplan, in 1990, Varo was not allowed to participate in a Latin American exhibit at the Metropolitan Museum (New York) because she was not an authentic Mexican, disregarding the fact that the artist lived in the country for forty years (12, 110). In 1937, her lover, Peret left Mexico for Paris, leaving Varo behind. This separation allowed her to have artistic freedom without being an overpowering surrealist member. In Varo's work she introduced her own European cultural roots focusing on medieval and renaissance art influences. She also used Psychoanalysis in her paintings, utilizing the Surrealist's aesthetics. This influence can be seen in Woman leaving the Psychoanalyst, 1960. According to Frida Gorbach's article, 2005: From the Uterus to the Brain: Images of Hysteria in Nineteenth-Century Mexico, Mexico was influenced by Europe's clinical studies, most particularly on Hysteria. Varo documents the gender issues at home in Mexico showing a strong European influence in academia. Modernization was taking place in Mexico but was tied to "socio-economic issues." Although she embraced the revolutionary energy of Surrealism, saying "Surrealism has contributed to art in the same way that psychoanalysis has contributed to the exploration of the subconscious," Varo's documentary work was injected with the truth serum. Some of her imagery is ironic, yet sweet discussing the history of women and their environment. In 1956, Varo had her first solo exhibition in Mexico City. It was extremely successful, as many of her buyers could empathize with her work (Kaplan, 112). "This idea of the domestic realm as a site of secret discoveries finds echo in many of Varo's paintings. Invoking stereotypical associations of women within this devalued and marginalized sphere, she repeatedly used images of household life --

knitting, cooking, feeding -- as settings for transcendent discoveries and magical creativity" (Kaplan, 119). Varo's gift to society was her intricate painting style and subject matter. Her decision to not have any children allowed her to pursue her profession and also showed how defiant she was. Varo helped break-through the male-dominated world with her artistic subject matter, independence, and work as a full-time artist in Mexico and Venezuela.

In 1941, Varo envisioned herself having a successful, financially secure art career. She pursued different employment opportunities in Mexico and abroad while Peret conversed with his peers about poetry, art, and politics. In 1947, a definitive break in the couple's relationship was due to Varo's taking safe haven in Mexico after escaping the Spanish Civil War and the Nazi Regime. Mexico was her home while Peret was determined to return to Paris for its atmosphere. Varo found a temporarily lover, Jean Nicole, a young French pilot who later flew her to Venezuela. As far as Varo's employment, it varied in commercial advertisement. Her list of employment included working with the British office of antifascist propaganda to create art and images "to attract Mexican attention to the Allied cause in Europe" (Arcq, 6). "She painted furniture and musical instruments for Clardecor, an interior design store; she designed children's toys with the sculptor Jose Horna, covering them with fantastic drawings; she collaborated with Leonora Carrington on the design of costumes and hats for plays by Jean Giradoux and Pedro de la Barca" (Arcq 6). In 1947, the artist moved to Venezuela in order to be able to visit her family who had left Spain. Varo was employed there working as a technical illustrator for the Malariology Division of the Ministry of Public Health, detailing illustrations of insects to advertise the preventive steps to malaria. As Arcq stated, her commercial work marked a new transformative process for the artist. She received many commissions by Bayer Mexico and "was already receiving checks for her work on the Bayer Mexico calendars, and her first commissions to illustrate medical advertising material dealing with malaria, pain, vitamins, rheumatism, aesthesia and vaginal discharge" (Arcq, 7). Afterwards Arcq stated, Varo's work was widely published in the magazine Publicidad y Ventas: "as an example of cuttingedge direct publicity at that time" (7). These commercial

images influenced her mature work, developing her individuality and observational skills in illustrating and depicting a variety of natural occurrences.

The nefarious gender politics in Mexico and in Europe were inevitable. These courageous women challenged the male principles of life. They created their own individuality, staying far away from someone else's muse, former lover, and for Varo's sake, someone else's caretaker. These women lived independent and productive lives in Mexico, most particularly Carrington, who became international in the 1970s, and Varo, who received many commissions from Mexico and Venezuela. Their husbands were supportive. In 1952, Varo's last husband, Walter Gruen, who was a wealthy man, wanted his wife to be successful and devoted time and money to exposing her work. The couple stay married until the time of Varo's death in 1963. Carrington's husband, Chiki Weisz, took care of their family while his wife was in New York working. The author Raay said this about the artists' life-partners: "They were the antithesis of Rivera: men who were content to support their women from the sidelines" (77). In Diego Rivera's My Art, My Life: an Autobiography, Rivera stated "If I loved a woman, the more I loved her, the more I wanted to hurt her. Frida was only the most obvious victim of this disgusting trait" (Rivera, 180). The women's contribution to Surrealism in Mexico and abroad was changing the subject matter. For Kahlo, painting was a cathartic ritual allowing her to express the complexity of her life. For Carrington, she painted old people, which was the antithesis of Surrealism's subject matter of youth and beauty. Also, Carrington painted people from her country, showing appreciation for different ethnic backgrounds in Mexico similar to some of Kahlo's paintings. As for Varo, she introduced psychoanalysis, gender issues, and an intricate painting style to Mexico. These artists each made their own contributions to Mexico and the world, expressing feminine consciousness and individuality. Carrington became politically involved in Mexico and the U.S., painting some of her experiences. In some of Varo's images, she depicted the social issues that were relevant in Mexico and abroad.

How did their personal relationships affect their status?

And finally, how have these female surrealist artists been neglected in Art History?

"Concealed, marginalized, undervalued, and often openly disdained, women artists have had to travel an arduous path to find proper recognition for their work, to have it valued and appreciated in the same way as that of male artists" (Saizar, 9). Carrington, Varo, and Kahlo were overshadowed by their partners' success. The women were easily admitted into the Surrealist group because of their youth, potential, and noteworthy partners. Andre Breton met each of these women through her partner. The Surrealist literature mentioned Carrington's name multiple times, even highlighting her in pictures amongst her peers. This showed how Ernst was more admirable than Peret because Varo was least likely to be documented in the history of Surrealism. As for Kahlo, Rivera painted his wife many times publicizing her as a female-heroine, a lover, and a maternal figure, depicting the roles she played in his life. Each had to depend on the other out of love (or perhaps lust) and "socio-expectations". In the period from 1920 to 1960, women had to depend on men for social mobility, as seen with Carrington and Varo in the Surrealist movement. As for Kahlo, her physical disabilities ensured her lifelong dependence on Rivera, as he was the bread-winner paying for Kahlo's hospital bills with his art. Physically, financially, and emotionally, she depended on Rivera from the time they were married till the time of her death. Rivera's philandering had affected her greatly, as seen in images such as Self-Portrait with Cropped Hair (1940), Selfportrait with Curly Hair (1935) and A Few Small Nips (1935). These paintings displayed Rivera's betrayal as well as a man's rejection toward his woman and were a response to Rivera's unfaithfulness to Kahlo. The Surrealist art movement had a long history of male surrealists as philanders yearning for young, beautiful women as their inspiration. It was mainly this chauvinism that prevented these women from being employable and taken seriously in the art world. These women could not enter their profession until the Surrealist art movement and the muralist movement started dwindling down. There was so much attention to men in their art profession that society left little room for female artists like Kahlo, Carrington, and Varo. They were marginalized from art.

"ESCAPISM"

Surrealism's banging door by Natalya Lusty (2003) and Frida Gorbach's article From the Uterus to the Brain: Images of Hysteria in Nineteenth-Century Mexico (2005) discuss the study of feminine madness. These articles were utilized to compare the identities and stereotypes of Varo's Woman Leaving the Psychoanalyst, Carrington's self-portrait in Inn of the Dawn Horse, and Kahlo's Self-Portrait with Cropped Hair. The portrayal of mad females is seen as unidentifiable and deceptive. In reconstructing this pathological idea, these women demand authority and dignity in their paintings, releasing themselves from their dependency on their diagnosis and enabling each to become a fully individuated woman.

Iconography / Contextual Approaches II: Feminism

In Varo's Woman Leaving the Psychoanalyst (1960) a female patient is attempting to drop her beheaded father into awater well. The author, Bogzaran, explained how this image relates to the Oedipus complex: a psychosexual development stage where a female has a conflicting desire and disappointment with her father. "This bearded head is often interpreted as Varo's father or second husband, the surrealist poet Benjamin Peret. However, it could also be seen as the archetype of male authority, a false masculine, the savior of the femmeenfant" (Bogzaran, 176). Psychology has always been fundamental to the Surrealist movement as well as the Pre-Surrealist movement. Varo was influenced by a Pre-surrealist, De Chirico, who related his metaphysical painting to the Metaphysical psychology from the 18th century. Metaphysical psychology is complicated and investigates an object's relation to nature and how it persists in its environment (Paul, 6). Varo applied metaphysical knowledge to project females in an environment that is natural to them but at times unbearable to live in. In the Woman Leaving the Psychoanalyst, the superior female reacts to her domineering father by overthrowing male dominance so she can maintain her sanity as well as her dignity. "As a twentieth-century European woman engaged in psychological exploration, Varo could not help but be influenced by the theories of Sigmund Freud and Carl Jung. The veiled heroine of her witty Woman Leaving the Psychoanalyst exits from a door marked Dr. F.J.A., which Varo explained in her notes as a reference to Freud, Jung, and Alfred Adler" (Kaplan, 152-155). According

to Bogzaran, the woman's falling mask symbolizes Jung's concept of Persona, and she is revealing her new self-image (176). The female patient holds a woven basket of domestic objects such as an alarm clock and some thread. The artist associates female domesticity through her motifs of knitting and weaving and at the same time creates power in a new reality. Her female characters are defiant as they confront fear, pain, uncertainty, and intimidation in daring acts similar to Varo's own journey in a world of male supremacy. Varo refused to be labeled as femme fatale or any other malesurrealist terminology for muse. Her reflections on female marginalization in society are similar to Kahlo's and Carrington's. Kahlo represents her sexuality and duality while Carrington portrays herself as wise, yet mad, and contradictory.

In Carrington's self-portrait Inn of the Dawn Horse, the painter depicts herself in disbelief. In a gloomily room, the haunting female appears to sit on the edge of the chair as if she anticipates someone's arrival. The woman's right hand gesticulates to the hyena while the left hand supports her body when she arises from the chair. "...one sees the horse bounding through the field just outside the open window. Inside, in sharp contrast, is the rocking horse of childhood, the prim "lady's chair," and the lactating hyena. In this role, the hyena must stay at home with the rocking horse. All of the feet (human, animal, and chair) have the same shape; they are too delicate to bound through the window into freedom. Leonora's mane of hair, which identifies her with the vital horse outside, will characterize her future female protagonists" (Levitt, 67). The nursing hyena embodies a primitive beast. The white horse repeats twice, symbolizing rebirth (Levitt, 66). The large rocking horse is placed behind her while the smaller horse appears leaping in the wilderness. Painting was a cathartic ritual for Carrington as well as for the other two artists, enabling them to express their emotions as two of the outcast women from the 19th century. Women from this time were easily stereotyped if they did not meet "socio-expectations". In Mexico, Carrington and Varo practiced witchcraft, alchemy, sorcery, Tarot, and magic and displayed those practices in their artworks. Carrington painted healers and witches that were wise and old in age, forfeiting the male-surrealist's theme of young naïve beauties as painting subjects. As for Varo,

some of her female subjects would be alchemists and scientists renewing the world with feminism.

In Kahlo's circumstances, an alter ego was re-created when Kahlo attempted to cut her ties to Rivera after their divorce was finalized. Kahlo cut her long hair and temporarily stopped wearing the Tehuana costumes that Rivera cherished. "In Self-Portrait with Cropped Hair (1940), she appears with scissors in her hand, dressed in a suit (her ex-husband's?), so enormous it swamps her, and sitting on a rush-seat chair in the middle of a floor strewn with stands of hair. Whether the scene represents female castration or reconquered liberty, or both, is unclear. More portraits were to follow as she gazed deeper and deeper into the mirror, representing herself, in her solitude, surrounded by domestic animals that expressed her dreams of renaissance, her erotic desires, and her martyrdom" (Burrus, 73). A buildup of anger and resentment has been released in the female subject. The image is an after-scene of the artist's rampage to reveal her lost identity. Long strands of hair are dispersed everywhere on the floor. Kahlo's scissors are near her genitalia demonstrating an early theory of Freudian's psychoanalysis. The scissors could represent female castration reflecting on the 1925 tram accident which impacted her ability to give birth. Her disabilities from the catastrophic event caused her to have suicidal thoughts and self-loathing, leaving her childless and broken at times. The thought of not meeting those "socio-expectations" affected her greatly, forcing her to choose art as a profession and to depend on an unfaithful Rivera. At the top of the painting, it reads: 'If I loved you, it was because of your hair, you see. Now that you're bald, I don't love you any more' (Burrus, 73). According to Herrera, Rivera only loved a part of Kahlo. He appreciated her indigenous roots and dismissed her European ancestry for "she played the role of Indian maiden for Diego, hers was an authentic artifice. She did not change her personality merely to suit Diego's ideal. Rather she invented a highly individualistic personal style to dramatize the personality that was already there and that she knew Diego admired. In the end, she was so extravagantly dashing that many people felt the peacock feather was more compelling (or more fetching) than the hat" (112). Rivera's fascination with Kahlo's Tehuana costume did not last long. She later felt isolated and

unappreciated. She sought the attention from female friends and Diego's former lovers. She desperately wanted someone to comfort her and relate to her sufferings because Rivera would not. Kahlo's loneliness, physical ailment, and adultery hindered her spirit and self-esteem. Many times, she suppressed her eroticism in paintings because of her special circumstances, as seen in *Self-Portrait with Cropped Hair*. Kahlo seemingly revealed her true identity especially in paintings, for she knew herself better than anyone knew her. This image showed a process of struggling and finding herself, then coming to terms with it.

CONCLUSION

Carrington and Varo are important female artists who have not received the attention they deserve. Carrington's and Varo's contribution to Mexican art helped to change the subject matter from personal issues to social issues, while Kahlo mainly focused on herself. Also, Varo's Magical Realism influenced Mexico's taste in her art and style. Later in Varo's and Carrington's art career, they became artistically involved in Mexico and abroad. Varo's profession involved commercial work in Mexico and Venezuela. As for Carrington, she sold her work in Mexico and New York, as discussed in the "Second Sex" section. Carrington benefited Mexico and America by being involved in the feminist movement and in the struggle for lower-class rights in Mexico. In the early stages of Varo and Carrington's art careers, their autobiographical imageries were not as harshly rendered as Kahlo's autobiographical paintings. Carrington, Varo, and Kahlo tried to structuralize their environment and their feelings. These female artists chose subject matters different from those chosen by their art companions and tended to focus on themselves, which was very contemporary and resulted in each going against the male-dominated ideology of incorporating the mundane, femme-fatale, and politics in art.

FIGURE 1.



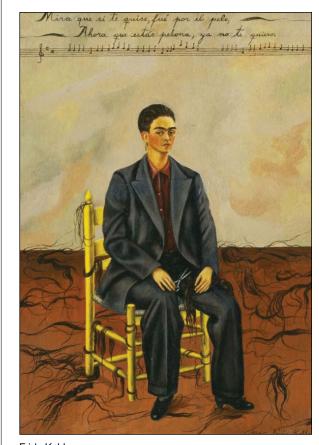
Remedios Varo, Woman Leaving the Psychoanalyst, 1960. Oil on canvas, 70.5 x 40.5 cm, Museum of Modern Art, Mexico City.

FIGURE 2.



Leonora Carrington, Inn of the Dawn Horse (Self-Portrait), c. 1937-1938, oil on canvas, 65.1 x 81.3 cm.

FIGURE 3.



Frida Kahlo, Self-Portrait with Cropped Hair, 1940. The Metropolitan Museum of Art, The Pierre and Maria-Gaetana Matisse Collection, 2002.

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EAGLE FORD SHALE PLAY METHANE SOURCE AND FATE ASSESSMENT

by COURTNE HAMPTON



ABSTRACT

Horizontal drilling and hydraulic fracturing can enhance methane transport to deep aquifers, soil, and the vadose zone. Methane in elevated concentrations has been observed in aquifers overlying active horizontal drilling sites in the Marcellus Shale operation area. In South Texas, horizontal fracturing is being applied to petroleum exploration in the Eagle Ford Shale play. There is little information available regarding the presence and origin of methane in Texas ground waters and the influence of horizontal fracking. The objective of this study is to assess sources and fate of methane in South Texas ground waters. The ultimate goal of this research is to understand potential environmental impacts of hydraulic fracking on groundwater supplies.



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For this purpose, 35 groundwater samples were collected from active and non-active drilling areas at depths ranging between 60 to 4,658 feet. Stable carbon isotope ratios in methane (${}^{13}C_{CH4}$) and dissolved inorganic carbon $(^{13}C_{DIC})$ analysis were measured to determine the range of signatures for shale petroleum-sourced methane and to differentiate between methane sources (i.e. microbial versus thermogenic). Results show that wells sampled in this study area exhibited ${}^{13}C_{CH4}$ signatures ranging from -49 and -21, which are consistent with thermogenic methane sources. The observed ${}^{13}C_{DIC}$ signatures ranging from -22% to -10% also indicate a thermogenic methane source. Bacteriallyderived methane was observed at just one location (i.e. $^{13}C_{CH4}$ and $^{13}C_{DIC}$ values of -65% and -6.2% respectively) at 1700 feet in the Carrizo aquifer. Future research such as the use of additional geochemical indicators (i.e. sulfate reduction analyses, alkalinity and stable isotopes of oxygen and hydrogen of water) will be conducted to determine if the source of methane in groundwater is derived from deep sources due to hydraulic fracturing and drilling processes.

INTRODUCTION

Physiographic Location

The investigation area is located in South Texas' Rio Grande Plains. Groundwater samples were collected from Atascosa, Frio, Gonzales, Karnes, McMullen,

and Wilson Counties (Fig. 1), areas where hydraulic fracturing for the Eagle Ford Shale play is most prevalent (Swindell, 2012). The predominant land use in the Rio Grande Plains is livestock production. The average annual rainfall is less than 25 inches and the average summer temperature is 96 degrees Fahrenheit (°F) or 35.5 degrees Celsius (°C), characteristic of a semi-arid climate (Texasalmanac.com, 2013). In the Rio Grande Plains, 76% of water needs are derived from groundwater for irrigation and municipal purposes (TPWD, 2013). Groundwater provides up to 33% of the total water needed for the Eagle Ford Shale play drilling processes (Barringer, 2013).

Hydrogeology

The major aquifers (Fig. 2) studied in this research are the Carrizo-Wilcox and the Gulf Coast aquifers. The Carrizo-Wilcox aquifer consists (Figs. 3 and 4) of Paleocene-Eocene-age sediments mostly comprised of silt, lignite, clay, and sand mixed gravel. The sand thickness varies locally from 150 to 1,200 feet. This "sand belt" trend extends from northeast to southwest Recharge to the aquifer occurs from precipitation infiltrating in the recharge zones. Water is fresh to slightly saline. Typically, the Carrizo-Wilcox groundwater salinity is no more than 100 milligrams per liter (mg/L). In 2005 and 2006, the Texas Water Development Board (TWDB) reported values exceeding maximum contaminant levels and secondary standards for chloride, fluoride, sulfate, nitrate, lead, manganese and total dissolved solids (TDS). However, TWDB still found the groundwater from the Carrizo-Wilcox aquifers to be of good quality (Boghici, 2009).

The other major aquifer of study is the Gulf Coast aquifer (Figs. 1 and 2), which consists of five stratigraphic layers. In order from surface to deepest layer it contains: the Chicot aquifer, Evangeline aquifer, Burkeville confining unit, the Jasper aquifer and Catahoula confining unit. Increased water quality is observed at shallower depths in this aquifer. Along the San Antonio River Basin and southwestward towards Mexico, water quality decreases in the Gulf Coast aquifer. This is a result of increased chloride concentrations and alkalinity. Thus, water from this portion of the aquifer is unsuitable at times for irrigation purposes. The Gulf Coast aquifer ranges in thickness from 700 feet to 1,300 feet. Observed TDS

concentrations are in average 500 mg/L at (max depth) 3,200 feet (McCoy, 1990).

Shale Gas and Conventional Oil Exploration Using Hydraulic Fracturing

Shale gas is a natural gas trapped inside of a non-porous sedimentary material. Natural gas reduces emissions and is readily available for production. To increase and facilitate gas production for commercial use, hydraulic fracturing uses high pressure water that creates interconnected fissures, thus increasing the overall permeability of the formation allowing the gas to escape to the wellbore (Soeder and Kappel, 2009). Over time traditional oil/gas exploration has increased the permeability of the already porous formations (i.e. limestone or sandstone). The combination of horizontal drilling and hydraulic fracturing has increased the production of both shale and oil by facilitating easier access to the resource being extracted (Uhlman et al., 2012).

Oil, wet gas, and dry gas are found in and around the Eagle Ford Shale play area (Marathon Oil Corporation, 2012). The Eagle Ford Shale requires 4.8 million gallons of water per well (mg/w) for drilling. South Texas' Eagle Ford shale play groundwater sources are the Carrizo-Wilcox and Gulf Coast aquifers. Eagle Ford shale play area is in an arid climate and has less surface water to rely on than other shale exploration areas. Groundwater only accounts for 3% of water used for Barnett Shale play (Johnson et al., 2013). Comparatively, Eagle Ford shale in Webb County uses as much as 33% of the area's annual groundwater recharge, which is collected slowly over time (Barringer, 2013). High activity hydraulic fracking and horizontal drilling areas are in Gonzales, Dewitt, Karnes, Live Oak, Atascosa, McMullen, Frio, La Salle, Zavala, Dimmit, Webb and Maverick Counties. Dewitt County exhibits one of the highest gas productions at 403,715 barrels of oil equivalent (BOE). Horizontal piping can extend 4,000 to 5,500 feet long (Swindell, 2012). There is little information available regarding the presence and origin of methane (CH₄) in Texas groundwaters and the influence of horizontal fracking.

Methane Formation Processes and the Associated ¹³C Signatures

Methane forms from organic matter in two ways: bacterial or thermogenic (Fig. 5 and 6). Bacterial methane begins

with a CO₂ reduction (methanogenesis) to methane and/or fermentation pathway. This commonly occurs in fresh sediments, swamps, commercial gas fields, and old sediments (Schoell, 1988). Methanogenesis is the process of methane formation through CO2 reduction through bacterial/microbial metabolism. Multiple environmental factors can influence the methanogenesis processes. For instance, sulfate in freshwater inhibits methanogenesis so such that the process cannot begin until concentrations are close to zero. Furthermore, temperature and pH play a key role in shallow aquifer systems. If the temperature is less than 13°C and (or) pH is less than 7, conditions are not favorable for CO₂ reduction. Lithology can also impact the methanogenesis process. For example, it has been shown that the process of methanogenesis is inhibited in thicker sand formations (Zhang et al., 1998). Thermogenic methane is produced as a result of heat and pressure effects. This process is dependent upon several variables such as conversion of organic matter, initial gas release, and trapping of the gas (McIntosh et al., 2011).

Stable carbon isotopes are the most common tool used to examine methane sources. The signature explains the origin and fate of the methane within groundwater. Signatures are calculated using equation 1 (Grossman, 1997):

$$\delta^{13}C(\%_0) = \frac{\left(\frac{^{13}C}{^{12}C_{Sample}} - \frac{^{13}C}{^{13}C_{Standard}}\right)}{\left(\frac{^{13}C}{^{12}C_{Standard}}\right)} * 1000 \tag{1}$$

where ${}^{12}C_{sample}$ is the stable carbon isotope of the collected sample and the ${}^{13}C_{standard}$ stable carbon of the standard (i.e. the Pee Dee Belemnite standard (PDB)).

Thermogenic methane in groundwater is generally associated with stable carbon isotopes of methane ($^{13}C_{CH4}$) signatures ranging between -41.2‰ and -8.5‰ (Zhang et al., 1998). Shallow ground waters within active drilling areas with signatures averaging $^{13}C_{CH4}$ were -37 ± 7‰, indicating deep thermogenic methane sources (Table 1). In non-active areas thermogenic methane signature of groundwater values are generally more negative (i.e. lighter signature -54± 11‰ (Osborn et al., 2011). Stable carbon isotopes of dissolved inorganic carbon (DIC) in water ($^{13}C_{DIC}$) can vary dependent on depth and the extent of

organic processes within aquifers. The observed $^{13}C_{DIC}$ signatures associated with thermogenic methane range from -12.5 % to -1.2 % (Warner, 2013).

Methanogenesis-derived sources of methane in groundwater are associated with $^{13}C_{\text{CH4}}$ signatures ranging between -80.1% and -20.6% (Table 1) (Zhang, 1998). In shallow aquifers, signatures of $^{13}C_{\text{CH4}}$ have been reported as low as -98% to -68% (McIntosh et al., 2011). Bacterially-derived methane in groundwater have also been associated typically with $^{13}C_{\text{CH4}}$ signatures lighter than -64% (Osborn et al., 2011). During CO₂ reduction to methane, DIC is depleted resulting in $^{13}C_{\text{DIC}}$ signatures ranging from -17% to -6.6% (Zhang, 1998). Bacterially-derived methane in groundwater is typically associated with $^{13}C_{\text{DIC}}$ signatures from -20% to +0.3% (Grossman et al., 1989).

METHODS

Groundwater samples were collected from 35 wells developed at different depths (i.e. ranging from 60 to 4,658 ft in the Carrizo-Wilcox, Queen City, Sparta, Jasper, and Gulf Coast aquifers (Fig. 3)). These aquifers were selected because they are actively used as sources of freshwater for irrigation, livestock feed locks, and drinking purposes (i.e. private and city wells). Furthermore, samples were collected from active and non-active drilling areas to better define the extent of contamination and/or differentiate between methane sources (i.e. shallow versus deep). Stable carbon isotope ratios in methane (13CCH4) and dissolved inorganic carbon (13CDIC) analysis were measured to determine the range of signatures for shale petroleum-sourced methane and to differentiate between methane sources (i.e. microbial versus thermogenic).

Specific conductivity, temperature, and pH were measured at each well after purging the equivalent of three well volumes (Grossman, 1997). A plastic hose with a fitting for the spigot was used to attach to each well faucet. On the end of the tubing a 3way stop cock was added to attach to a BD 3/60 mL syringe for small/large vials respectively. Each vial was labeled with the date, location, well ID (if available), and well name. All samples were kept on ice for preservation purposes. Then 2 and 5 mL clear serum tubing vials were topped with grey butyl septum and open aluminum ring

crimped sealed. Samples collected in 2 and 5 mL vials were preserved using copper sulfate injected into the vials using the syringe for DIC and CH4 testing. For all samples besides the 2 and 5 mL vials it was important to make sure that the sample collected filled the vial to the top so that no air bubbles were inside. If there are air bubbles in vials used for methane testing the dissolved methane can de-gas over time affecting the results (Uhlman, 2013). The 5 mL vial was filled with 2 mL of sample using a 3-way stopcock with a 3 mL syringe attached. A volume of 0.5 mL saturated copper sulfate solution was injected into the vial for DIC measurements and 1 mL saturated copper sulfate solution was added to water samples collected in 20mL vials for methane measurements. In the laboratory, head space was created in the CH4 vials by injecting nitrogen gas.

Carbon stable isotopes of CH_4 and DIC measurements were conducted at the United States Naval Research Laboratory using a Thermo-Finnigan GC Combustion III (Thermo-Fisher Scientific, Waltham, MA) interface and transferred to a Finnigan Delta Plus XP (Thermo-Fisher Scientific, Waltham, MA) isotope ratio mass spectrometer. Carbon isotope ratios are reported in the conventional delta () notation in per mil (‰) relative to the Pee Dee Belemnite (PDB) carbonate standard. The detection limit was approximately 1 mg C, and the precision was \pm 0.3‰, based on triplicate measurements.

RESULTS & DISCUSSION

Methane and DIC signatures

Measured $^{13}C_{DIC}$ values ranged between -0.2‰ and -22.8‰, with an average -9.4 ‰. Observed $^{13}C_{CH4}$ values ranged from -65.7 ‰ to -21.3‰, with most samples ranging between -49 ‰ and -21‰. There was just one sample with a $^{13}C_{CH4}$ more negative than -49‰ (i.e. sample 25). The average $^{13}C_{CH4}$ value is -38.3 ‰ (Table 1). It was observed that the $^{13}C_{CH4}$ signatures become more depleted (i.e. more negative) with depth, as the signatures became more negative than average values (Fig. 6). This indicates that methane at increasing depths may be formed by a mixture of thermogenic and early stages of methanogenesis sources. Well 25 had a $^{13}C_{CH4}$ signature of -65.7 ‰ associated with the early stages of methanogenesis and a $^{13}C_{DIC}$ of -6.2 ‰. All

other samples exhibit $^{13}C_{\text{CH4}}$ signatures characteristic of thermogenic methane (Figs. 5 and 6). Previous research conducted in close proximity to active hydraulic fracking and horizontal drilling areas indicates that groundwater is characterized by $^{13}C_{\text{DIC}}$ signatures ranging between -22% to -10%. Furthermore, the $^{13}C_{\text{CH4}}$ values range between -41.2 % and -8.5% . These signatures are consistent with a thermogenic-derived methane source.

The results of this study is only somewhat consistent with those reported by Zhang et al, (1998) related to the Eocene aquifers (i.e. Yegua, Sparta, Queen City, and Carrizo-Wilcox aquifers) in east-central Texas. Compared to the current data, groundwater extracted from the Eocene aquifers (Fig. 1) is more depleted at $^{13}C_{\text{CH4}}$, indicating that methane is derived through the early stages of methanogenesis. On the other hand, signatures reported by Zhang et al., (1998) for Cretaceous aquifers had signatures more similar to those reported in this study and mainly of thermogenic source. This may be explained by the close geographic location of the current research area and the one investigated by Zhang et al. (1998) (i.e. the Cretaceous aquifers) (Fig.1).

Specific Conductivity and Well Depth

Specific conductivity (SC) is related to the amount of TDS in the water sampled. For the investigated area, groundwater collected from depths less than 1,000 ft deep are characterized by larger SC ranges (101 micro-Siemens per centimeter (µS/cm) to 2590 µS/cm). Groundwater collected between 1,500 feet and 2,640 feet below ground surface were characterized by smaller SC ranges (340 to 676 µS/cm). This is most likely due to the lower confinement of the shallower parts of the aquifer allowing for contaminant infiltration from the surface. Also, this can be explained by closer proximity of shallower aquifer units to the outcrop areas where aquifers are generally recharged from precipitation. Contaminant infiltrating into the ground in these area will eventually be transported down gradient with the groundwater flow. Deeper parts of the aquifers are likely confined by overlying impermeable layers that would impede contaminant transport to depths.

CONCLUSIONS

The purpose of this study was to assess sources and fate of methane and to understand potential environmental impacts of hydraulic fracking on South Texas groundwater supplies. Stable carbon isotopes of DIC and CH4 were used to determine the source and fate of methane in aquifers located in areas where exploration of oil and gas is most prevalent. The major aquifers of study were the Carrizo-Wilcox and the Gulf Coast. Results show that groundwater sampled in this study area exhibited ${}^{13}C_{CH4}$ signatures ranging from -49 % and -21%, which is consistent with thermogenic methane sources. Bacterially-derived methane was observed at just one location (i.e. ¹³C_{CH4} and ¹³C_{DIC} values of -65% and -6.2% respectively) at 1700 feet in the Carrizo aquifer. Other studies indicate this is a normal occurrence in active areas with hydraulic fracturing and horizontal drilling. However, future research such as the use of additional geochemical indicators (i.e. sulfate reduction analyses, alkalinity, and stable isotopes of oxygen and hydrogen of water) will be conducted to determine if methane in groundwater is derived from deep sources due to hydraulic fracturing and drilling processes.

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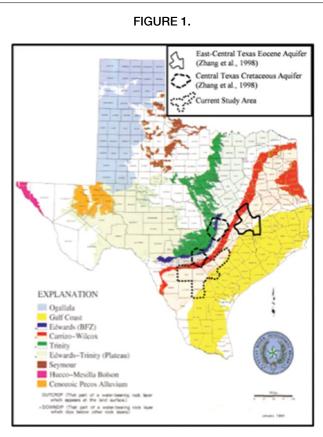
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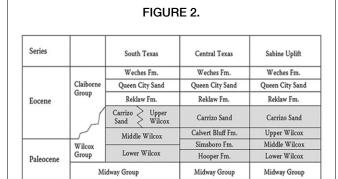
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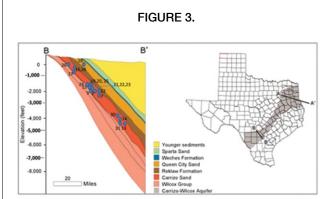


Texas major aquifers map. The Carrizo-Wilcox and Gulf Coast aquifers are represented by red and yellow colors, respectively (Ashworth and Hopkins, 1995).

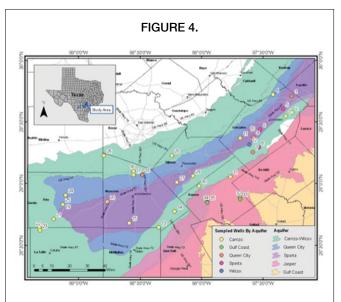


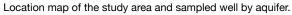
Carrizo-Wilcox Aquifer

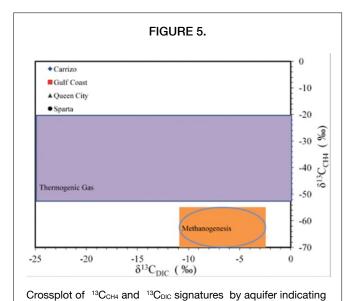
Stratigraphic layers comprising the Carrizo-Wilcox (gray-shaded) (Boghichi, 2009).



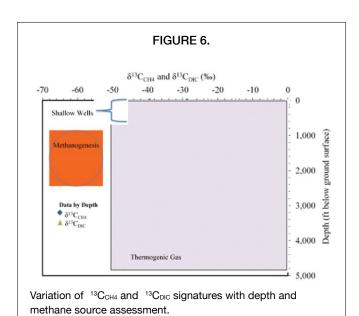
Crossectional view of the Carrizo-Wilcox with sampled wells, formations and depths. Refer to Table 1, column labeled WID (TWBD, 2013).

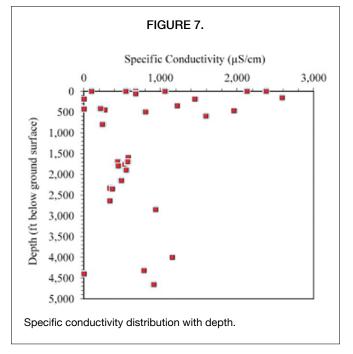






the two types of methane sources.





FIBROMYALGIA AND PAIN: FINDING INEXPENSIVE AND EFFECTIVE THERAPEUTIC INTERVENTIONS

by RENAE HUDAK



ABSTRACT

Introduction: Fibromyalgia (FM) is considered a syndrome rather than a disease. It is characterized by chronic, widespread musculoskeletal pain with multiple tender points in the tendons, muscles, and other soft tissues throughout the body. While pharmacotherapy may be able to mask pain temporarily, other therapeutic interventions that address the underlying factors of FM, such as depression or anxiety relief and strengthening of the affected muscles, may be more effective in increasing a person's overall quality of life. Goal: The purpose of this study is to investigate the wide variety of therapeutic interventions that are used for individuals who suffer from FM. The interventions that were investigated in this study included different types of exercise regimens, hydrotherapies, educational approaches,



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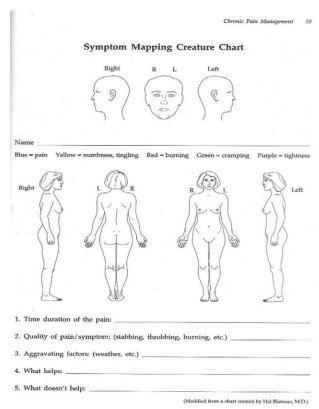
and various combinations of these interventions. Research Question: What will be the most effective and inexpensive therapeutic intervention to use for people who suffer from FM? Methods: The search for this study was to identify 15 articles that were relevant to finding effective and inexpensive interventions for FM. This research did not take into consideration whether or not the patients are on any medications. Sampling and Subjects: There were a total of 501 patients who participated in the 7 studies that were reviewed. The subjects' ages ranged from 18-65 years. Each individual was diagnosed with FM syndrome according to the American College of Rheumatology criteria. Results: There were significant improvements from the base line to the midpoint of all of the studies reviewed in the categories of the BIQ, FIQ, and the VAS (p<0.001). However, all but the hydrotherapy (balneo/thalassotherapy) were only short term improvements. The individuals who participated in the different hydrotherapies continued to significantly improve. Some were still showing substantial improvement up to six months after the conclusion of the study in which they participated. Conclusion: The results of this study indicate that FM patients who combined long term exercise with hydrotherapy experienced significantly decreased pain, anxiety, and depression while enjoying a statistically significant increase in quality of life.

INTRODUCTION

Fibromyalgia (FM) is considered a syndrome rather than a disease. Starlanyl (1999) argues that, "to be acknowledged as a disease, there needs to be definite causes and symptoms that can be clearly identified" (p. 8). However, this is not the case with FM. Even though many individuals with FM describe extremely debilitating pain as one of their chief complaints, "the location or type of the pain varies among the patients (Smith, 2013)." FM is characterized by chronic, widespread musculoskeletal pain with multiple tender points in the tendons, muscles, and other soft tissues throughout the body. Martinez and Kravitz (2013) depict FM as "a puzzling pain fatiguing syndrome" (p. 26). The common signs and symptoms include severe pain, depression, anxiety, and inability to sleep (Wierwille, 2012). A similar article describes the etiology of FM as uncertain, while the prognosis for symptomatic recovery is generally poor (National Fibromyalgia Association, 2009). Gur (2006) continued to explain that some current etiologic hypotheses are that FM is a rheumatoid-like disease or a disorder of muscular abnormality or repair, and that it results from aberrant mechanisms of peripheral pain.

According to the National Fibromyalgia Association, since no two individuals have identical symptoms, it takes an estimated average of five years for an FM patient to get an accurate diagnosis (National Fibromyalgia Association, 2009). Doctors may also delay diagnosing FM because they lack adequate information and education about the syndrome. Many patients feel discouraged when repeated, costly doctor visits result in no improvement of symptoms or alleviation of pain. Believing (or being told) that their pain and symptoms may be imaginary adds even more stress to FM sufferers.

Once the patient is properly diagnosed with FM, several therapeutic interventions can be offered to alleviate symptoms (Corrales, 2010). Gur (2006) wrote, "Prevention, causal therapy, and rehabilitation are not possible. Having fibromyalgia means continuous work with the intentions of positive effects in quality of life, pain, anxiety, and depression. Currently, therapy is polypragmatic and is aimed at reducing the pain and other symptoms associated with fibromyalgia" (p. 29). The therapies that are available and have been researched for people in the past century include: drug treatment,



Starlyanyl.1999.Chronic Pain Management [Chart]

The above chart is used to help patients map the pain they experience as a visual record. There are five parameters that will help to describe the pain verbally.

- Make a number of copies to map the pain for several weeks
- Use colors to draw body pain in patterns on the figures in the chart. Blue is generalized pain, yellow for numbness or tingling, red for burning, green for cramps, and purple for tightness.
- Make sure to always fill in the details regarding duration, quality, aggravating factors, and more.
- These can help individuals keep track of their progress while using the therapeutic interventions prescribed.

physical exercises, psychological interventions, and other symptomatically oriented therapies such as acupuncture and laser treatment (Gur, 2006).

STATEMENT OF THE PROBLEM

The purpose of this study is to investigate the wide variety of therapeutic interventions that are used for individuals who suffer from FM. The National Fibromyalgia Association has documented that out of 10 million Americans who have been diagnosed with FM, 75-90% of the patients are women (National

Fibromyalgia Association, 2009). The systematic reviews (Ardic et al., 2006, Ayan et al., 2009, Busch et al., 2011, Carbonell-Baeza et at., 2012, Corrales et al., 2012, Andrade et al., 2008, Evick et al., 2002, Demirbag & Oguzoncul, 2012) that were assessed for this study had 98.4% of females who participated and were properly diagnosed with FM. All of the males and females who participated in the studies ranged in age from 18-65. The interventions that were used in this study included different types of exercise regimen, hydrotherapies, education, and a combination of interventions.

SIGNIFICANCE OF THE STUDY

Symptoms of FM have been reported to worsen with a range of factors that are largely cognitive, psychosocial, and behavioral in nature (Van Houdenhove & Luyten, 2008). Buskila (2009) discovered that, apart from pharmacologic and psychosocial therapies, alleviating factors common to a majority of FM patients have not so far been identified. The main rationale behind this systematic review is to find inexpensive and effective interventions for FM patients to use at home on their own time. These interventions will hopefully aid in reducing the use of medications which might be able to offer temporary relief but will not be a long-term solution. The results of this study will provide physicians, physical therapists, occupational therapists, friends and family members with quantifiable data to determine if there are therapeutic interventions that will help people who suffer from FM.

LIMITATIONS

This study is limited to interventions that can be practiced by FM sufferers at home and relatively inexpensively. Offenbäck and Stuchi (2000) list several therapeutic interventions to help patients decrease primary and secondary effects of FM. "Some of the modalities that are used are ultrasound, massage therapy, and interferential currents" (IFC) (pg. 78-85). Although these modalities have proven to be somewhat effective, their continuous use is not very practical for many patients, as they may require frequently repeated visits to a physical therapy clinic, expensive and bulky machines, or time consuming treatments. These factors also made the same treatments unfeasible for this review.

DEFINITION OF TERMS

Fibromyalgia is a common and complex chronic non-degenerative, non-progressive, truly systemic pain disorder that affects people physically, mentally, and socially (National Fibromyalgia Association, 2009).

Rheumatoid Arthritis (RA) is a chronic, progressive, and disabling auto-immune disease. It is a painful condition that can progress very rapidly, causing swelling and damaging cartilage and bone around the joints (mostly hands, feet, and wrists) (Rheumatoid Arthritis, 2013).

Hydrotherapy is the application of water for the treatment of physical or psychological dysfunction. Hydrotherapy or aquatics is the use of water or an aquatic environment to help with advancement of a rehabilitation program. ("North American Spine," 2013).

Balneotherapy – refers to soaking in warm natural spring water (at least 68 °F/20 °C and usually about 93 °F/34 °C) that contains at least 1 gram of mineral per liter. The water's mineral content varies according to its natural source, with sulfur, mineral salts, and silica being most common (Klotter, 2011).

Thalassotherapy – based upon climate factors, shore climate, seawater bathing, impact of waves, marine (e.g., algal) products poultices, seawater medication; the approach is very similar to thermalism, (Chinese traditional medicine, now a medical approach using thermal [mineral] waters), but is geared to the role of the sea and seawater (Charlie & Chaineux, 2009).

Exercise – Planned, structured, and repetitive bodily movements that are preformed to improve or maintain one or more components of physical fitness. "Exercise is a subset to physical activity" (Busch, 2007).

American College of Sports Medicine (ACSM) – minimum exercise guidelines recommend 20 minutes of aerobic activity 3 days per week, and 1 set (8-12 repetitions) of 8 to 10 resistance exercises to train the major muscle groups 2 days per week.

Trigger point injections − a method of relieving pain whereby pain medication or anesthesia is injected into tender muscles called "trigger points." (Offenbächer & Stucki, 2001).

REVIEW OF LITERATURE

Inaccuracy in the diagnosis of fibromy algia syndrome: analysis of referrals. One of the leading causes of misdiagnosing FM in patients is physicians who do not have enough information or education about this syndrome. When doctors don't know enough about FM, they may fail to recognize and diagnosis the syndrome where it occurs. On the other hand, they may diagnose it where they don't really know it exists, just to facilitate disability benefit claims (National Fibromyalgia Association, 2009). According to Fitzcharles and Boulos (2001), another reason for misdiagnosing FM is because, "it has been considered a fashionable diagnosis in North America. "It has been popularized by the lay press and conscientiously advocated by patient focused groups" (p. 263). The articles explains that the cost of this illness in the United States and Canada, and the burden of this syndrome to both the patient and society has been reported to be used as a diagnoses for individuals who are seeking disability benefits (Fitzcharles & Boulos, 2002). According to Smith (2013), "studies show that, at any given time, approximately 25 % of FM patients receive some form of disability compensation" (p. 11). Because of these two differential prognoses (failure to diagnose or improper diagnosis), it has become increasingly imperative to develop a method for accurately diagnosing FM in patients.

Exercise for Fibromyalgia. Without a cure for FM, treatment plans need to focus on alleviating the symptoms and improving the patients quality of life. It has been documented that research efforts are expanding, with over 4,000 research reports and studies related to FM recently published (Smith, 2013). Busch and her colleagues (2007) express that regular exercise is one of the cornerstones of management of fibromyalgia. A balanced treatment plan leads to the greatest improvements for FM sufferers, according to a survey of studies conducted by Kenney and Wilmore. Dragoi et al. (2012) emphasize the benefits of physical exercise for FM sufferers, as regular exercise increases endorphins and serotonin levels. Weinberg (2010) describes endorphins and how they act as analgesics. This means that they are a type of natural pain killing substance found in the brain. They also tend to act as a sedative which can be found in the several areas of the body. When exercising, endorphins are released in response to neurotransmitters and can give an individual a feeling of euphoria. Finally, this feeling can be joined by an energized and positive quality of life. Weinberg and Gould (2010) also explain that serotonin is a chemical in the brain that helps to influence mood. In addition, an increase in endorphins and or serotonin both help to naturally relieve stress, anxiety, and depression, which are often symptoms that afflict individuals with chronic illnesses such as FM (Smith, 2013). Busch (2007) discusses how important it is to determine the most effective types of exercise (aerobic, strength, flexibility, or other), and with what intensity, duration and frequency they should be prescribed, and also discusses the incidence and type of any related adverse effects.

Physical therapy in the treatment of fibromyalgia. Based on a systematic review, Offenbäck and Stuchi (2000) found that physical therapy interventions may help with short term pain for people who suffer from FM. Starlanyl (1999) studied how people with FM have been trying alternative medicines over prescribed medications to help alleviate their pain. A few alternative medications individuals used to relieve their pain included trigger point injections, massage therapy, acupuncture, biofeedback, transcutaneous electrical nerve stimulation (TENS), and whole body cryotherapy. Starlanyl (1999) argues that as long as the physician knows and understands the trigger point therapy and is educated well enough to treat the whole body not (just the affected area) then acupuncture and trigger point injections can be useful to help with pain. Massage therapy is another great alternative in therapy with the right kind of touch. If the therapist is too aggressive, a massage can end up causing the tenderness that is associated with FM instead of alleviating, and thus worsen the condition. Banfi and colleagues (2012) researched how cold therapy is commonly used as a procedure to relieve pain symptoms, particularly in inflammatory diseases, injuries, and overuse symptoms. Metzeger and colleagues (2000) have studied the effect of cryotherapy on the patients for treatment of inflammatory rheumatic diseases. In 1996 they conducted a study on FM patients and found that patients' pain levels after application of the cold therapy decreased significantly, and the effect of pain relief lasted about 90 minutes. Offenbäck and Stuchi (2001) found

the same results in a separate study on cryotherapy that reported only short term pain relief for the patients who participated. Along with the cryotherapy, Offenbäck and Stuchi (2000) and Hammond et, at., (2013) had the similar result of temporary pain relief with no statistically significant long term benefits using trigger point injections, acupuncture, massage, and TENS therapy.

RESEARCH QUESTION

What will be the most effective and inexpensive therapeutic intervention to use for people who suffer from fibromyalgia?

METHODS

The initial search for this study generated 12 hits. Each article was reviewed carefully to see if it met the following four criteria: research was conducted from 2002-2013, the use of pharmacotherapy was permitted publications were not limited to the United States, and 90% of the patients were females. Six articles were excluded because: (1) interventions in four studies were not self-applicable, (2) eight studies met all the criteria and thus included in this review.

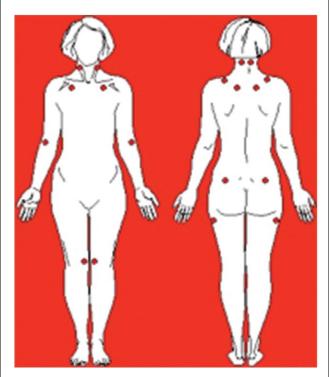
Subjects and Sampling

There were a total of 501 who participated in the 8 studies that were reviewed for this study. The subjects' ages ranged from 18-65 years. Each of the studies had two groups, the control group and the treatment group. Of the 501 participants there were 403 females and 8 males. Each individual was diagnosed with FM syndrome according to the American College of Rheumatology criteria (Table 1).

There were 42 patients who participated in a study using physical therapy only, 30 females who used patient education only, and 102 (94 females, 8 males) who used both physical therapy and patient education as their intervention

Several different kinds of hydrotherapy (i.e. thalassotherapy, balneotherapy, aquatic therapy) were also studied: 147 females went through the hydrotherapy only; 180 females were treated by the combination of hydrotherapy and land based exercises.

TABLE 1.



To receive a diagnosis of FM, the patient must meet the following diagnostic criteria:

- Widespread pain in all four quadrants of the body for a minimum duration of three months
- Tenderness or pain in at least 11 of the 18 specified tender points when pressure is applied

(American College of Rheumatology FM Diagnosis.2001.[Chart] Retrieved from National Rheumatoid Arthritis society)

This exam is based on the standardized American College of Rheumatology (ACR) criteria.

Instruments

All the eight studies used the same four tests for patient outcome measures. Three of the eight studies used additional tests and measurements.

Visual Analogue Scale (VAS): The scale measures the severity of pain and was developed by Price, et al (1983). This scale is 10cm long and ranges from 0 (no pain) – 10 (most severe pain), (0-100 in other studies). Patients are asked to mark a point corresponding to the severity of pain that they were feeling at the time of the measurements taken.

Beck Depression Inventory (BDI): This self-report questionnaire subjectively measures an individual's

physical, emotional, cognitive, and motivational functions of depression, developed by Beck et al., (1961). This is a self-assessment scale including 21 items rated on a 4 point scale with each item ranging from 0-3. Zero represents a neutral condition while three represents the most severe condition (Demirbag & Ofuzoncul, 2012).

Fibromyalgia Impact Questionnaire: Burckhardt (1991) developed this questionnaire which measures the state, course and outcomes in the patients with FM. This is a self-assessment scale consisting of Likert (psychometric scale capturing variation that points to the underlying phenomenon) type 10 questions, each score between 0-3 (Demirbag & Ofuzoncul, 2012).

Trigger/Tender Points: the number of trigger/tender points were examined by applying a pressure of 4kg with the tip of the thumb or index finger on the 18 points defined in the American College of Rheumatology classification criteria (Tenderness or pain in at least 11 of the 18 specified tender points when pressure is applied) (National Fibromyalgia Association, 2009).

EuroQOL-5D – used in Busch's study (2007): This was used to assess the quality of life of the participants for this research. It has five domains: mobility, self-care, daily activities, pain, and anxiety and depression.

Fitness Testing. Types of fitness testing included flexibility (sit and reach), aerobic endurance (12 minute walk test), and joint range of motion. All of these tests and their standards for the fitness testing are met from the American College of Sports Medicine, and every individual is carefully supervised and monitor by professionals during testing.

Research Design/Statistical Analysis:

The durations of the therapeutic intervention in each study varied from 3 weeks - 24 weeks. The studies completed the baseline assessments for all of the participants. There were also assessments given in the middle of the trials, the end of each trial, and for the follow- up. Different versions of the statistical package for social sciences (SPSS) software program were used in five of the studies. All of the eight studies used in this review set a P value of less than 0.05 as being statistically significant.

Health Education Home-Based Program: The statistical analysis of the data for this review was performed with the Epiinfo 6.0 and Epidat 3.1 programs. For the statistical description, the mean was used as a centralizing measurement and the typical deviation as a measurement of dispersion. To analyze the changes undergone before and after intervention and at the time of follow-up, paired data were subjected to variance analysis. The analysis of differences between treatments was arrived at through a variance analysis after normality was demonstrated for the distributions by means of a variance contrast with the F2 test.

Education and Exercise: The data was analyzed using the statistical package for social sciences (SPSS Inc., Chicago, IL, US) version 11.0. In the evaluation of data, the chi-square test and the t-test for independent variables. The data was represented by a mean ± standard deviation, and as a percentage.

Long-Term Exercise Program: The normality of the data distribution for this trial was initially tested using the Kolgomorov-Smirnov test. Differences between groups were tested using analyses of variance (ANOVA) for continuous variables, and the 2 test for categorical variables. The effects of the intervention programs were evaluated by age-adjusted analyses of covariance for repeated measures. The analyses were performed using SPSS 15.0 (SPSS Inc. Chicago, USA).

Balneotherapy: SPSS 12.0 Software program was used for statistical analysis. Mann–Whitney U test and Wilcoxon matched paired tests were applied, interand intragroup analysis as appropriate, to compare results. Spearman ranked correlation test was used to correlate VAS and serum PGE2 levels. The alterations in the measurements were analyzed by using repeated measures test. Because a large proportion of serum IL-1 ve LTB4 values were undetectable in group 2 and group 3, cytokines were described as either detectable (pg/ml) or undetectable.

Thalassotherapy: This study determined the statistical analysis by using x2 test to compare demographic data. For intra-group, analysis paired t tests were used. Unpaired t test was applied for inter-group analysis. SPSS Software was used.

Land- and water-based exercise: This study analyzed continuous variables with one-way analysis of variance and Chi-square tests. The used analysis of covariance (ANCOVA) to assess the training effects on the primary and secondary study outcomes. For each outcome variable a report of the effected size and the level of significance corresponding to the main group (between-subjects), time (within-subjects), and interaction (group × time) effects will be recorded.

Interventions

Patient Education and Exercise: The program was structured in two phases; Learning (12 weeks) and follow-up (24 weeks). During the learning phase, the subjects were divided into three groups of ten. The first four weeks were given over to teaching the different exercise regimens, first week (a 45-minute session), physical exercise; second week (30 minutes), relaxing; third week (15 minutes), breathing exercises, and in the fourth week (45 minutes), stretching. After the program, patients were encouraged to continue practicing what they had learnt on their own at home for the following six months, each one being given a diary and an activity calendar in order to record what they did. All the patients were allowed to use their medications during the intervention program as well as during the follow up.

Patient Education: The education program included the information about the natural course of FM, the relationship between personality traits and syndrome, and frequent recurrence of syndrome. The subjects were also briefly informed about the following issues; what FM is, how it typically is diagnosed, what the current treatment options of FM are, what the causes of FM are, and if the patients with fibromyalgia have improved. They were also told that FM was not a psychological disorder, but that stress, depression, anxiety, sleep disturbances, trauma, working too hard, and bad posture are often associated with it. Moreover, it was stressed that FM is a benign illness, which does not cause actual tissue damage. The importance of sleep, stress alleviation, and medical treatment for FM was explained to the subjects. The education program lasted 20 minutes. The exercise program was prepared by a hospital and on a one-to one basis included the practices of neck, hand, arm, and foot exercises.

Aquatic Therapy: The subjects trained in waist-high warm water, three times per week for 12 weeks. Every one-hour session included slow walking and mobility exercises, aerobic exercise at 65–75% of maximal heart rate, and overall mobility and lower-limb strength exercises. At the end of the 12-week training period, the group was instructed to avoid physical exercise training until their next evaluation.

Balneotherapy: The treatment group (n = 12) received bathing for 20 min a day, for 5 days per week, for 3 weeks, for a total of 15 sessions. The thermal pool water heat was 36°C. Analgesics, non-steroidal anti-inflammatory drugs, or additional medication such as anti-depressive drug usage was not permitted during this period.

Thalassotherapy: Treatment for one study occurred in summer at 03:00 pm, when the sea is warmer (sea group), similar to pool water temperature. Pool-based exercises were performed in a warmed (28-33°C) swimming pool (pool group). Both groups received the same physical fitness program, for a total duration of 60 min, once a day and three times per week for 12 weeks, following the American College of Sports Medicine guidelines (American College of Sports Medicine, 2013). The program was composed of a 10-min stretching exercise, 40 min of various forms of low-impact aerobic exercise according to the desired intensity, after that a 10-min relaxation period. The last 2 weeks of the study were used for adjustments, with light intensity exercises only (between 30 and 49% of VO2 max, which correspond levels 10 and 11 on BORG scale) and learning the exercises. Afterwards, the subjects were allowed to practice on the target intensity. If pain occurred during the exercise, the subjects were taught to decrease the intensity for a short amount of time to relieve the disturbance. In the aerobic training, subjects practiced walking against water resistance, bicycling simulation, stationary march, shoulders and elbows bending and extension with dumbbells, alternating (right/left) air punches in several directions associated with low jumps, multidirectional kicks against water resistance, pushing and pulling against water resistance in several directions, stepping and sinking the resistance weights with feet, and jumping jacks and low jumps on water using the calf for leverage. All sessions were supervised by two certified physical therapists, and to

avoid bias neither of them was involved in the clinical assessments.

Long Term Exercise: Assessments were taken at baseline and immediately after the 24-week intervention. The subjects in the exercise group performed twice-weekly sessions of combined exercises with 1-hour duration, including 10 min warm up, 10–15 min of aerobic exercise at 65-70% HR max 15–20 min of muscle training with eight exercises of the major muscle groups (1 set of 8–10 reps with 1–3 kg) and finally 10 min of flexibility training with 8–9 exercises (1 set of 3 reps, keeping the stretched position for 30 s).

Land and Water Exercise: The land and water-based intervention groups trained 3 days per week (60 min per session) for a 24-week period. The intervention involved exercises for improving cardiovascular endurance, muscle strength, and joint range of motion, and will meet the minimum training standards of the American College of Sports Medicine (2013). The exercises involved all major muscle groups and each session was carefully supervised by a certified exercise trainer. During the first weeks, the main part of the sessions focused on teaching the patients how to perform the exercises correctly. Each session included 10 min of warm-up with slow walks and mobility exercises, followed by 35-40 min of aerobic exercises which developed progressively at intensity sufficient to achieve 50% (at the beginning of the intervention) and ~80% (the last month of the intervention) of predicted maximum heart rate (209-0.73 x age), and resistance strength training. Finally, each session ended with 10 min of cooling down with low intensity, flexibility and relaxation exercises. Intensity (expressed as RPE) ranged from 12 to 14. These RPE values correspond to a subjective perceived exertion of "light" and "somewhat hard" respectively.

Land-Based Exercise: The land based exercise intervention consisted of cardiovascular exercises and incorporated walking at different speeds, continuous and rhythmic activities that affect large muscle groups, and aerobic dance. Resistance strength training included biceps curls, arm extensions, arm side lifts, shoulder elevations, lateral leg elevations, stand-ups from seated position, lunges, sideways lunges and step-up/step-down exercises, performed 1-3 set of 8-12

reps. Flexibility was developed by static stretching (i.e. Stretch by the end range, hold it 10-30 seconds to the point of tightness or slight discomfort) at the end of the warm-up and cool-down periods.

Water-Based Exercise: The water-based exercise intervention group trained in a chest-high warm (~30°C) pool. A modified version of the land-based intervention, adapted to the restrictions and peculiarities imposed by water, was used. The cardiovascular exercises included bicycling simulation (with the floater between legs), walking around the pool, and continuous and rhythmic activities that affects large muscle groups and aerobic dance. The strength exercises were performed at slow pace using water and aquatic materials for resistance. Flexibility exercises consist of static stretching at the end of the warm-up and cool-down, as in the land-based intervention.

Usual Care Groups (Control): Participants randomly assigned to the usual care (control) groups received general advice from a certified exercise trainer about the positive effects of physical activity. They will receive informative pamphlets describing the benefits of physical activity and general guidelines about how to increase the daily physical activity levels.

RESULTS

Health Education study

No difference was observed in the patient tender points between the control and the treatment groups. The mean remained the same with a score of 13 throughout the study. Both the patients' illness and flexibility improved significantly (p < 0.01) during the learning phase. However, during the follow-up they began to worsen and at the end of the study there was no significant improvement within the group (p < 0.05).

Education and Exercise Study

The scores of BDI, FIQ, and VAS of the patients in the intervention and control group before and after the education and exercise program significantly improved (p<0.01). There was a significant difference between the BDI, FIQ, and VAS scores of the patients before (20.33±7.4, 67.19±13.9, 7.65±1.44, respectively) and after the education and exercise program (14.20±4.5, 47.58±11.82, 5.41±1.15, respectively; p<0.05).

Long term exercise study

Three participants did not show up to complete the follow-up evaluation after the intervention and thus were eliminated from the study.

There was significant improvement for the global score of the SF– 36 (22%). There were also significant improvements for physical function, general health, vitality and mental health, and body pain (14%). There was no significant improvement with the control group.

Hydrotherapy Studies

Four out of the eight studies included different types of hydrotherapy. The total of 327 subjects participated in a study with some form of hydrotherapy; including thalassotherapy, and two balneotherapy studies.

Aquatic Therapy

There was a statistically significant improvement in the aquatic therapy group, with their overall quality of life improving by 29%. All subdomains, mobility, self-care, daily activities, pain, and anxiety and depression, also showed significant benefits due to the hydrotherapy, except daily activists.

Vas improvement in pain, VAS scores were significantly better in the hydrotherapy group compared to the control group from the baseline measurement to the post test measurements.

The difference between the two groups, however, gradually became smaller and, at the time of the 12-week post-intervention follow-up, no longer significant difference was observed.

Thalassotherapy

Four participants from the control (pool) group and four participants in the intervention (sea) group (eight in total) did not complete the intervention and thus were excluded from the study. For each of the categories: VAS, tender points, FIQ, PSQI, and the BDI there were significant improvements within their own groups (pool group (p < 0.001). and the sea group (p < 0.001).). However, there was not a significant difference in improvement between the two groups (sea group and the pool group p<0.05) in any of the categories. Pain also significantly improved in patients of both of the groups; both decreased by 60% between the base line

and post treatments (p < 0.001). In the post treatment there was a significant improvement at the end of the study for the patient's fatigue (p < 0.001). The pool group reduction was 3.3 and the sea group was 4.8 for the VAS fatigue. The reduction in the number of tender points was observed in both groups (p < 0.001). The tender points count in the post treatment for the pool group was less than 11 in 6 (31%) and in 7 (36%) of patients in the sea group.

Both groups improved their FIQ total scores in the post treatment when compared to the baseline (p < 0.001). The pool group had a decrease of 38.7 and the seas group of 40.6 for their total FIQ scores.

There was a statistically significant improvement in both the physical (p < 0.001) and mental (p < 0.001) components in the post treatment SF-36 scores when compared to the baseline.

There was a statistically significant improvement in the BDI scores in both groups from the baseline to the post treatment (pool group 17.0-8.9 and the sea group: 28.8-9.3).

Balneotherapy effects on serum level

The FIQ scores significantly improved from the baseline to the post treatment of test (p < 0.001).

The VAS scores also significantly improved from the baseline to the post treatment of test (p < 0.001).

Balneotherapy

There was a statistically significant difference in the number of tender points, visual analogue scores, Beck's Depression index, and fibromyalgia impact questionnaire scores after the therapeutic intervention program, all with a (p < 0.001).

At the 6-month follow-up, there was still an improvement in the number of tender points, which was considered as "significantly different" from the baseline to the post treatment of test (P < 0.001). There was not a statistical difference in the control group (p < 0.05).

Author	Sample Size	Intervention	Outcome Measures	Results/Comments
Ardic et al.	A:12 B:12	A: 20 min bathing, once a day, 5 days a week B: No treatment	- VAS - BID - FIQ - Tender Points	Statically significant improvement in all outcome measures (p<0.001) for A. Balneotherapy is an effective treatment for patients with FM
Ayan et al.	A:30	A: week 1: 45min session physical exercise, week 2 30min relaxing, Week 3 15min breathing exercises, week 4 45min stretching	- FIQ - VAS - Flexibility - Tender Points	No difference in tender points throughout the study, both illness of participants and flexibility significantly improved during the program Poor adherence to the treatment caused illness and flexibility worsened overtime.
Busch et al.	A:18 B:17	A: trained in waist high water 1 hour 3x/week for 12 weeks B: No treatment	- EuroQOL-5D - VAS	Improvement in overall quality of life was greater in A by 29%. There was a significant improvement in VAS scores for A by 19mm (bases of 10cm chart).
Corrales et al.	A:21 B:21	A: Exercise performed 2x week/ combined exercise 1 hour duration for 24 weeks B: No treatment	- BDI - SF-36 (mental health)	Significant improvements were observed for combined exercise in the patients SF- 36 of 22% for A during follow up. Significant improvement in BDI by over 20% during follow up in A.
Andrade et al.	A:23 B:23	A: (pool group) performed in 28-330C water, 60 min 3x week/ 12 weeks B: (sea group) performed at Ponta Negra beach, Brazil, no waves imitating a pool., 60 min 3x week/ 12 weeks	- VAS - Tender Points - FIQ - BDI	Significant improvement within A from baseline to follow up p<0.001 in all outcome categories. Significant improvement within B from baseline to follow up p<0.001 in all outcome categories. Aerobic exercise performed in A or B are effective for FM patients.
Evick et al.	A:22 B:20	A: Balneotherapy at 360C 20min/day, 5x/week for 3 weeks B: No treatment	- Tender points - VAS - FIQ - BID	Statistically significant improvement from baseline for A p<0.001 for all out come measures (up to six months).
Demirbag & Oguzonul	A:51 B:51	A: received education lasted 20min, and exercise program 15-20min. Visited once a week/1 month to repeat education & exercise program B: No treatment	- VAS - BDI - FIQ	Significant improvement in all outcome measures at the end of study for A (p<0.05 for each) with continuous use of exercise and education at home patients with FM have shown positive effects on pain, Quality of life, and depression.

CONCLUSION

Results of this study indicate that combining long term exercise with hydrotherapy has significantly decreased pain, anxiety, and depression while demonstrating a statiscally significant increase in quality of life following following those interventions. With these specific types of interventions, the improvements have been shown to last up to 6 months after the study has taken place. While exercising in a pool resulted in significant improvement, there was an even greater improvement

when using balneo/thalassotherapy. These results from the balneotherapy and thalassotherapy may have advantages due to salts and other elements of the sea water. While the other interventions seemed to provide significant improvements in the patients who participated, after the final evaluations, the effects seemed to be short term.

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DIFFERENCES IN POWER STRATEGIES UTILIZED BY MEN AND WOMEN

by KELLI HUEY



ABSTRACT

Over twenty years ago a research study was conducted by Falbo and Peplau (1982) to examine sex differences in the strategies used in relationships to influence partners in decision making. Their findings suggested that males were more likely to utilize direct and bilateral strategies of communication as compared to females. The present study attempted to investigate whether these same patterns of communication hold up in today's culture. It was predicted that females would demonstrate more effective communication strategies (direct and bilateral) than found in the past. For males, no change in communication strategies was expected. Using a similar paradigm to that used in Falbo and Peplau (1982), participants were presented with a variety of direct, indirect, bilateral, and unilateral communication statements people might use to get what they want in a relationship. An in-group sex bias emerged from



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the results in which both men and women endorsed direct and bilateral strategies as their own, although participants indicated that indirect and unilateral strategies were judged to be used more generally by women rather than by men.

Keywords: power strategies, sex differences in communication

INTRODUCTION

The need to form healthy relationships has been described as a fundamental human need (Baumeister and Leary, 1995). To maintain the relationships we form, however, often requires a great deal of effort. In committed relationships, for example, partners engage in a wide variety of relationship maintenance behaviors to preserve and enhance their current relationship (Etcheverry and Le, 2005). Communication within relationships may become complicated at times when partners attempt to get what they want while still attempting to maintain their relationship. Research in communication has established that, in general, women communicate more effectively than men (Hyde and Linn, 1988). Women tend to use more self-disclosing talk in communication, saying more about their feelings and sharing personal aspects of their lives (Fox, et al., 2007). Men, on the other hand, are less intimate and supportive in their communication than women (McHugh and Hambaugh, 2010). In view of this,

women should have an advantage in persuading others over to their way of thinking, since communication is usually a key factor in the persuasion process.

Social power is a term that refers to the ability to change others' behavior and to resist the influence of others on us (Huston, 2002). Communication styles have been linked to the social power one possesses in relationships (Falbo and Peplau, 1980). Those holding higher status in a relationship have been found to communicate more directly, explicitly asking for what they want and unambiguously announcing their desires (Sagrestano, 1992). In addition, those holding higher status seek their goals through bilateral communication, in which both partner's positions on an issue are considered. Although direct and bilateral communication may first appear to be a strategy that women should use in a relationship more than men, since they are considered more skilled at communication, in heterosexual relationships at least, Falbo and Peplau found quite the opposite. Women were found to use more indirect and unilateral forms of communication (Falbo and Peplau, 1980). Based on such differences in communication in heterosexual relationships, it appears that men, in general, hold more social power.

Research shows that equal power helps couples create intimacy and relationship success (Knudson-Martin, 2013). Falbo and Peplau (1980) found, however, that although couples desire equality in relationships, models of mutual support are not well developed, and in traditional relationships males possess a more powerful role. Even in situations where couples seek counseling, there is little guidance for how to address power imbalances. The present project attempted to examine the communication strategies used by men and women to "get what they want" in a relationship. The project focuses on sex differences in the use of direct strategies (stating ones desire directly) and indirect strategies communication (using other forms of behavior to allude to one's desire), as well as examining gender differences in the use of unilateral (including only ones own preference) and bilateral strategies of communication (including the desires of both partners).

Falbo and Peplau (1980) asked participants to list strategies they used to "get what they want" in a relationship. The results of this study found that men

and woman used sex-typed power tactics in dating relationships. Based on the responses, strategies such as asking, bargaining, Laissez-faire (does what he she wants on own), negative affect, persistence, persuasion, positive affect, reasoning, stating importance, suggesting, talking, telling, and withdrawal were identified. These strategies were then grouped into four attributes: direct/indirect, unilateral/interactive, active/ passive, and good/bad. Indirect ways consisted of positive and negative affect, hinting, and withdrawing. Direct strategies consisted of asking, telling, and talking. Independent actions such as laissez-faire, withdrawing, and telling reflected a unilateral strategy. Men are more likely to report using direct and bilateral strategies whereas woman more often reported using indirect and unilateral strategies. The study also showed that individuals reporting themselves as having relatively greater power in relationships used more direct and unilateral strategies. In addition, greater relationship satisfaction was found to be associated with the use of these same strategies.

Knudson-Martin (2013) addressed the notion that couples relationships should enhance the well-being of both partners. She suggests that power is relational and that effective communication is central to relationship health. The authors also address the issue of power imbalance within intimate relationships, especially when the differences were covert and related to gender. Many times male power comes not from outright acts of domination but from an unacknowledged preeminence of men's priorities, needs, and desires in ways that seem unquestionable or ordinary. Relationship partners exert power on each other through influence processes connecting emotional experience, communication, and conflict management, decision making, personal validation, trust, and intimacy. Equality appears to be defined by the partner's perception of their ability to influence the other. Those that feel they have a great deal of power tend to use the direct unilateral strategies, whereas those that perceive less ability use indirect influence strategies. When power is perceived as equal, both partners use direct strategies and reported a higher rating on their relational satisfaction and better overall wellbeing.

In a study conducted by Falbo (1982) the kinds of power strategies used by masculine, feminine,

androgynous, and undifferentiated people in their relationships were investigated. Falbo took two hundred University students (one hundred homosexual and one hundred heterosexual) and evenly divided them by gender. A two-dimensional model was constructed based on the strategies written on open-ended essays. These two dimensions concerned the extent to which the strategies were (a) direct (ranging from direct to indirect) and (b) interactive (ranging from bilateral to unilateral). Gender differences were found among the heterosexuals with men more likely to report using direct and bilateral strategies. The effects of gender paralleled findings concerning the balance of power within the relationships. Androgynous people reported using primarily bilateral strategies such as persuasion. Undifferentiated people reported using primarily unilateral strategies such as doing what they wanted regardless of their partner's compliance. Feminine reported using indirect and unilateral and masculine reported using direct and bilateral strategies. The findings for the masculine and androgynous people did not significantly differentiate themselves in terms of strategy use.

Park, Troisi, and Maner (2010) found that for egoistic and altruistic concerns in communal relationships, benefits are given in response to a need and out of concern for the welfare of the other person. In such relationships, receiving benefits does not create a specific obligation to return a comparable benefit, as it does in exchange relationships (Clark and Mills, 1993). Park, Troisi, and Maner's (2010) research was developed to measure and assess egoistic versus altruistic concerns underlying a communal relationship orientation. The authors hypothesized that individuals with egoistic concerns will pursue different types of goals, with implications for wellbeing, and use more self-fulfilling strategies such as indirect and unilateral and will also be found to be less satisfied in relationships and to experience depression. The authors took three hundred college students and administered a series of computerized questioners. The answers were then examined to assess personal and interpersonal functioning. concerns predicted increased relatedness and empathy and decreased anger, hostility, and aggression, whereas egoistic concerns predicted decreased relatedness and empathy and increased anger, hostility, and aggression.

In addition, altruistic concerns predicted more otheroriented (e.g., community) goals while egoistic concerns predicted more self-oriented (e.g., image) goals and depressive symptoms. These findings suggest that a hallmark of psychological well-being is possessing close, mutually caring social relationships. Having close relationships promotes a wide array of positive personal and interpersonal outcomes. The authors also suggested that attachment styles could serve as a good predictor of feelings of power and satisfaction in relationships. A good experience with attachment and a secure attachment style greatly increases ones feeling of power and satisfaction.

Falbo and Peplau's (1980) study was conducted over 30 years ago. Since that time, it has been suggested that women of today, at least in America, are higher in instrumentality as compared to earlier generations (Twenge, 2009) and gaining more control over economic and political resources. In addition, both women and men have become more egalitarian in their views of marriage (Bryant, 2003). As a result of these changes, one might suspect that communication styles within relationships may have changed as well. The purpose of the present study is to see if Falbo and Peplau's (1980) findings are still true today. Do men still use a direct and bilateral approach to communication strategies and do women still use the indirect unilateral approach to communication strategies? It was predicted that women would be more likely to use direct and bilateral communication styles than they were 30 years ago.

METHODS

Participants

The participants for this study were 143 randomly selected college students from Texas A&M-Corpus Christi consisting of 46 male and 97 female participants. All participants volunteered their time during or after classes to take our survey. There was no monetary compensation offered, and all were guaranteed anonymity so as to try and rule out any bias variables.

Measures

This research measured unilateral (one sided actions with disregard to other parties), bilateral (taking both parties into consideration), direct (straightforward), and indirect (round about; circumventing) strategies

used in making decisions with partners. Happiness and Satisfaction were also measured. Relationship satisfaction was measured by using the Relationship Assessment scale (Hendricks, 1988). The Relationship Assessment Scale is a brief measure of global relationship satisfaction. It consists of seven items, each rated on a five-point Likert scale. It is appropriate for use with any individuals who are in an intimate relationship. Research has shown the scale to be correlated with other measures of love, sexual attitudes, self-disclosure, commitment, and investment in a relationship. Happiness was assessed using the General Happiness Scale (Lyubomirsky, & Lepper, 1999). The General Happiness Scale is a 4-item scale designed to measure subjective happiness. Each item is completed by choosing one of seven options that finish a given sentence fragment. The options are different for each of the four questions. Research has shown the scale to have strong reliability and validity (Lyubomirsky, & Lepper, 1999).

Procedure

After students were informed that the survey they were taking was for a research project studying communication in relationships and that its purpose was to examine how people get what they want in a relationship. Participants were then administered a 55question survey. The survey presented a scenario of a couple, who had been together for a while, and were disagreeing about where to go and what to do on Spring Break. The survey then gave different scenario options for how to resolve this disagreement using a variety of answers ranging from direct, indirect, unilateral and bilateral approaches. The last few questions of the survey asked the likelihood of the approach chosen being chosen by a male or female. The last set of items asked about their happiness and satisfaction in their current relationships. All participants received the exact same survey with the exact same layout of questions and scenarios to choose from. Participants were allowed to ask any questions they wanted pertaining to their understanding of the survey. Survey items were based on original procedure.

RESULTS

Both the relationship assessment scale (alpha = .89) and general happiness scale (alpha = .78) were found to be

reliable. As predicted, males and females did not differ on their endorsement of direct strategies, t(141) = 1.24, p = .216 or bilateral strategies, t(141) = .10, p = .320. Consistent with previous findings, female participants were more likely to endorse indirect strategies, t(141) =2.44, p = .008, and unilateral strategies, t(141) = 2.774, p < .001 (see Figure 1). Female participants were more likely to say that the actors in bilateral scenarios were female, t(141) = 3.50, p = .001 (see Figure 2). In addition, female participants were more likely to say that the actors in direct scenarios were female, t(141) = 2.35, p = .02. Male participants, however, were more likely to say that the actors in bilateral strategy scenarios were male, t(141) = 2.93, p = .004 (see Figure 3). In addition, male participants were more likely to say that the actors in direct strategy scenarios were male, t(141) = 2.301, p = .001. Relationship satisfaction was negatively related with the endorsement of unilateral strategies, r (85) = -.335, p = .001, and indirect strategies r (86) = -.385, p < .001. No significant correlations with happiness were found.

DISCUSSION

As predicted, women and men were not found to differ in their endorsements of bilateral and direct influence strategies. This may suggest that women's status in heterosexual relationships has increased in the last 30 years, as suggested by other research (Twenge, 2009). This finding may also be due, however, to a trend in both males and females becoming more egalitarian in their relationships (Bryant, 2003). In either case, as long as there is a trend toward more equal power, research suggests that relationship satisfaction should increase (Knudson-Martin, 2013). Unfortunately, however, although evidence suggests that the traditional gender roles are becoming more egalitarian, other empirical evidence suggests that traditional roles continue to dominate heterosexual relationships (Sanchez, Fetterolf, & Rudman, 2012).

On the other hand, some of the results of the present study were consistent with those of Falbo and Peplau (1980). Women were found to have greater endorsements of both unilateral and indirect strategies compared to men. This suggests that women are still more likely, at times, to use indirect and unilateral strategies. At the same time, however, both women and

men were more likely to say that people who shared their own gender tend to utilize direct and bilateral power strategies in their intimate relationships. Thus it appears that a gender based ingroup bias emerged from the data in which each sex thought that they used a better communication strategy than the other. Future research is needed to uncover the nature of such a gender bias.

Unfortunately, the results of the present study do not shed much light on the ingredients of relationship satisfaction and happiness. The endorsements of both direct and bilateral strategies were found to be poor predictors of relationship satisfaction and happiness. What the data do suggest, however, is that the use of unilateral strategies is associated with lower relationship satisfaction. Bilateral communication then, appears to be a desirable relationship quality that may be a necessary requirement for relationship satisfaction.

It appears then, that power in relationships has evolved somewhat over the last 20 years. Future studies should be conducted to further explore the complex role women play in modern intimate relationships and the impact that their influence strategies have on relationship health.

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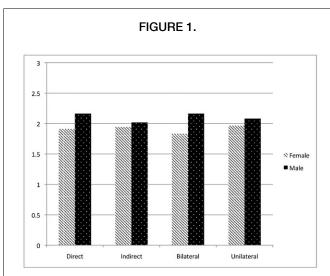
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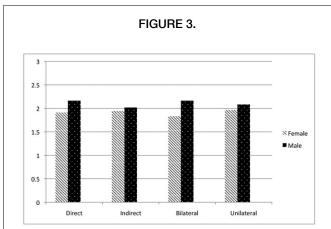
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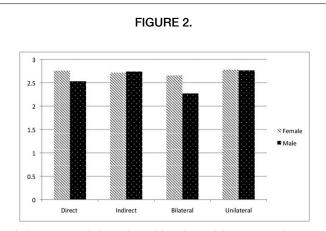
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Male and female endorsements of direct, indirect, bilateral, and unilateral influence strategies.



Judgments made by male and female participants as to the likelihood that the person using direct, indirect, bilateral, or unilateral influence strategies was male.



Judgments made by male and female participants as to the likelihood that the person using direct, indirect, bilateral, or unilateral influence strategies was female.

DECEPTION DETECTION: DO TRAINING AND SELF-ASSESSMENT MATTER?

by ARRON HUSS



ABSTRACT

Modern research has not reached a consensus on the ability of the average person to detect deception, specifically which characteristics may contribute to the accurate detection of deception. This research studies the connection between self-assessment and deception detection with the hypothesis that higher self-assessment will positively correlate with deception detection accuracy. Also being tested is whether minimal training improves the average person's ability to detect deception. The literature review discusses how deceivers must continually monitor their own deceptive actions while also adjusting their performance according to the feedback of the receivers of the deception. This monitoring of performance is simply self-assessment used specifically for deceptive purposes. Precedence has been established in previous studies where training has positively affected the ability of individuals to detect deception (Driskell, 2012). In this study participants were asked to complete



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an information survey as well as the Self-Monitoring Scale (Snyder & Gangestad, 1985). Participants watched a short video with an individual making five statements, with one of the statements being a fabrication. The participants then selected which statement they believed to be the fabrication. Training was not correlated with an increase in confidence to detect deception nor did it lead to more accurate detection. Surprisingly, self-monitoring was negatively associated with deception detection in that those lower in self-monitoring were better at detecting deception than those high in selfmonitoring. Results are discussed and implications are offered.

Keywords: Deception Detection, Self-Assessment, Self-Monitoring, Training, Confidence

INTRODUCTION

Deception detection research has been quite contentious on whether deception detection by the average person is greater than chance or not greater than chance. There have been numerous studies and meta-analyses on the subject. Depending on the method of deception detection in relation to how it is measured cognitively, behaviorally, physiologically, etc., no overwhelming consensus of researchers has agreed on how common deception detection occurs in the average person. However, while not overwhelming consensuses, several meta-analyses of numerous studies have found that

the average person detects deception no more than chance. An example: "On the average, judges achieve about 54% lie-truth discrimination accuracy" (Bond & Depaulo, 2006). Also that "Overall, people were better at correctly rating truths as nondeceptive (61%) than lies as deceptive (47%). Numerous meta-analyses support the strong possibility that this study will also have an accurate deception detection rate being no more or little better than chance. However these studies did not test for self-assessment as a factor in deception detection. This study will test to see if self-assessment is a factor in deception detection in the average person with no formal deception detection training. The reason this study attaches self-assessment to deception detection is that conversation between two people is a dynamic and ever-changing interaction as described by Burgoon and Buller (1994). They stated that "deceivers must continually monitor their own performance while adapting to receivers' feedback" (p. 157). This ongoing monitoring of a deceiver's self while they are deceiving is self-assessment, just a form of or comparable to selfassessment for the purpose of deception at that time.

Deceivers Recognize Deception

A study by Wright, Berry, and Bird (2012) attempted to measure if there is an association with deception and deception detection. The study found that there was a significant relationship between deception and deception detection. This finding was done in an experiment that most studies of deception do not attempt, a social interactive setting. The study ultimately found that there was a positive correlation between the ability to deceive and the ability to detect deception and states these findings support a possible theory that there is a general deception ability. The researchers continue to call for more research into this area and theories. This study is attempting to do that by studying the relationship of self-assessment in detection deception. If there is a correlation between the two, then more research would be needed and justified to see if self-assessment is a factor in the general deception ability.

Deception Training

The other factor that will be researched in this study is the average person's aptitude to receive training and see if there is a correlation between training and deception detection. DePaulo (1994) argues that it is possible to train the average person to better detect deception, however there is no concrete research that supports the evidence of any single training program or technique that can make anyone better at deception detection. There is no "magic bullet" or "secret technique" to deception detection. One of the more reliable ways to increase a person's deception detection ability is for them to not rely on visual or audial cues very much because "nonverbal and verbal cues to deception are ordinarily faint and unreliable" (Vrij, Granhag, & Porter, 2010, p. 111). While an inexperienced liar or a liar in a high risk environment to themselves may show more verbal or nonverbal cues in their deception (Frank & Feeley, 2003) these cues vary from person to person and also across cultural and social norms (Seiter, Bruschke & Bai, 2002; Vrij et al., 2010). Therefore the training that will be used for this study will be to inform the participants of the unreliability of verbal and nonverbal cues and to not use these cues as deception detection. Instead the participants will be instructed to use temporal and paralinguistic cues to detect deception.

There will be two main points of focus in this study. The first will be the focus of self-assessment being correlated to deception detection due to how the deceiver "must continually monitor their own performance while adapting to receivers' feedback" (Burgoon & Buller, 1994, p. 157). This high self-monitoring will make individuals better at detecting deception. The second focus will be the attempt to instruct the average person in deception detection with only minimal instruction, to see if this minimal instruction (with a focus on paralinguistic and temporal cues) will yield any results. I hypothesize that those with high self-assessment will be better at deception detection. I also hypothesize that minimal training will make the participant better at deception detection.

Self-Monitoring

Self-monitoring is a mixture of managing and monitoring your behaviors and your actions. Self-monitoring is explained by Snyder as "Self-monitoring (self-observation and self-control guided by situational cues to social appropriateness)" (1974, p. 526). It is how you observe your own actions and reactions to situational and social occurrences as well as controlling them. This

is performed within certain learned social constructs and norms, but is also personal and each individual has learned their own methods of self-observation and self-control. Because of this personal and individual aspect of self-monitoring each individual has different "levels" of self-monitoring. Meaning that there are those who self-observe and self-control more (high self-monitors), or those who do not (low self-monitors).

METHOD

Participants

Selection of participants was done by convenience sampling. The participants were all active students enrolled in an American regional university at the time of the experiment. The groups of participants were all psychology classes selected by the researcher. The groups chosen to have the training variable were done so by random assignment by class.

MATERIALS

Stimulus video

First, the deception stimulus used for this experiment was a 68 second video of an individual making five statements. four of the statements were true statements and one was a false statement, a complete fabrication. The statements used by the actor in the video were partially scripted. The subject of the statement to be made by the actor was selected and scripted by the researcher (Appendix A) but what the actor said on the video and how they presented on video were the actor's actions alone. The actor in the video had no deception or deception detection training. The actor was instructed on two points for the statements to be said. First, was that the statement selected as the lie was to be a complete fabrication, not a half-truth or partially true statement. Second, was that the statements were not to be overly long or short. The statement to be the lie was selected at random. The video begins and ends with no breaks between the statements being read. The actor says the statements one after another with a slight pause, 1-2 seconds, between each statement said.

Measures and tests

There were two handouts given to the participants. The first was the Self-Monitoring Scale (Snyder & Gangestad, 1985). The second was the information sheet (Appendix B) provided to the participants to gather demographic and other data as well as an answer sheet to the stimulus video. On the information sheet was a confidence scale asking the participant to rate their ability to detect deception in others compared to the average person. This confidence scale was presented as a continuum from one to six, with one being much worse than the average person and six being much better than the average person.

Design

The test would be conducted in a similar fashion each time it was executed. The researcher would be working off of a basic format and script for the presentation and conduction of the study to maintain as similar a presentation of the study between the participant groups as possible. The only part of the script that changed between the four groups was that for two groups there was a part of the presentation where they received the minimal training; the other two groups did not.

The training received by two of the participant groups was about paralinguistic and temporal cues. The researcher told the participants to look for two specific characteristics that could strongly suggest deception, specifically the pitch of the speaker's voice as well as the length of the statement given by the speaker. The participants were told that an increase in pitch of the speaker's voice indicated a strong chance of deception by the speaker. The participants were also told that when there is a noticeably shorter or more concise statement then that is a strong indication of deception for that statement. I presented this training to the two participant groups at the end of the scripted presentation, right before the stimulus video. I then restated the two characteristics of pitch and statement length/conciseness after the stimulus video.

RESULTS

In total, data was collected from 153 participants. Males accounted for 21.1% of the participants and females accounting for the remaining 78.9%. The distribution

of race/ethnicity was 8.6% African-American, 2.6% Asian-American, 44.1% Hispanic/Latino, 31.6% Anglo/Caucasian, 7.2% mixed, and 5.9% other. Age for participants ranged from 18 to 69, with the mean age being 22. Distribution of school classification was 32.2% Freshman, 4.6% Sophomore, 25.7% Junior, 36.8% Senior, and 0.7% Graduate Student.

Deception Detection & Perceived Ability

Of the 153 participants data collected, 145 gave full and complete answers to the research. A total of 23.4% of the participants answered that they thought their ability in detecting deception was average or a three on the continuum. Only 5.5% of participants answered that their ability was less than average, 4.8% answering with two on the continuum and 0.7% answering with a one or "Much worse than the average person" on the continuum. A total of 37.9% of the participants gave a four on the continuum of deception detection ability. Lastly, a total of 26.2% of participants answered with five on the continuum, with 5.5% of participants answering that their ability of deception detection was "much better than the average person" or a six on the continuum. Altogether 6.2% of the participants rated themselves as less than average for their ability, 61.6% of participants reported their ability was greater than average for deception detection.

Participant's perceived ability of deception detection was not significantly related to correctly identifying the deceptive statement in this research. The mean of deception detection confidence for those who chose incorrectly which statement was the deception in the stimulus was 4.03. The mean for those who chose correctly was 3.91. This means that there was almost no difference in the confidence of those who correctly identified the deception and those who did not.

Self-Monitoring & Deception Detection

Self-monitoring was analyzed by two separate methods. It was found statistically significant in both the chi square and t-test.

T-Test

The mean self-monitoring score for those participants who did not identify the false statement among the other true statements was 9.62 (SD= 3.27) while the

mean for those who were able to correctly identify the false statement was 8.19 (SD = 2.85)(t(138) = 2.55, p = 0.012). This means that compared to those who were not able to identify the false statement, those who were able to identify the false statement tended to score lower in self-monitoring. These statistics were found statistically significant utilizing a t-test, in a two tailed independent samples test.

Chi-Square test

For the chi-square test the participants were divided by median split between low and high self-monitors. The median split was established as scores from 1-8 being low self-monitors and scores from 9-18 being high self-monitors. That yielded 74 participants classified as high self-monitors and 66 participants classified as low self-monitors. Of those high self-monitors, 16 of the 74 chose correctly (21.6%); of the low self-monitors, 31 of the 66 chose correctly (46.9%). This difference was statistically significant (χ^2 (1, N = 140)) = 10.05, p = 0.002). This is further evidence that those low in self-monitoring are more capable of detecting deception than those high in self-monitoring.

Self-Monitoring and Confidence in Deception Detection

The confidence of participants in their deception detection ability showed a significant difference between low and high self-monitors. The mean confidence of participants who were low self-monitors was 3.73. The mean confidence of participants who were high self-monitors was 4.18. This difference was found to be statistically significant (t(134) = 2.74, p = 0.007).

Also, it was found that there was a significant positive correlation between self-monitoring and confidence, r= +0.265, p= 0.002. This shows a positive correlation between these two variables, which shows that those with higher self-monitoring had a higher confidence in their deception detection and those with low self-monitoring had lower confidence in their deception detection.

Instruction and Deception Detection

In this project, instruction was not helpful or effective in increasing one's ability to detect deception. The group with instruction was able to correctly identify the false statement 34% of the time (29 out of 85), while those

in the control group (i.e. without instruction) were able to identify the false statement 29% of the time (19 out of 65). This difference was not statistically significant $(\chi^2(1, N = 150) = 0.40, p = 0.52)$.

Instruction and Confidence in Deception Detection

Lastly, and surprisingly, the level of confidence did not differ significantly between the instruction group and the non-instruction group. The mean confidence level for those in the instruction group was 4.10 (SD = 0.99), while the mean level for those in the non-instruction group was 3.89 (SD = 0.99) (t(143) = 1.25, p = 0.21).

DISCUSSION

The variable of training helping participants detect deception was not significant. There was a positive difference between the groups that were given instruction and those that were not, but not enough to support our hypothesis. However, we did find that there was significance in self-monitoring determining deception detection ability but not in the direction we had hypothesized. Low self-monitors were more successful at determining deception than high self-monitors.

Our results did not support our hypothesis that minimal training would make the participant better at deception detection. The data from this study could not support the hypothesis and was not statistically significant. These results are actually in agreement with DePaulo (1994) that no single way of training can, by itself, make an individual better at detecting deception. An implication of these findings that less training does not work effectively could mean that more training both in material and time spent is more effective. The effect of instruction on confidence in deception detection was also determined to not be statistically significant. There needs to be more research done to determine the viability of these theories.

Our results show that self-monitoring and deception detection was indeed statistically significant. The results did not support our original alternative hypothesis that high self-monitors would be better at deception detection. It was actually the exact opposite, lower self-monitors were better at detecting deception when compared with higher self-monitors. This goes against

our theory that those who are higher self-monitors would be better at detecting deception because of their high tendency of self-monitoring and the relationship with deception and self-monitoring as pointed out by Burgoon and Buller (1994) with deceivers continually monitoring their performances. Our results do not support this research and instead refute it, saying that those who are less likely to monitor themselves are actually better at detecting deception. Because of these results our research does not support our own hypothesis as well as the support of previous research we presented.

If future research is considered, more robust methods of selection and counterbalancing need to be implemented. Larger and more equitable (gender) sample sizes should be used. More robust testing should be utilized, checking for and trying to reduce variance as much as possible. More research focus needs to be done on self-assessment with a better test and scale developed to determine a relationship between self-assessment and deception detection.

The implications of this research is that if low self-monitors are better at deception detection then it would allow for more research opportunities in deception and deception detection. It would also allow for better screening of deception detection abilities in occupations that require it, such as interrogators, police officers, intelligence operatives, etc. The instruction variable was found statistically not significant, however, if more research is done to determine significance there could be implications of training a "naïve" population with minimal effort or resources, but only if significance is determined.

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APPENDIX A: Stimulus Video Script

INSTRUCTIONS FOR YOUR STATEMENTS: Whatever statement is chosen as the lie, the lie cannot be a half-truth or partially true. It must be a complete fabrication.

Statement #1: Tell where you were born and a brief statement about your hometown

Statement #2: Tell a childhood experience that you are fond of

Statement #3: Tell about an experience you have had at work or school

Statement #4: Describe a relative- not just physically but a characteristic or two

Statement #5: Describe your favorite food and a characteristic or two about it

APPENDIX B			
Please answer the following questions. All of your responses will be confidential.			
Sex:	Male Female		
Race/Ethnicity:	African-American Asian-American Hispanic/Latino Anglo/Caucasian Mixed Other		
Age:	years		
Year in school:	Freshman Sophomore Junior Senior Graduate Student Other		
Compared to the average, person how would you rate your ability to detect deception in others? [Circle one]			
Much worse than The average person 1 2	Much better than the average person 3 4 5 6 H STATEMENT WAS A LIE?		
1 2	3	4	5

FIELDS OF COAL: ENVIRONMENTAL CHANGE ALONG THE RIO GRANDE IN A FORMER COAL MINING AREA

by ARTHUR OADEN



ABSTRACT

Research was conducted on a historically significant pond located in the former mining town of Dolores, located north of Laredo, Texas. The intention of this work was to obtain records of and determine the extent and occurrence of droughts in the region, and also gather information on human industry and settlement in the area. This pond was created only 130 years ago, in 1882, giving a distinct time frame for any sedimentary records showing changes in water levels and environmental conditions. Additionally, the pond is located ~160 m downslope from a former coal mine and waste pile, and was therefore a likely site of coal accumulations as well as other debris. Field work was conducted to obtain sediment cores from the pond, and corroborating evidence was gathered using historical documents. Sediment cores obtained were shorter than desired as a result of the densely packed clay, which reduced the penetration of coring equipment, leaving the historical extent of the cores limited.



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The split cores were scanned with a spectrophotometer, and the results were transformed into first derivative spectrum equivalent data to identify common sedimentary minerals according to their first derivative signatures. The analysis on the cores determined a large amount of clay minerals, and also limonite/goethite according to prominent first derivative peaks centered on ~440 and 540 nm. This agrees with visual observations, given the largely yellowish-brown hue of the cores. Magnetic susceptibility analysis indicated minor changes in mineral content, some associated with ash from fires. Basic conclusions indicate the present environment to be minimally affected by the coal operations and resulting tipple pile, but with a variance over time in mineralogy and composition of sediment, with further research necessary to determine the occurrence of droughts and other environmental change, as well as the extent and nature of human activity in the area.

LITERATURE REVIEW

Coal production along the Rio Grande was a significant feature of history in the border region of Texas, and provided livelihoods to many Mexican immigrant laborers and others who lived near and worked at the mines. Towns came and went, and thousands of people lived, worked, studied, and played in areas where the primary industry was coal production. However, with a few exceptions, analysis of these areas is limited. One exception on the historical side is the town of Seco

Mines, which is now a suburb of Eagle Pass, a town whose history was documented by Roberto Calderón in South Texas Coal Mining: A Community History¹. However, this is the only border mining town to receive extensive scholarly analysis. There were many similar towns in Webb County to the north of Laredo, but these have not been studied in depth, either despite or because of their proximity to such a large border town. Additionally, a geologic or environmental perspective has not been used to analyze the coal production itself. The most recent geologic analysis of this area, Tertiary Coals in South Texas focused on the basic geology and more recent areas of coal production, such as the Palafox mine. Population statistics have been analyzed, but in the realm of environmental studies there has been little analysis of this area.

This project will focus on the town of Dolores, one of several mining towns in Webb County. (Figure 2, 4) The specific mine in the area studied is the San Jose Mine, one of four coal mines in operation in the town of Dolores. This mine operated from the 1890's until almost 1920, and will be analyzed through an environmental analysis of the sedimentary record which aims to help us understand environmental change such as drought in the area, and will also help us understand the nature of coal production and human activity in greater detail. Some aspects of coal mining and labor in the Rio Grande have been analyzed by geologists, as well as historians to some extent, and both history and geology will provide us information to help further an understanding of how this infrastructure developed and expanded. Natural factors such as drought would have affected the ranchers in the area and the gardens of residents, while human factors produced by settlement and industry may have left their record in the sedimentary record as well. Information to assist in analysis of this record can be found in references by geologists and historians as well as historical documents.

One of the premier historical documents researching coal mining along the Rio Grande has been *Mexican Coal Mining Labor in Texas and Coahuila* by Roberto Calderón. In it he discusses the labor and life of coal miners throughout the Rio Grande area, both in the United States and Mexico. He includes statistical analyses of Webb and Maverick Counties, detailing the composition and origins of the laboring population.

The tables show that in 1910 the San Jose mine was the single largest employer of workers except the Minera Mine², and showed that it had one of the largest populations of school children, except for Minera³. The large population housed here should certainly have affected the environment and been recorded in the sedimentary record to some extent.

Geologic data on this area will be derived primarily from sediment cores taken from a pond near the mine of interest. Interpreting and exploring for this record requires additional information. Information on the general layout of the area can be easily found through several maps and satellite photography in Google Earth. The initial source of data was a map of the mining operations in the area from George H. Ashley's USGS report The Santo Tomas Cannel Coal, and this gave a clear indicator of where the various mining operations in Northern Webb County were located4. (Figure 4) Correlating this with the use of Google Earth imagery and USGS topographic maps showed that the area of interest contains a pond produced from railroad construction in the late 19th century. This pond should contain a sedimentary record of the local area accumulated over the time period from 1882 to the present.

The pond near the mine was originally a shallow creek or gulley that led to the Rio Grande. After construction of a rail gradient in 1881⁵, the upper part of the depression became a pond⁶. This led it to accumulate sediment from the construction and run-off from the surrounding area. This will have allowed the accumulation of a record of the surrounding environment's changes, with droughts, floods, fluctuations in the water level, and other changes being recorded in the sedimentary record. Additionally, this tank is downhill from a tailing pile of the San Jose mine. This should have allowed sediment from the tailing pile to have accumulated, providing a geologic record of mining activity.

The coal production can be analyzed and understood by taking advantage of the characteristics of the coal, such as changes in chemical composition. The coal mined in this area was studied in the 19th and early 20th centuries, and was found to contain large amounts of volatiles, more per volume than most other examples of coal in the country. Several different

analyses described the content. All show a high volatile content that makes the Santo Tomas cannel coal an outlier⁷. Ashley suggested that this could be useful for the Haber process if there was an efficient means to extract the volatiles, particularly the nitrogen content necessary for the creation of ammonia. Volatile content from the 1892 *Report on the Brown Coal and Lignite of Texas* for specimens obtained from this area show that volatiles were 42.67% of mass for a specimen from an outcrop, and 51.05% for a specimen from the Santo Tomas mine⁸. Samples obtained from the Cannel Coal Company closer to the current worksite show 48.84% volatile matter, 36.61% fixed carbon, 9.07% ash, and 2.45% sulfur⁹.

The unique characteristics of this coal could be tested for, and variations in quality over the course of production could be observed from core samples as well. These variations could tie to price, but must be observed in light of environmental conditions. Coal residue in the pond would degrade more severely in times of drought, when the water level was lower and the effects of aeolian action were more pronounced, while potentially being less subject to those affects at higher water levels and accumulation rates with less influence of sunlight. This could allow for a better understanding of the timeframe if correlated with hard records, thereby giving accurate dates to periods of drought activity.

Because this area is near the Rio Grande, the water table is relatively high, and the pond in question frequently remains wet. However the surface is dry, and gardens had to be irrigated with water pumped from the mine shafts. Gardening was a common activity for the households in the town of Dolores, and was benefitted by the good supply of water in the area. This supplemented the food that could be bought in the store with miners' wages, which was the only industry in the town besides seasonal employment in agriculture¹⁰ and animal husbandry¹¹. Fluctuations in the water level should be easily observable, give us an insight into life in the area and the availability of water for agriculture, and help us better understand the sequence of droughts in the area and their effects.

Reduction or termination of the coal signal should have begun by 1940, with the termination of mining operations in 1939¹². In 1939 the mines were shut

down because of the need to upgrade safety equipment, and the increasingly limited amount of money from coal mining. Coal production in the State of Texas had been declining precipitously across the state since 1920, the start of the oil boom, and by the end of the 1940's had largely been replaced by oil and natural gas¹³.

Many other affairs occurred in Dolores, but they are much more difficult to analyze with respect to the sedimentary record. The operation of the school, the general store, and the world of marriages and births, are all things that are beyond the scope of this study. However, we know that livelihoods in this town were dependent on coal production, and thus we can gain insight into the town's coal industry and major environmental events through an analysis of the sedimentary record found in this small pond in Dolores.

METHODS

The main research materials for laboratory research consist of several cores, along with the written documents that can assist in understanding the area. Several methods were used to retrieve and analyze the cores.

Core retrieval

Cores were obtained using aquatic and terrestrial coring systems to obtain records from various areas of the pond. (Figure 3) The terrestrial coring system uses standard 10 cm internal diameter (4 inch) Schedule 40 PVC pipe. The aquatic coring system was a hammer core using 7.62 cm internal diameter (3 inch) transparent acrylic pipe. Two terrestrial cores were retrieved from the edge of the pond, and one aquatic core was retrieved from the center of the pond.

For laboratory analysis retrieved cores were split, with one half being archived and the other used for analysis and sampling.

Core Logging

The cores were logged using visual observations to determine geologic units and notable features in the observed stratigraphy. A Munsell Color guide was used to accurately determine colors and record them in core logs.

Spectrophotometry

Color signatures were analyzed at 1 cm and .5 cm levels using a Minolta CM-2600d color spectrum analyzer from Konica Minolta and Spectramagic software. Data was gathered primarily from the visible spectrum in the range of 360-740 nm in 10 nm increments and as Munsell color codes to ensure accuracy and consistency of data, and spectrographs were made from the raw data. Data was converted to first derivative spectra and compared to first derivative spectragraphs generated from the USGS Spectral Data Library¹⁴ to compare to the spectra of the cores at various depths. Basic principles for this form of analysis were set down in Balsam et al., which gives a variety of recommendations and suggestions for procedures to be followed when analyzing cores¹⁵.

Photography

Cores were photographed to record their state before destructive sampling was begun. A light box with full spectrum Phillips F17T8/TL950 fluorescent lamps and a Canon Rebel XS DSLR camera were used to produce raw photographs. GIMP¹⁶ was used to combine the raw photographs through manual joining to produce full length sediment core photographs.

Loss on Ignition and Bulk Density Analysis

Samples were obtained from working half of split cores for loss on ignition and bulk density analysis. Samples were retrieved using a 1 cm³ constant volume sampler and composition was determined through dehydration and through combustion at 550 °C and 1000 °C. The procedures followed were based primarily on Dean (1974) ¹⁷, with additional modifications to the approach based on Heiri et al. (2001) ¹⁸ and Santisteban et al. (2004) ¹⁹.

Magnetic Susceptibility Testing

Magnetic susceptibility testing was used to determine changes in magnetization of material in the area, both as a result of natural processes and human activity. Equipment used consisted of a Bartington MS2E high resolution surface scanner and an MS3 magnetic susceptibility meter. Environmental factors and bacterial processes can produce changes in magnetic susceptibility²⁰. Local areas can be affected heavily by

local industrial processes, and the coal production in the area may leave a detectable signature from the operation of coal powered ventilation equipment²¹.

Analysis of Primary Source Documents

Documents on Dolores were obtained from the Webb County Heritage Foundation, the Laredo Public Library, and the Webb County Courthouse. These documents were analyzed to determine events that may have been recorded in the sedimentary record and determine the general time frame for the pond's existence.

DISCUSSION

We can find much evidence for environmental change, including drought and desiccation, as well as evidence for periods of standing water in the area; however there is no clear time frame to determine when this sequence of events began. There is definite evidence of changes in the material over time, but no records of coal production were obtained as a result of local soil conditions, limiting data on that area of the project.

Mineralogy

We can see some change in the mineralogy of the cores over time, but overall there is a general consistency. Spectrophotometry data shows variation over time, with no perfectly stable environment around the pond, as is to be expected in a man-made environment of recent origin. One difficulty found was the large amount of noise introduced into the spectral data from approximately 600 to 750 nm, preventing the use of that part of the spectrum for analysis. The pond frequently becomes oxic (Figure 7), and has changed over time as a result of environmental factors in the recent past, one major cause of changes in mineral content. Site DP-02 shows greater variation than DP 01, while DP-AC shows large variations only in the 600-725 nm portions of the spectrum. (Figures 8, 9, 10) Also, DP-AC shows a high noise signature in the strata from 3.0-3.5 cm, most likely caused by the high amount of desiccation in that layer. (Figure 10)

Possible causes of variation in sediment composition are the locations of the cores in the pond, leading to slightly different environments of deposition. Spectral data shows a strong signature for montmorillonite among the clay minerals of the core, with a clear peak at 530 nm in almost all strata in each core. Goethite is also a strong possibility, with clear signatures at approximately 550 nm in DP-01 and DP-02 (Figure 8 A, 8 B). There is a possibility of limonite as a major component in oxidized strata as well, given its mineralogical relationship to goethite and the consistent visual and spectral data. See appendix for USGS mineral information used to interpret cores. Variations are probably caused by environmental factors such as droughts in the area, but oxic conditions also may be a result of biological factors introducing oxygen into the pond despite it being submerged. Biological factors are also a possible cause of present day oxic conditions, although the general shallowness of the water (Figure 1) is the most probable cause.

Sedimentology

The longest core retrieved, DP-01, shows charcoal in the deepest portion, indicating a local fire in the area at the time of deposition. (Figure 9) Determining the extent of this fire from cores is not possible, as neither of the other cores show any evidence of burning. Given the large amount of sand found in this unit and the oxic conditions, drought is the most probable cause.

Bulk density data had some errors due to unfamiliarity with the equipment by the researcher conducting the sampling. Another difficulty was the viscosity of the sediment, and the presence of tree roots, both of which reduced the ease and accuracy of sampling. The above features are noted in the core logs. (Figure 9, 10, 11)

With no clear start of aquatic sedimentation, which should begin in 1882, there is no clear timeframe for any of the environmental changes recorded in the cores. As seen in all graphs, photographs, and logs, none of the cores contained terrestrial sediments from the past, showing that all material found was deposited at some point after the pond was created. Attempts to find information on coal production, human activity, drought, and environmental change was limited by the lack of data and the absence of a clear timeframe to indicate when these events occurred.

Magnetic data indicates greater amounts of magnetic susceptibility in the past, some of which may be natural or human in origin. Figure 5 shows high magnetic susceptibility for core DP-01 produced during the

deposition of burnt charcoal and sand, caused not just by an increase in the sand content but also the conversion of less magnetic minerals in the soil into magnetic forms. Figure 7 shows heightened magnetic susceptibility as well, with a corresponding increase in organic matter, suggesting a biologic factor in magnetism. DP-01 has a corresponding increase in magnetic susceptibility as noncombustible material increases (Figure 6), a common feature of sediments such as sand. This could potentially indicate a drier environment in this period, but could also be a consequence of sediment transport by flooding, as the lack of highly oxic stratigraphy indicates the pond was submerged at this time.

CONCLUSION

Information about recent geologic history was obtained, but it could not be correlated to dates, and lacks information from the time of the pond's creation. Further information could be derived with different coring equipment, such as a Vibracore to obtain a more complete record from this pond. Lack of equipment limited the depth of core that could be obtained, and thereby limited the data that could be obtained on the time frame this research project was intended to study. Further research in this area may provide additional information and help us to further understand the changes and influences on the environment, including droughts and other environmental changes, as well as help provide greater insight into the industry of the area.

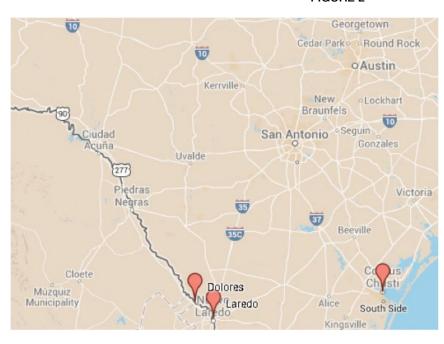
DATA AND MAPS

FIGURE 1



Photograph of pond on the day cores were retrieved. The picture shows a wet but shallow environment. (Courtesy Alex Musella)

FIGURE 2



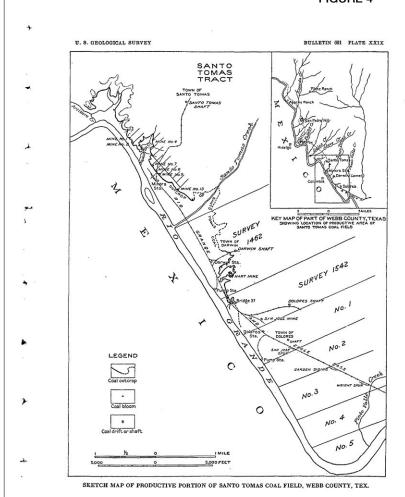
Map showing the location of Dolores in the State of Texas. (From Google Maps)

FIGURE 3

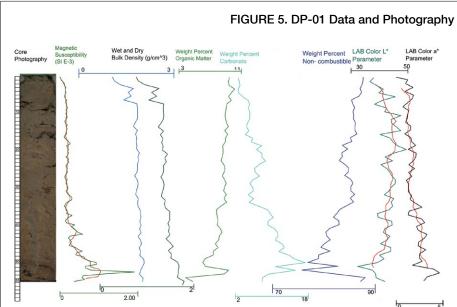


Aerial photograph of pond showing approximate locations where cores were taken. (From Google Earth)

FIGURE 4



Map from Ashley's Santo Tomas Cannel Coal²² showing locations of production, including the site of interest, the San Jose mine in Dolores.



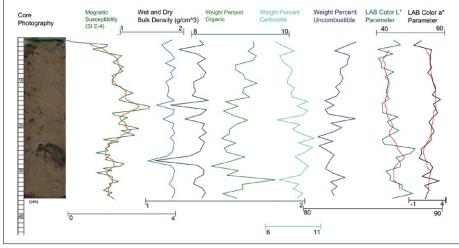
Decreasing magnetic susceptibility and increasing noncombustible matter are notable features of this sediment core.

There is also a trend towards an increase in

There is also a trend towards an increase in organic matter and noncombustible matter and a decrease in carbonate.

Red indicates 5 Point Average

FIGURE 6. DP-02 Data and Photography



Core shows fluctuation in magnetic susceptibility, with a clear increase over time in noncombustibles. There is also an increase in organic materials, with a decrease in the proportion that is carbonate.

Red indicates 5 Point Average

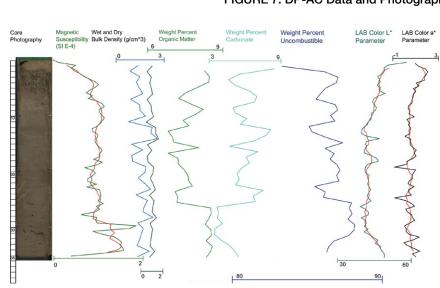
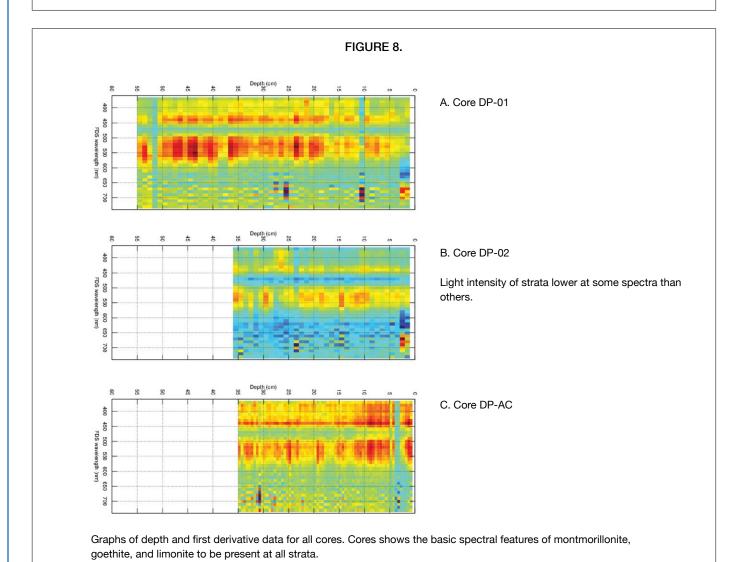
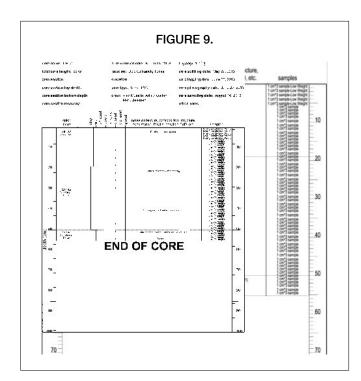


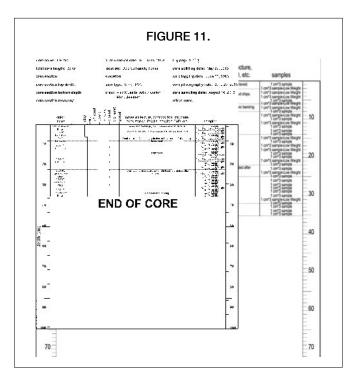
FIGURE 7. DP-AC Data and Photography

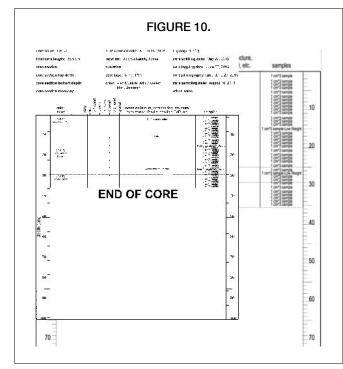
This core follows the pattern of DP-01, and shows a clear trend towards decreased magnetic susceptibility. Also shows a trend towards increasing carbonate material over time. Carbonate and organic matter were both stable below 25 cm.

Red indicates 5 Point Average



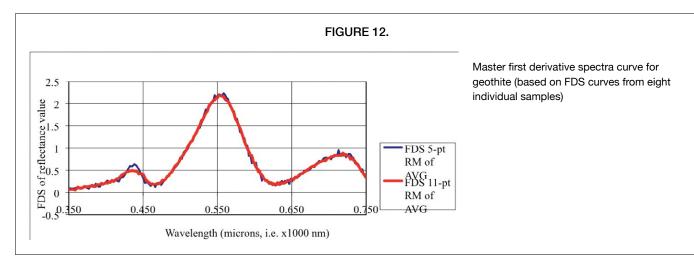


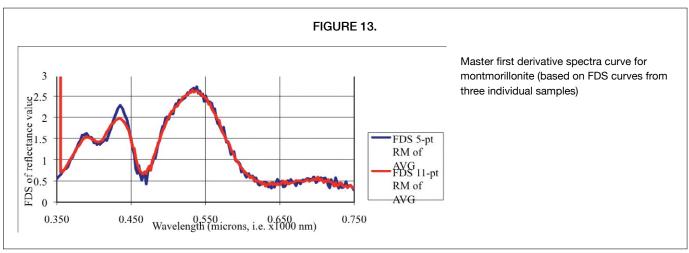


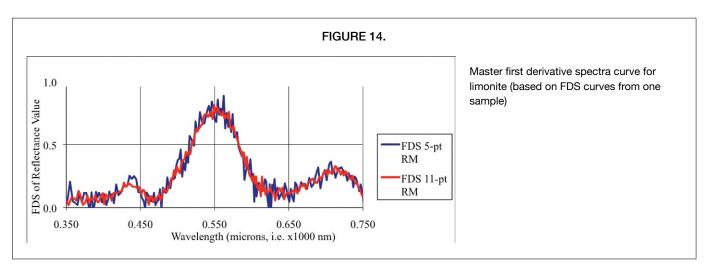


APPENDIX

Spectral Figures calculated from USGS Spectral Library Samples²³







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HOW ART FROM THE ROMANTICISM AND REALISM PERIODS INSPIRED SOCIAL REVOLUTION IN NINETEENTH CENTURY FRANCE



by SARAH PONS

ABSTRACT

Art plays a more dramatic role in society than one may initially assume. It is on display for all to see and this realization is enough to demolish any idea of field-designated confinement; for example, it would be unrealistic to say that only a painter could appreciate a painting. Art is influenced by its surroundings and the opinions that accompany the society in which it is birthed, such as disillusionment with the government or the effect of national tragedy. Whether or not the audience is aware of the creators' influences depends on luck, but if a painting is made from passion then that emotion will usually come across to whoever gazes at it. In the long run, the question does not rest on the intentions of the artists, but rather upon how the viewers react and how they handle their own reactions. The responses may be as simple as an appreciative glance but other acknowledgements may be the spark that is needed to change the world. The

unprecedented public responses to The Raft of the Medusa, Rue Transnonain and The Stone Breakers are examples of how art from the Romantic and Realism periods inspired social revolution in nineteenth century France.

LITERATURE REVIEW

The Raft of the Medusa

The Raft of the Medusa was painted in 1819 by the French Romanticist painter Jean-Louis André Théodore Géricault. The painting depicts the real life tragedy of the ill-fated freight Medusa and her forgotten passengers. In 1816, 15 people were rescued from a floating raft in the middle of the Atlantic (Alhadeff 17). The survivors were refugees from the Medusa which had shipwrecked off the coast of Africa nearly two weeks prior to the rescue. In the aftermath of the wreck, a large raft had been fashioned out of the irreparable ship and originally held one hundred and fifty of the Medusa's passengers (Alhadeff 17). Also, the raft was originally tied to the ship's companion boat, which carried Captain Hugues Duroys de Chaumareys and his accompanying government official, Colonel Julien Schmaltz (Alhadeff 118). After departure from the African coast, the cables that connected the secondary boat and the raft were severed and the passengers were left to the complete mercy of nature. The headcount diminished from one hundred and fifty to fifteen in just thirteen days; many



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of the passengers succumbed to hunger, drowning, and heat strokes, and the dead bodies provided nourishment to those who awaited rescue (Alhadeff 17). On the thirteenth day, the French vessel *Argus* took a wrong turn in its navigation and that turn lead the ship to the occupants of the raft. In September of 1816, *The London Times* had commented that the surviving passengers "would have finished devouring each other had they not been saved by a miracle" (Alhadeff 45). The passengers had been rescued entirely by accident (Alhadeff 118).

Géricault began painting his masterpiece in the winter of 1818, two years after the tragedy had become public (Alhadeff 9). Desiring realism, the painter conducted an in-depth study of decaying flesh by purchasing preserved anatomical parts from Parisian morgues and storing them in a space that acted as both his apartment and art studio; it was a tiny dwelling which was located in the infamous Parisian slum known as Faubourg du Roule. The room was chosen specifically for its confining walls because Géricault aimed to experience a portion of the fright that was felt by Medusa's refugees (Alhadeff 9). Géricault's primary source of information concerning the event came from Alexandre Corréard, who was one of the lucky few to see land again. The painter used the memoirs of both Corréard and his fellow survivor Jean-Baptiste Henri Savigny, which were both published in 1817 (Riding, "The Fatal Raft"). Most of the final composition is based on the disturbingly detailed words of the scarred survivors.

The Raft of the Medusa was revealed at the Paris Salon of 1819. The critics did not favor the piece due to its dishonorable characters (Alhadeff 29); the figures were called such because they were neither praying (Alhadeff 29) nor were they of the noble class (Deligiorgi, "Modernity with Pictures: Hegel and Géricault"). The public was unnerved by the barely-there presence of the rescue ship (Alhadeff 46) but they were moved by the human contact that the survivors were eager to give and receive (McCullough 216). The people buzzed with excitement over Géricault's decision to place a man of African descent at the top of the pyramid of survivors (Alhadeff 12). In the unveiling of the painting, racial lines and class divisions were forgotten; spectators of all races and classes gathered to honor Géricault and to mourn the passengers who were lost (Alhadeff 128-129). Historian, Albert Boime, has linked Corréard's memoirs and Géricault's painting to the abolitionist views of 1800s France (Riding, "The Fatal Raft") and I must agree with this notion. This paper will discuss the elements behind the idea.

Rue Transnonain

Rue Transnonain is an 1834 lithograph by the French caricaturist Honoré Daumier. It represents a real massacre that occurred inside an apartment complex at the corner of the Parisian street, Rue Transnonain (Symmons 33). On April 13th, 1834, a group of Parisians erected barricades in their residential streets in a demonstration of sympathy toward the working class citizens of Lyon, who were protesting a new law which prohibited the formation of workers' unions (Symmons 31). The Paris event was over as quickly as it had begun, due to the violent tendencies of the National Guard which killed thirty protestors (Symmons 31). The men of the National Guard retained their posts well into the night of the 13th when a rifle was fired in their general direction; no one was hurt nor were the police sure of the direction from which the shot was fired (Symmons 31). The police assumed the shot had come from the roof of the building at the corner of Rue Transnonain; their reasoning for such an assumption is unknown. The uniformed men waited until dawn because it was illegal to enter one's private residence before sun-up, according to article 359 of the French Constitution (Symmons 33); when dawn came on the 14th of April, the National Guard stormed the complex, killing twelve men (Farwell 56) and injuring several women and one child (Symmons 33). This was done when no evidence had linked the tenants to the mysterious shooting. The residents of the Rue Transnonain apartment complex had not even been involved in the barricade assemblies (Symmons 31).

Daumier's lithograph is a visual aid for the massacre's aftermath. The scene displays the fate of one random family who lived in the apartment building. The father and grandfather lay dead, after having been dragged out of bed by the police; the child is being crushed by the weight of his father, who had meant to shield him from the shots (Symmons 33); the mother lays motionless in the corner, perhaps unconscious or stunned. The *Rue Transnonain* lithograph was published in the summer of

1834 in the left wing pamphlet *La Caricature* (Farwell 57). Daumier had been compared to Géricault in his quest to portray the victims of capital negligence as dignified martyrs (Farwell 57). Daumier was praised for his stylistic homage to Francisco Goya, which came through in the utilization of chiaroscuro (Symmons 33). Charles Philipon, the publisher of *La Caricature*, described Daumier's piece as a prime example of modern history and stressed the fact that it was not a caricature but a grim account of a real, national tragedy (Kimball, "Strange Seriousness': Discovering Daumier").

Daumier already had a reputation amongst the French government due to a prison sentence in 1832, over his anti-July Monarchy caricatures (Letheve 166). When Rue Transnonain was distributed amongst the citizens of Paris, King Louis-Philippe attempted to have all copies destroyed (Kimball, "'Strange Seriousness': Discovering Daumier"). The lithograph was used as proof of how violent the government was willing to be in order to suppress the masses (Hofmann, "Ambiguity in Daumier (& Elsewhere)"). Amy Wiese Forbes implies that France's liberal art of the 1830s had a profound effect on the people and politics (Forbes, "The Lithographic Conspiracy: How Satire Framed Liberal Political Debate in Nineteenth-Century France"). I think there is truth to this thought and this article will be exploring the possibility of such a concept.

The Stone Breakers

The Stone Breakers is a painting by the French realist Gustave Courbet. This piece was revealed at the 1850 Paris Salon and was met with both disdain and awe. The art critic known only as Champfleury called Courbet "the new Géricault" (Clark 124), due to his heroic portraval of the common man. In 1849, Courbet wrote a letter to Champfleury, who was also his friend and colleague. In the letter, the realist described his two stone breakers as "pitiable creatures" (Chu 92). Courbet goes on to say- "I made up none of it; I saw these people every day on my walk" (Chu 93). There is one man whose limbs -which have stiffened over timehave been made to look like extensions of a machine (Chu 92). His clothes are coarse and dirty while his ratty, straw hat offers very little protection from the afternoon sun. The younger of the two is suffering from scurvy and can be seen lifting a large sack of the

broken stones (Chu 92). They are building a road to Belgium, which is a perfect nod to industrialism (Clark 80). The items scattered throughout the field —which includes hoes, sledgehammers and picks— are the tools used for splitting the stones. A rustic pot in the corner holds lukewarm soup and it is their only source of food during their twelve hour shift (Chu 92). Stone-breaking is the oldest job in rural areas (Clark 79), but the people of the French countryside were growing increasingly bitter about their monotonous, back-breaking lives. Courbet said in regards to his characters— "you are born like one and you die as the other" (Clark 80); he was speaking of the working class.

The Stone Breakers was created when the Realism art period was in its infancy, but it sets the tone for the entire genre. Courbet's heavy use of browns and grays and minimal utilization of color took many critics aback and caused them to react unfavorably. Courbet paints his masterpiece with the primary assistance of the pallet knife, a skill that many painters find difficult. The artist makes a conscious move to hide the faces of his two workers, in order to make them more indirectly relatable; these unfortunate, forgotten children of society could be your brother, your father, your friend or even yourself. This notion no doubt contributed to the mood of opening night and Courbet loved it. It is no secret that Courbet thrived on shock value.

The Stone Breakers opened at the Paris Salon, which was actually free to the public, and much of the working class flocked to this particular show (Janson 91). Pierre-Joseph Proudhon, a leading figure in what would later be known as the Third Republic, described Courbet's painting as a socialist piece (Janson 122). Interestingly, it was not Courbet's intention to make a statement on social class, but he was more than willing to offer his art to serve the worker's revolution (Janson 122). Art historian, James Henry Rubin, has stated that The Stone Breakers and other Realism paintings by Courbet are closely linked to the philosophy of Proudhonism, which fights for the rights of the common man (Frayling, "Rev. of Realism and Social Vision in Courbet and Proudhon" by James Henry Rubin). This same philosophy ultimately led to the creation of the 1871 Paris Commune (Woodcock 277-278); the 1871 Paris Commune is an independent society that focused on proletariat needs (McCullough 307).

METHODS

Topic of discussion

The main topic in this research is the role of art in social revolution. This is not a new concept; many people have connected individual art pieces and entire art genres to communal cataclysm. Art has even been accused of instigating social revolt rather than coming out of the aftermath (Richards, "Art as the Soul of the Revolution"). Iconic pieces do, indeed, come after revolution; Ferdinand Victor Eugène Delacroix's 1830 painting Liberty Leading the People was a direct reference to the freshly finished French revolution of 1830 (Kleiner and Mamiya 666). I am not dismissing the post-revolution collection. I also believe that art has been guided by the changes that occur within the artists' environments. To say that art only comes after revolution, however, is an almost trivial claim. Even Leon Trotsky, a Marxist radical, implied that art comes before revolution and that art has even gone so far as to help the public prepare for an impending shift in the community (Rasmussen, "Art, Revolution and Communisation"). I was fascinated with this concept, and that is why this article will focus on certain historically relevant revolutions that may have been inspired by or even caused by art.

Nineteenth century Paris

The reason I chose pieces from this era is because the nineteenth century produced an unprecedentedly high number of French revolutions; such an amount had not been seen in the Western world since the Renaissance. The monumental series of revolts stem from the fact that nineteenth century Paris was filled with social and political turmoil. The city doubled in size over the course of fifty years (1800-1850) and this expansion was encouraged by the government (Cole 1). The national leaders were desperate to recover from the record high death toll that occurred in the last decade of the eighteenth century (Cole 1). Most of the French population was illiterate and this implies that the majority of the population consisted of either the working class or peasantry (Cole 1). By 1851, there were 900,000 day laborers in Paris alone and this was due to the ever growing industrialization of Europe (Gildea 93). The French people lived a bleak existence. In the first half of the nineteenth century, most of the population could barely afford food and were homeless more often than not, while the privileged few lived in fear of the very people whom they belittled, because of the rising anger amongst the less fortunate. The nineteenth century was a dismal time, particularly for Paris due to the country's major shift in economics, politics and morality.

The chosen pieces

I wanted to write about these paintings because of the circumstances surrounding their births and their receptions, which were quite unique. The aspect of The Raft of the Medusa that took people by particular surprise was that the man hoisted up above the desperate and the dying –the hero of the piece, the one to signal the rescue ship- was black. John Singleton Copley's 1778 piece, Watson and the Shark, has a man of African descent amongst the rescue party, but nobody had ever portrayed a black man as the only savior of the unfortunate. What was even more unexpected was the avalanche of positive reactions Géricault received from his peers and admirers. I found this part of the story to be interesting because in 1819, slavery was very much alive on both sides of the Atlantic. The bourgeoisie and the elite had not been known for their acceptance when it came to racial and economic diversity, but this painting moved those very people to tears. Let us not forget that most of the individuals who frequented art galleries were of the upper class. My wish was to investigate the connection between The Raft of the Medusa and the abolitionist movement, an organization that became a part of the mainstream in France less than one year after the opening of the painting. I also desired to connect the abolitionist movement to the French revolution of 1848 which led to a revision of the French Constitution.

Rue Transnonain hit the Parisian papers in 1834 and the public outrage it generated was directed at the police. In the 1800s, the police force was not part of the private or even the regional sector; each officer worked directly under the orders of the French monarchy. The debacle at Rue Transnonain proved that the National Guard was careless, arrogant, and simply had too many liberties. They were allowed to enter homes without warrants and kill those who were deemed most likely to cause a fuss; they usually targeted the lower half of the French caste system. Police brutality was at an all-time high in the nineteenth century and that problem was brought to light with the help of Daumier's piece. I wished to link

this lithograph to a conspiracy that occurred in 1834 which was extended to a revolution that transpired in 1839. I also think that there is an association between *Rue Transnonain* and a censorship law that went into effect in 1835. Lastly, I believe a connection may be found between *Rue Transnonain* and the 1848 rewrite of the French Constitution.

The Stone Breakers was painted in 1849 but it was not revealed until the 1850 Paris Salon. I chose this painting because it was among the first of many epic Realism paintings to revolve around the lowest part of the French caste system, which consisted of rural peasants. The reaction it drew from the public was one of unprecedented compassion toward the ones who had been forgotten by the majority of Parisian society. I found the reaction captivating because the age-old flippant attitude toward the poor changed very quickly once this piece became public. The workers of Paris had little to no rights, and it was only after the premier of Courbet's painting that things started to evolve socially. Unions and protests demanding better working conditions and higher wages grew immensely from 1850 onward. I wanted to unite The Stone Breakers with the onslaught of workers' unions and I also wanted to explore the painting's possible connection to the 1871 Paris Commune.

Status in art history

The paintings and the lithograph are considered to be some of the most important in art history because they stray so far from the norm of their time; this commonly happens in art during times of despair (Rasmussen, "Art, Revolution and Communisation"). All memorable pieces are unique in their respective ways, but only a few are able to pull a grandiose response on opening night and still generate the same reactions two hundred years later. This respect goes beyond technique or how many people attended the opening. Extenuating circumstances play a part in what makes a piece great. If the subject points out a flawed system or provides a what-if scenario concerning a social change that the people want but do not know how to obtain, it may provide just enough of a push to motivate the people to try to change the law. I believe this is the case with The Raft of the Medusa, Rue Transnonain and The Stone Breakers.

Limitations

My biggest limitation was the lack of accessible literature on the given subjects. The three featured artists are popular and revered within the art history community, although the pieces I have chosen to represent do not seem to be favorites amongst the researchers. The social importance of *The Raft of the Medusa* is undeniable and it has been universally accepted as Géricault's masterpiece. Many art historians and scholars, however, have focused on Courbet's 1849 piece A Burial at Ornans rather than The Stone Breakers. Rue Transnonain has been repeatedly pushed aside for Daumier's Gargantua, which is an even more blatant display of hatred toward the monarchy. The lack of publication on The Stone Breakers and Rue Transnonain caused me to take a different approach and examine the documented speeches of nineteenth century revolutionaries to see if maybe there had been any references to any of the pieces or to art in general. I also compared the dates of the same speeches to the dates of the pieces' respective premiers. I isolated the social content of the art piece and then I looked for parallelisms between those same scenarios and the social uprisings that seemed to happen right after the premiers of these three works of art. I even went as far as to compare the amendments of the 1848 French Constitution to see if there had been any drastic changes in the nineteenth century revisions. Interestingly, it was through these approaches that I discovered some of my most astonishing information, and my biggest limitation turned into my biggest advantage.

Beneficial to art history

Exposing art as a stimulus to revolution will make art history accessible to a wider spectrum of enthusiasts. Many people unconsciously dismiss art history because it is a concentrated area and the average individual shies away from what is not within their immediate interests. This project simply aims to broaden some horizons. The entire point of revolution is to strive toward positive change, and that desire is something to which *everyone* can relate. The art featured in this project was birthed from political ideas and desires which many people already had; the artists were just among the first to express them in such a blatantly uproarious fashion. Art that is inspired by a revolution that is already in progress or has even come to a close is all well and good, but if one is able to reverse the roles and suggest that art

inspires revolution, then the casual observer may have the incentive to take art —especially art history— a little more seriously. My goal is to break down the walls of confinement and connect art history to something more universal— the fight for a better tomorrow.

DISCUSSION

The Raft of the Medusa

Before I offer any constructive theories on this painting, I will first mention the conspiracy surrounding *Medusa*. One of the reasons why many historians and revolutionaries have tied it to abolitionism is because the ship had actually been secretly involved in the slave trade (Alhadeff 118). Captain Hugues Duroys de Chaumareys turned a blind eye while Colonel Julien Schmaltz smuggled African captives aboard the ship (Alhadeff 16-17).

One of the things that cannot be overlooked is the man of African descent, who is clearly portrayed as the hero of the featured scenario. He is at the highest point of Géricault's pyramid of human misery and the man takes it upon himself to try and signal a potential rescuer. Everyone who viewed it in the 1819 Salon assumed that the artist was most likely attempting to make a political statement with this bold decision. I believe wholeheartedly that Géricault was indeed trying to cause a social stir but -at the same time- I do not think it was his original intention. Only one dark-skinned man was aboard the raft in 1816 and his name was Jean Charles; he was a French soldier who was among the 15 castaways that lived to be rescued (Riding, "The Fatal Raft"). It is widely speculated that the man rising from the emaciated crowd is Jean Charles, though Géricault himself never disclosed this information (Riding, "The Fatal Raft"). Because the artist never formally identified his hero (Riding, "The Fatal Raft"), I do not believe he is Jean Charles. If one examines two of Géricault's 1818 preliminary studies for The Raft of the Medusa -both of which are entitled The Sighting of the Distant Argus- it should be noted that the dark-skinned man who signals the Argus was not part of the original composition; in fact, the one black man (out of the final three) that appears to be a constant in the developmental process is the man standing next to Corréard's figure (Alhadeff 60-63). I suggest that Corréard's companion is actually Jean Charles because of his consistent presence.

The debate of who's who leads us back to the man at the top of the pyramid. I would like to shift the focus away from his ambiguous identity and to the item that he is frantically waving; he uses a red cloth as a flag which was no more a part of the preliminary process than the man. This detail has evaded mainstream attention and I dare say it is one of the most provocative aspects of the piece. The red flag has a colorful reputation in the history of social revolution; it has been used in several major political demonstrations since the French Revolution of 1789 and has represented multiple sects of the common outcast. Long before it represented the overlooked worker, the red flag had been coined by slaves as a symbol of revolt ("Story of the Red Flag," revcom.us). The man and the flag may have been last minute decisions on the part of Géricault but it was not accidental. I believe the flag is a symbol of revolution and I think the risen man represents one who needs -nay, deserves- a revolution; this potential social commentary parallels the Medusa castaways needing and deserving rescue after being left for dead. The red flag is also a universal sign of distress, which had the majority of the French population in a death grip at that time. Whether this character and his inanimate object were planned from the start or not, they provoked a response of which many artists can only dream.

Among the French citizens who were struck particularly hard by Géricault's oil painting was the great Victor Hugo. Hugo, the renowned author of the 1862 classic, Les Misérables, was also a known revolutionary and even compared his liberal views to those of the proletariat leader, Robespierre (Petrey, "Victor Hugo and Revolutionary Violence: The Example of 'Claude Gueux""). The author and poet owned several houses all over France and each dwelling had rooms which Hugo set aside for the purpose of hiding and aiding exiled French citizens (Robb 352). His code name for these rooms of refuge was 'The Raft of the Medusa' (Robb 352). This is a prime example of how a single piece of art will greatly inspire a state of mind. Art may lead to public revolts, but it will also lead to the most personal and private of protests.

Many spectators covered the floors of the 1819 Paris Salon, which has been marked as a "turning point" (Gildea 184) in the history of art and the impact it is capable of having on people. One who had been present for the unveiling of *The Raft of the Medusa* was

a liberal art critic by the name of Charles Blanc. He was so overwhelmed by the painting that he would study it and write about it for decades to come (Clüver, Plesch and Hoek 66). Whilst staring at the piece, he uttered-"why must a divine image of hope be so small and so uncertain" (Alhadeff 46). He was speaking of the barelythere Argus which would eventually make its way to the raft. This statement perfectly summarized the mindset of post-French Revolution Paris; the regional revolt in 1789 was a time of hope, but by 1819, the people were growing pessimistic because very little had actually changed (Plack 3). The provisional French government following the 1789 revolution consisted of that infamous dictator, Napoleon Bonaparte; after Napoleon stepped down from the throne, a king was back in office and the French people were back to square one. The future of the common man was uncertain because it seemed that not even ten years of bloodshed had made a difference; the relevance of those many years of revolution was growing smaller (Plack 3). The Raft of the Medusa could not have come at a better time. The people were ready to try for a revolution once again. Particularly coincidental is the fact that Charles Blanc was the brother of Louis Blanc, a man who played an outstanding role in the French revolution in February of 1848 (Traugott, "The Mobile Guard in the French Revolution of 1848"). Louis Blanc was very much aware of Géricault and even followed his brother's example and wrote several manifestoes about the man and his art (Clüver, Plesch and Hoek 66). The Raft of the Medusa is Géricault's masterpiece and there is no possibility that any abolitionist and/or Géricault fan had been unaware of the painting.

I would like to conclude the discussion on *The Raft of the Medusa* by mentioning the abolitionist movement itself. One month after the piece was revealed, a man by the name of Henri Grégoire led an anti-slavery protest. In his motivational speech, Grégoire referred to slaves as "castaways" (Alhadeff 135). Abolitionist literature became a part of the mainstream in 1820, as did the entire movement (Alhadeff 132), and circulated with dizzying speed throughout the French public all the way up to 1848. In February of that fateful year, there was a short-lived revolution which managed to overthrow the July Monarchy of France and put the Second Republic in place as the provisional government. This drastic alteration of the government initiated a revision of the

French Constitution the very same year; in this revision, there was a section which specifically stated that slavery would be abolished in France forever (Lieber, "Appendix XIII: Constitution of the French Republic, Adopted in November of 1848," libertyfund.org). It appears that the 1848 revolution single-handedly put an end to slavery in France (Oldfield, "Rev. of French Anti-Slavery: The Movement for the Abolition of Slavery in France, 1802-1848" by Lawrence C. Jennings). As a final tie between abolitionism, revolution, and Géricault, I would like to point out a detail on the seal of the Second Republic: the seal meant to symbolize the Second Republic portrays Liberty sitting next to an artist's palette.

Rue Transnonain

There was an incredible outpouring of animosity toward the National Guard and the king after the Rue Transnonain lithograph became available to the masses, and the entities on the receiving end of this new public hatred did not react well. The latter half of 1834 was overflowing with trials issued by King Louis-Philippe against journalists, newspaper editors, and political caricaturists (Beck, "Pages in History: Daumier's Political Eye"). The July Monarchy used the law to target those believed to be causing further damage to the image of the monarchy and its acting government systems. Many satire artists were intentionally antagonizing the King, including Daumier himself (Beck, "Pages in History: Daumier's Political Eye"). The string of trials continued throughout 1835, until Louis-Philippe issued a censorship law that planted considerable restrictions on political manifestoes and caricatures (Mayor, "A Bequest of Prints by Callot and Daumier"). The left-wing newsprint La Caricature, the publisher of Rue Transnonain, was discontinued by authority of the government (Beck, "Pages in History: Daumier's Political Eye"). The decision to terminate the newsprint that carried Daumier's lithograph is important testimony to the government's brash reaction to confrontation.

I would like to turn to the people's point of view and entertain the notion that both a conspiracy to revolt and an actual revolution were inspired by the art piece in question. In 1834, a famous socialist activist by the name of Louis Auguste Blanqui headed an underground liberal assemblage known as *Les Société des Familles* (Bookchin 66-67). The goal of this proletariat group

was to get as many of their members initiated into the National Guard as possible, only to execute a plan to take down the police from the inside (Bookchin 66-67). I came across a translated version of Blanqui's directions on approaching the National Guard. He stresses that they must refrain from public demonstrations and when taken to court if caught- none must confess lest they be named a traitor of the people (Abidor, "Organization of the Society of Families," marxists. org). Blanqui's plan to crush the police was uncovered before it could be properly executed. Blanqui was then sentenced to prison for conspiracy in 1836 (Bookchin 66-67). What I find interesting about this particular incident is its directed target. The French Revolution in 1789 targeted the king, himself, Louis XVI (Hunt, "The Rhetoric of Revolution in France"). The several smaller revolutions that occurred between 1830 and 1834 set their vengeful sights on the bourgeois (Popkin, "Worlds Turned Upside Down: Bourgeois Experience in the 19th-Century Revolutions"). Yet here, in 1834, revolutionaries had gone after the police. The major revolution that had led up to the Rue Transnonain massacre back in April of 1834 had nothing to do with the police, but with the oppression of the worker (Symmons 31). I find it peculiar that from 1789 to April of 1834, the target was always the elite, but then priorities dramatically shifted. I think this had everything to do with the tragedy of Rue Transnonain; the police slaughtered innocent citizens and the people reacted to it. Blanqui was reacting to the massacre itself, but I believe that Daumier's lithograph served as additional stimulus.

I would also like to touch upon a major revolution that happened in France after the 1834 debacle. The year was 1839 and the short yet productive revolution of May 12th was led by the newly released Louis Auguste Blanqui. He and his reunited posse, which changed its title to Société des Saisons, picked up where they left off (Bookchin 66-67). In a speech Blanqui made prior to the revolution, his fire-and-brimstone words were clear -his people were to follow the military and the police to uncover their posts (Abidor, "Appeal of the Committee of the Society of the Seasons," marxists.org). The people of the Society did discover the posts and they spent twenty-four hours raiding armory shops, desecrating the posts, and violently storming the police headquarters (Pinkney, "The Revolutionary Crowd in Paris in the 1830s"). In the preliminary speech, Blanqui

said-"...the blood of our murdered brothers cry out to you and demand vengeance. Let it be terrible, for it has delayed too long..." (Abidor, "Appeal of the Committee of the Society of the Seasons," marxists.org). Let us note that Blanqui uses the word murder, a term that specifies the slaughter of innocents; the men who were killed at Rue Transnonain were not in any way involved in the protests (Symmons 31), so a slaughter of innocents is exactly what happened in April of 1834. We should not ignore the fact that Blanqui uses the term brother which addresses the male gender; only men were slain in the massacre (Symmons 33). Blanqui also uses the word delay, implying that such a demonstration as the one made in 1839 was previously attempted- and it was. I believe that Blanqui was talking about the murdered men of Rue Transnonain who still -even five years later- had not been properly avenged.

Lastly, I would like to look at the 1848 French Constitution. The Second Republic revoked the 1835 censorship law, giving the press back the freedom they had lost (Lieber, "Appendix XIII: Constitution of the French Republic, Adopted in November of 1848," libertyfund.org). The liberties of the police were drastically suppressed under the new constitution, which included the people's right to resist illegal arrest, the restriction of entering private homes without a signed warrant, and the ban of fatal punishments regarding political protests (Lieber, "Appendix XIII: Constitution of the French Republic, Adopted in November of 1848," libertyfund. org). I believe these new articles were issued because of the tragedy of Rue Transnonain which was permanently imprinted into the minds of the people, thanks to Daumier's gutsy lithograph.

The Stone Breakers

The Stone Breakers had a lasting effect on the proletariat circles. The painting brought the abysmal conditions of the working class to public attention, and the reaction began during its unveiling at the 1850 Paris Salon. Pierre-Joseph Proudhon, who was a radical liberal, fell madly in love with this painting and even dubbed it a socialist painting (Janson 122).

Strikes and unions in the commoners' communities were nothing new before 1850, but Paris saw a dramatic increase in public demonstrations once the second half of the nineteenth century was under way. The right to form a union was legalized in 1848 (Lieber, "Appendix

XIII: Constitution of the French Republic, Adopted in November of 1848," libertyfund.org). Each proletariat union served as a stepping stone to the immensely influential social movement known as the Paris Commune of 1871. The Paris Commune was the first French society to have a government run by the working class ("The Paris Commune, 1871," speakout-now.org). The Commune hit some incredible milestones in terms of workman's rights. It is thanks to this movement that we have the eight hour work day and set salaries ("The Paris Commune, 1871," speakout-now.org). Through my research, I discovered that Gustave Courbet was heavily involved in the Paris Commune and was elected to the head of the art council by his revolutionary peers ("The Paris Commune, 1871," speakout-now.org). To make matters even more interesting, Courbet's personal consultant was none other than Honoré Daumier ("The Paris Commune, 1871," speakout-now.org).

The Commune was based on Proudhonism specialized form of Socialism founded by Pierre-Joseph Proudhon himself— which displayed a deep resentment and disregard for class segregation (Woodcock 277-278). Karl Marx, one of the Commune's leaders, stated that Proudhon had a bigger influence on the Commune than even Marx himself (Woodcock 277-278). Back in 1850, Proudhon asked for Courbet's permission to use *The Stone Breakers* as the image of his revolution, to which Courbet readily gave his consent (Janson 122). I believe that Proudhon's followers were very familiar with Courbet's painting. The Paris Commune is testimony that Proudhon did have a massive entourage which revered the day laborer, going as far as to compare one to a prince (Larkin, "Courbet and His Contemporaries, 1848-1867").

Several proletariat communities solicited secular churches and instead of placing statues of Christ in the altars, the people desired to hang *The Stone Breakers* (Larkin, "Courbet and His Contemporaries, 1848-1867"). I believe this bit of information says what people thought of Courbet and his masterpiece. They viewed Courbet as a savior and in turn saw *The Stone Breakers* as his slogan. I also sense that people of other classes held Courbet in high regard. During a Courbet exhibit in 1855, one anonymous member of the bourgeoisie wrote in the guest book- "pray that Courbet will wash the feet of his stone breakers" (Clark

90). Many people have dismissed this comment as a typical, demeaning response from the upper class, but I cannot disregard such a unique choice of words. Let us not forget that religion was a big part of bourgeois life in the nineteenth century and odds are that none would so boldly compare a controversial artist to Jesus— unless they were being serious. I cannot help but wonder if the working class did indeed have sympathizers from the upper classes. Let us not forget that most of the working class was illiterate in nineteenth century Paris (Cole 1), so who would be the ones to actually read the pamphlets and literature published on the peoples' rights? I would not be so quick as to forget any help the poor may have received, even if it came from the privileged.

There is only one existing photograph of the Paris Commune, which had been taken in 1871. I looked at the arrangement of its members and their surroundings; the more I looked at it, the more I realized the scene had some striking similarities to another image with which we have grown familiar. The people of the Commune stand around a massive wall which is made entirely of broken stones. Many of the members in the back can be seen carrying rifles, but the figures standing in front of the wall are proudly holding sledgehammers, much like Courbet's stone breakers ("1871: The Paris Commune," libcom.org). I believe, without a doubt, that *The Stone Breakers* led the snowball effect that influenced the development of the Paris Commune of 1871.

To close this discussion, I would like to take a moment to talk about Courbet's good friend Jules Vallès. The two had met in 1850 and he, too, was a dedicated participant in the 1871 Paris Commune (Edmonds, "In Search of Jules Vallès"). As the general public grew more comfortable with Socialism, Vallès regaled his listeners with a prominent memory from his early revolutionary days, the day he first encountered *The Stone Breakers*-"...our emotion was profound. We had a deep-rooted respect for everything that suffered or was defeated, and we asked the new art to play its part in the triumph of truth and justice..." (Clark 135). I think his comment speaks for all who took Courbet's portrayal of the forgotten and used it to change the world.

CONCLUSION

In conclusion, I attest that art plays a significant role in the French revolutionary movements. One needs to take into consideration the fact that there were few forms of escapism in the nineteenth century, and art was the reigning form of entertainment. Today, there is the cinema, television and social media and all have been known to affect the minds of those who are driven to make a difference. Art is an age-old celebration of beauty and inspiration and it is widely distributed through the world and is at the fingertips of millions. Every monumental figure in history starts out as just a part of the millions. To think that art does not affect the advancements of society is unrealistic. Too many people have access to art and the dramatic representations reach out to them on a deeply emotional level. Revolution is fueled by emotion and the spark needs to start somewhere. I see no reason why it should not begin with art.

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THE EFFECT OF PHYSICAL FATIGUE ON VISUAL RECOGNITION AND VISUAL TRACKING OF COLLEGE STUDENTS

by ABBY QUINONEZ



ABSTRACT

Although many researchers have conducted investigations on the effect of physical fatigue on the human body, the effect of physical fatigue on visual skills has gone undocumented. While evidence from numerous studies has shown physical fatigue to reduce physical performance, it is unknown if physical fatigue affects visual skills. Purpose: The purpose of this study is to investigate the effect of physical fatigue on visual recognition and visual tracking of college students. For this study, fatigue was defined as a heart rate greater than 80% of the subject's maximum heart rate. A null hypothesis was utilized stating that no significant difference will exist between the pre-test and post-test scores on the visual recognition and tracking skills of college students. Methods: Visual recognition and tracking response times were measured using the computer software Vizual

Edge, which assesses both categories using Vizual Edge Performance Trainer (VEPT) scores and individualized category scores. A t-test for dependent samples was utilized with a p value of .05. Results: Data analysis indicated no significant difference between the pre- and post-test visual recognition and visual tracking scores of college students. Although an increase in visual skills for the students was observed, it may have been due to an increase in familiarity of the VEPT software. Conclusion: The result of this study indicates that physical fatigue does not play a significant role in the visual recognition and tracking skills of college students. It is suggested that further research be conducted on this subject in order to provide more evidence on the effect of physical fatigue on visual skills.

Keywords: visual tracking, visual recognition, VEPT, fatigue, Vizual Edge, students

INTRODUCTION

Visual skills are one of the most important aspects of a person's visual sense. For athletes, vision serves as a direct medium used to interpret their surrounding and provide visual feedback, which in return can improve reaction times, hand-eye coordination and other areas within the sport that help increase performance (du Toit, et al., 2010). "The role of vision in our everyday lifestyles is immense and adequate...visual skills are needed for simple tasks which include reading and



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writing, that are especially important for students" (du Toit et al., 2011). Improvement of visual skills can provide improved performance to those who use visual training exercises (Spaniol et al., 2008). Of the five senses, vision serves as the primary and dominant sense that is critical to the planning and execution of responses to certain stimuli (du Toit et al., 2011). Understanding how a person's visual tracking and recognition differs with physical fatigue can benefit other researchers, coaches, doctors and athletic trainers by identifying ways to help improve the visual skills of their athletes in order to optimize the ability of their players and team as a whole.

Fatigue is one of the primary causes in decreased physical ability. It is a "complex phenomenon described as a time-dependent, exercise-induced reduction in the maximal force generating capacity of a muscle" (Letafatkar, Alizadeh, Kordi, 2009). Since fatigue is unpreventable, knowing the effects it has on the human body can be beneficial in preventing injuries. "Muscular fatigue is considered a predisposing factor to the appearance of injuries, such as the ankle sprain" (Letafatkar, Alizadeh, Kordi, 2009). In addition, muscular or physical fatigue can be the cause of a failure within the process of creating a muscular contraction. Once physical fatigue occurs within a person, a trickle-down effect is then caused, which in return has a negative effect on all other systems in the body (Stiles, 1920). Studies have also shown that muscular fatigue can cause an adverse change in proprioception (Letafatkar, Alizadeh, Kordi, 2009). Due to this belief, testing the effect of physical fatigue on visual skills will provide insight to better understand the relationship between these two variables.

VEPT is a software program designed to test five different areas of vision including visual alignment, depth perception, visual flexibility, visual tracking and visual recognition (Vizual Edge, 2012). The software provides the ability to determine the subject's pre- and post-test scores for visual tracking and recognition response times, using a combined VEPT score for all five areas and categorical score for each component of the test. With the use of the software, improvement in speed and efficacy, as well as training the visual skills of a person's visual system can be noted, with continued regular use of the software (Review of

Optometry, 2008). A comparison of both test scores, provided by VEPT will determine if fatigue played a significant role in the outcome of the student's visual skills. Recent studies suggest that visual training can improve sport performance, but neglect the significance of transferring findings into a relatable testing form for real world situations. (Maman, Gaurang, & Sandhu, 2011). While on the other hand, another study resulted in no significant improvements with the visual testing software program beyond those which resulted in familiarity with the program (Abernethy & Wood, 2001). The two focal points for this research, visual tracking and visual recognition time, are both important aspects of a person's visual skills. There are two main differences that separate visual tracking from visual recognition. Visual tracking uses modeling inter-frame motion and appearance changes, while visual recognition needs modeling appearance changes between frames and gallery images (Shaohua, Rama, & Moghaddam, 2004).

The purpose of this study was to investigate the effect of physical fatigue on visual recognition and visual tracking of college students. For this study, physical fatigue was defined as a heart rate greater than 80% of the subject's maximum heart rate. A null hypothesis was utilized stating there would be no significant difference between the pre-test and post-test scores on the visual recognition and tracking skills of college students.

LITERATURE REVIEW

Visual skills of college students and fatigue. Vision is a sense that we use in order to evaluate our external environment (du Toit et al., 2011). Vision is used in order to direct and analyze our surroundings, which in return exemplifies the necessities required to fulfill certain criteria. College students require vision in order to eliminate certain problematic issues that may arise, such as stress (du Toit, et al., 2011). A study was conducted by du Toit and associates in 2011, testing the effects of visual skills on college students using different sports related vision testing protocols. From the study it was determined that having the correct sport visual training can eliminate or minimize stress and other related issues that may occur over time. Fatigue can be caused by being mentally or physically exhausted, as well as from other sources (Stiles, 1920). With all the

demands on a college student's everyday life, fatigue and stress are two of the most reoccurring subjects (Soyeur, Unalan, & Emali, 2010). A study conducted by Soyeur, Unalan & Emali (2010) examined the fatigue levels experienced with physical activity done by a sample of college students. It was found that a significant amount of physical activity increased the student's heart rate to an optimal point of fatigue. The point of fatigue differed between students depending on the amount of physical fitness and wellness each student demonstrated.

All subjects in the present study achieved physical fatigue (80% of max heart rate) at different rates according to their individual physical fitness levels. Therefore, heart rate may not be an ideal determinant of when a person may reach their fatigued states.

Fatigue. There are two main types of fatigue: physical and mental. Tsutsumi and colleagues (2011) define fatigue as "difficulty in the initiation of or sustaining of voluntary activities" (171). Physical fatigue can also be attributed to muscular fatigue (Stiles, 1920). When muscular fatigue occurs it can often influence other body systems (Stiles, 1920). Stiles also mentioned how muscular fatigue is connected to the cause of mental fatigue due to the pressure asserted onto other body systems.

A study conducted by Tsutsumi and partners was done using 12 male volunteers and a mirror visual feedback system that was used to regulate physical fatigue (Tsutsumi et al., 2011). The volunteers were split up into two groups of six, each group being exposed to different situations. One group performed fatigue inducing activity while viewing the mirror on the first day of the experiment, while on the second day the fatigue activity was done without viewing the mirror. For the other group, the opposite took place. The results of the experiment showed no significant change in the visual analogue scale (VAS) scores of both groups on their right hand, but the left hand in both groups showed lower VAS scores when the mirror was present (Tsutsumi et al.,2011).

In summary, despite the type of scale used to score the significance in visual testing, results did vary depending on the accuracy of the testing and the definition of physical fatigue used for each study.

Vizual Edge. Vizual Edge is a computer based vision test that is used to improve an individual's visual skills using 3D equipment and five area tests. The website is aimed at enhancing the visual skills of athletes (Vizual Edge, 2012). The Vizual Edge website explains how Vizual Edge Performance Trainer (VEPT) uses a 3D computer based program in order to evaluate, measure and boost eye movement, depth perception, recognition and tracking ability. Each portion of the VEPT test measures five different elements of visual skills, they include: visual alignment, flexibility, recognition, tracking and depth perception.

A study done by Clark et. al., (2012) tested the reliability and validity of testing visual skills on athletes to determine if there is an improvement in visual skills after high performance training The players participated in a pre-season and in-season visual training regimen using visual equipment such as Dynavision, Near Far training and other visual exercises (Clark et al., 2012). After comparing results from past seasons, the team increased their batting average and on-base percentage. The study indicated that visual skills exercise implemented into the athletes' daily routine improved team batting performance. In addition to Clark's study, Oudejans (2012) conducted research on elite female basketball players by comparing the results of their visual control training using Plato LC goggles within a control and experimental group using a pre-test and post-test and 50 free-throw shots. As a result, Oudejans concluded that a slight increase in vision control was demonstrated with the experimental group when compared to the pre-test and post-test.

Lastly, visual skills testing whether done by computer software or other test varieties may be a determinant in the assessment of the visual skills of athletes. Depending on the sport and subjects being assessed results may vary with different visual skill assessments.

METHODS

Subjects and Sampling

The data necessary for this project was archival and collected from kinesiology classes at Texas A&M University-Corpus Christi (TAMUCC). The data was used with permission from the TAMUCC Department of Kinesiology. Seventeen subjects, both male and female, participated in the study. The demographic age

of the subjects ranged between 20-39 years old. The convenience sample represented a mixed group of ethnicities.

Instruments

Visual skills were assessed by the VEPT, a commercially developed web-based application that assesses visual flexibility, visual depth perception, visual alignment, visual tracking and visual recognition. Scores from each of the five visual elements were combined and calculated to provide a comprehensive VEPT score for all subjects. Testing occurred on two separate occasions, once while the students were in a physically rested state (pretest) and again in a post exercise state (post-test). The treatment of exercise consisted of stair stepping until a desired heart rate of 80% of maximum heart rate was achieved. For the purpose of this project, only categorical VEPT scores for visual tracking and recognition were utilized. Testing was completed in a controlled environment at the Department of Kinesiology's Biomechanics Lab at TAMUCC.

Research Design and Statistics

A t-test for dependent samples (p=0.05) was used to determine if a statistical difference existed between the pre and post exercise VEPT scores. A one group pre-test and post-test experimental design was utilized for this study.

Procedures

IRB approval was granted from the TAMUCC Institutional Review Board. Convenience sampling was used to recruit subjects from two kinesiology courses (KINE 4311 and 5313). The subjects were instructed to wear any corrective eyewear to encourage valid and reliable test results.

Computers in the Biomechanics lab were used for all pre and post VEPT testing. Test administrators informed all subjects of necessary instructions, and remained to provide help throughout the entire procedure. All subjects were assigned a partner and worked in pairs. One partner tested while the other provided assistance. Each subject completed VEPT testing using 3D glasses. Each individual within the group completed both preand post-tests before exchanging equipment with their partner. Once the pretest was complete, each subject was instructed to exercise using stair stepping to induce

an exercise response of a minimum of 80% of maximum heart rate. Once threshold heart rate was achieved, the subject retested using VEPT. Heart rate was monitored with an electronic heart rate telemetry system. If at any time the subject's heart rate dropped below the 80% percent target, the subject returned to stair stepping in order to stay above the target heart rate.

Once testing was complete, individual VEPT scores were calculated for the pre-test and post-tests. For the focus of this study, only the final scores from Vizual Recognition and Vizual tracking categories were used. From the data, averages for each category were calculated along with a t-test for dependent samples to determine if any statistically significant differences existed between the mean pre and post fatigue scores in the two categories.

Results

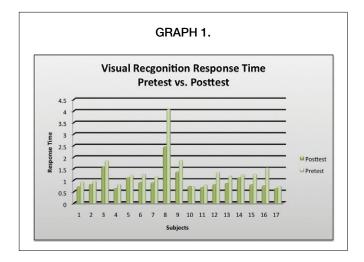
The results from the study determined that there was no significant difference in the pre and post fatigue VEPT scores for visual tracking and recognition. In order for the t-test to be considered significant, values over 2.11 would need to be achieved due to the degrees of freedom being 16. A probability of 0.05 was used to determine the significance of the study. Table one demonstrates the pre-test results for each of the 17 subjects, including a mean score of 1.35 seconds for visual recognition response time and a mean of 0.58 seconds for visual tracking. When the pretest scores were compared to mean posttest scores for both categories (table 2), a visual recognition score of 0.997 seconds was found along with an exact same score of 0.58 seconds for visual tracking. A slight increase existed between the average pre and post recognition time scores. Although response time averages stayed quite consistent, a minimal increase in the average percent correct for both categories was noted. The increase could be attributed to the students becoming familiar with the software or not reaching the optimal 80% maximum heart rate necessary. Yet, the small increase in response time and percentage correct was not sufficient to create a significant difference in a post fatigue state. A t-test for dependent samples was used to compare the mean pre-test and post-test scores, which determined no significant difference (p=0.000825) for visual recognition and tracking skills of the subjects. Due to the outcome of the t-value, the null hypothesis was accepted.

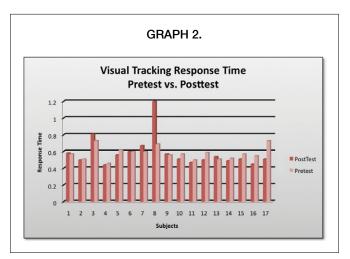
TABLE 1. Pretest Results

Subjects	Visual Recognition Response Time (0.5-4.0)	Visual Recognition % Correct	Visual Tracking Response Time (0.1-4.0)	Visual Tracking % Correct
Highest Possible Score	4	100	4	100
Lowest Possible Score	0.5	0	0.1	0
1	0.93	93%	0.57	97%
2	0.97	93%	0.51	91%
3	1.85	80%	0.73	81%
4	0.82	96%	0.46	89%
5	1.2	89%	0.62	94%
6	1.26	89%	0.6	89%
7	1.15	80%	0.6	89%
8	4.07	21%	0.69	64%
9	1.86	92%	0.56	99%
10	0.72	87%	0.57	91%
11	0.8	96%	0.5	91%
12	1.34	95%	0.59	94%
13	1.18	92%	0.51	89%
14	1.24	78%	0.52	94%
15	1.25	86%	0.57	92%
16	1.54	75%	0.55	87%
17	0.74	87%	0.73	84%
Average	1.3482353	84%	0.5811765	89%

TABLE 2. Post-Test Results

Subjects	Visual Recognition Response Time (0.5 to 4.0)	Visual Recognition % Correct	Visual Tracking Response Time (0.1 to 4.0)	Visual Tracking % Correct
Highest Possible Score	4	100	4	100
Lowest Possible Score	0.5	0	0.1	0
1	0.72	93%	0.58	99%
2	0.83	96%	0.5	91%
3	1.57	75%	0.81	84%
4	0.65	88%	0.44	93%
5	1.11	74%	0.56	97%
6	0.92	86%	0.6	97%
7	0.9	96%	0.67	92%
8	2.45	29%	1.2	62%
9	1.36	88%	0.57	97%
10	0.74	97%	0.51	92%
11	0.69	99%	0.47	84%
12	0.81	91%	0.5	96%
13	.87	100%	0.54	100%
14	1.11	86%	0.49	89%
15	0.81	99%	0.51	87%
16	0.76	83%	0.45	87%
17	0.65	97%	0.51	94%
Average:	0.9970588	87%	0.5829412	91%





Average & T-Test Results

	Visual Recognition Response Time (0.5 to 4.0)	Visual Recognition % Correct	Visual Tracking Response Time (0.1 to 4.0)	Visual Tracking % Correct
Pre-Fatigue Average	1.3482353	84%	0.5811765	89%
Post-Fatigue Average	0.9970588	87%	0.5829412	91%
T-Test	0.00082572	0.09142567	0.480742494	0.113828

CONCLUSION

Results from the study showed no significant difference between the pre- and post-fatigue VEPT scores. Limitations of the study that may have altered the outcome of results include: a small subject population (17 subject sample), a lack of researcher supervision to ensure a minimum and maintained heart rate of 80% of the subject's normal rate, and subject familiarity with VEPT software. Multiple studies have been conducted on overall visual skills with similar results. Yet, there have been minimal to no studies conducted to test the overall effect of fatigue on visual recognition and visual tracking response times.

With the addition of more studies focusing on visual tracking and recognition, a better understanding of how physical fatigue affects these two components of visual skills will provide a more concrete background and development of the subject. Since the study did not differentiate between athletes and non-athletes, conducting a study specifically focusing on the visual

tracking and recognition skills and the effects of physical fatigue on athletes may be desirable. According to Christenson and Winkelstein (1988), their research has indicated that athletes are significantly better than non-athletes in certain visual skills (as cited in Zwierko, 2007). Hopefully, future research will provide greater insight into the significance of visual skills and the role they play in physical performance.

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POROSITY AND HYDRAULIC CONDUCTIVITY OF SEDIMENTS IN A SEMIARID ENVIRONMENT IN RELATION TO GROUNDWATER — SURFACE-WATER INTERACTIONS



by KELLIE RULONG

ABSTRACT

In this study a hydraulic characterization of three sediment cores was conducted to determine if an exchange between groundwater and surface water would be possible in a clay-rich environment. Average porosity of both wet and dry porosity methods ranged from 51.5-66.1%, with a median value of 56.8% falling into the clays sized particle range. Hydraulic conductivity of 11 samples containing enough volume to run falling head permeameter test ranged from 0.02-0.07 (m/y) with a median value of 0.003 m/y also falling within the clay sized particle range. Hydraulic



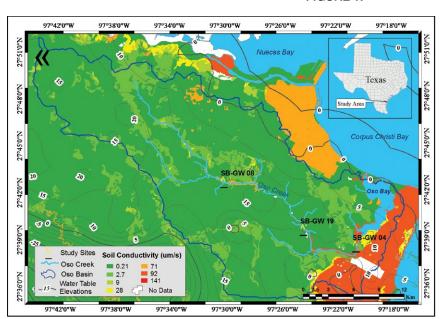
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conductivity of samples increased as porosity increased, which does not follow the accepted theory for clay sized particles. All samples exhibited swelling – typical of clays – during the wet porosity analysis ranging from 11.8-78.1% with a median of 32.3%. Further research will be conducted to analyze sediment mineralogy and organic content and how it affects hydrologic parameter estimations.

INTRODUCTION

This study focuses on defining sediment characteristics that will aid in determining if an exchange between surface water and groundwater is possible and to what extent it may occur in a clayey streambed. The investigation is concerned with understanding porosity and hydraulic conductivity of the area's sediments and how it relates to fluid flow. The exchange of fluid and the associated constituents (i.e. nutrients) between groundwater and surface water may have impacts on the health of ecosystems through limited freshwater discharge from the underlying aquifers of increased contaminant inputs. Low transmissive sediments such as clays allow limited transfer of water between groundwater and surface water. However, it is believed that, although in limited rates, the exchange can still be significant when concerned with contaminant inputs from groundwater to surface water. Hubbert (1956) points out that hydraulic conductivity is a function of porosity and the fluid moving through it. Increases of

FIGURE 1.



Geographic location of study area and core sampling sites (SB_GW08, SB-GW19, and SB-Gw04 [modified from Scotch, 2013]).

nitrates in surface water from agricultural runoff have been known to trigger algae growth. Once the alga dies and falls to the bottom of the surface water body, microorganisms help decompose the alga using excess oxygen, thus creating an anoxic environment. The oxygen-depleted waters are often the cause of death for larger marine animals such as fish. On the other hand, the reverse is also possible. For instance, when the surface water level is higher than that of groundwater, surface water and the associated contaminants may travel downward into the underlying aquifer. Contamination of the underlying aquifers may concentrate in the freshwater supply.

Movement of groundwater depends on sediment properties such as porosity and hydraulic gradients (hydraulic conductivity). Porosity is the volume of pore space relative to the total volume (sediment and pore space). A good conductive formation is characterized by high conductivities and medium to high porosities. Clays are generally characterized by high porosities and low hydraulic conductivities (i.e. the ease with which fluid can move through a porous material). Hydraulic conductivity is dependent on the degree of connectivity between pore spaces [Fetter, 2001]. Clays are generally characterized by high pore space volumes that are poorly connected. In this case, water may become trapped in pore spaces, and water and solute (i.e. contaminant) transfer rates are very slow. The exchange

between groundwater and surface water is controlled by many factors, including hydraulic gradient, hydraulic conductivity, streambed topography, sediment grain size and sorting, and sediment transport [Rosenberry and Pitlick, 2009]. When speaking of hydraulic conductivity, factors such as grain size and shape, tortuosity, packing arrangement, and pore shape affect the rate at which the fluid flows through the sediment [Morin, 2006].

Study Site

Study area is located in the Oso Creek watershed, near Corpus Christi along the Texas Gulf Coast (Figure 1). Oso Creek discharges in Oso Bay after flowing for nearly 40 km. The change in relief is approximately 4.5 m throughout the entire watershed [Ockerman and Fernandez, 2010]. The study area is characterized by a subtropical and subhumid climate with hot summers and mild winters [Larkin and Bomar, 1983]. The average precipitation from 2010-2013 was 81.3 cm, and the average temperature was 21.9°C (National Oceanic and Atmospheric Association, 2013). The sedimentary basin consists of low permeable clays and muds with interfingered sand lenses which are part of the Pleistocene Beaumont Formation [Aronow, 1971]. Three study sites were selected along Oso Creek as representative of stream (SB-GW08), tidal (SB-GW19), and bay environments (SB-GW04)(Figure 1).

METHODS

Sediment Core Collection

Sediment cores were collected from the three selected locations using clean 5 cm-diameter acrylic plastic tubes. Cores were collected carefully so as to minimize disturbance of sediment sample and reduce compaction. Acrylic plastic tubes were placed upright and hammered into the sediment using a rubber mallet. After extraction, each tube was capped using florist foam and wrapped in clear plastic cling wrap to minimize evaporation. Each core was split using a circular saw and stored at room temperature in clear plastic cling wrap for stratigraphic logging and hydraulic properties analyses.

Sediment Core Analysis

Each core was visually logged for changes in color, large organic matter and particle size. Each change was marked and its length recorded. The varied segments in each core were removed and placed into metal trays labeled with the core name and segment length. Effective porosity is that portion of the total void space of a porous material that is capable of transmitting a fluid. Effective porosity occurs because a fluid in a saturated porous media will not flow through all voids, but only through the voids which are interconnected [Gibbs and Barcelona, 1984]. For porosity measurements, the segment's original mass was taken and recorded. Each segment (in trays) was placed in a drying oven at 105°C for 24 hours [Gealy, 2007]. Repeated measurements of the samples' masses were conducted every 8 hours to determine water loss and establish a constant mass for each sample. Once each sample reached a stable mass, the samples were placed into beakers and the initial volume recorded. The samples were saturated with deionized water and the initial amount of water recorded. After the sample saturated fully, the excess water was removed using a pipette. The excess water was recorded and subtracted from the total amount of water added initially. The difference represents the volume of the void space (Vv) of the sample. The final volume amount of sediment was also recorded to account for swelling. To obtain percent porosity the following equation was used:

$$f = 100 \times \frac{vv}{vs}$$

The equation calculated the percent porosity (f) by dividing the volume of the water in the pre spaces (Vv) by the volume of the sample (Vs) according to the wet porosity methods.

The dry porosity method was used to determine the probable porosity of sediments using density measurements of each sample combined with the average density of quartz of 2.65 gram per cubic centimeter (g/cm³). This method works best if the investigated type of sediment is known. However for the purpose of this study, this method is used to identify any errors that may have occurred when using the wet porosity methods (i.e. swelling or evaporation). The dry porosity was calculated using the bulk mass density (bulk) derived by dividing the sample mass and volume by the average density of quartz (sand) as shown in equation 2 [Lambe, 1951]:

$$n = 1 - \frac{\rho_{bulk}}{\rho_{sand}}$$

Hydraulic Conductivity

The standard Falling Head Test using a permeameter was employed to calculate the hydraulic conductivity of the sediment core samples. This method is best suited for low conductivity materials [Fetter, 2001]. The permeameter consists of a base and top with inflow and outflow valves separated by a clean, acrylic cylinder which hold two porous stones and a spring (Figure 2). The acrylic cylinder is placed on top of the base and a porous stone is inserted into the cylinder. The cylinder was filled with the sample sediment, which was tamped down to remove any air pockets within the sediment. The use of 127 cm³ or more sediment is recommended to provide more accurate results. The diameter of the sediment sample was recorded. Another porous stone was placed on top of the sample. The spring is placed on top of the porous stone to ensure the water pressure does not move the sample. The apparatus top was then placed on top of the porous stone/spring and tightened down using three nuts. This ensures the apparatus is airtight. The length of the sample was recorded and the inlet and outlet tubes connected. The inlet and outlet tubes were connected to the water reservoir and a graduated manometer, respectively. The inside diameter of the manometer was recorded. The water was turned

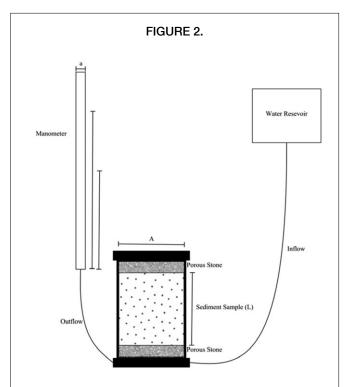


Diagram of Permeameter setup (not to scale). The diagram shows the measured parameters required for hydraulic conductivity calculations: length of the sediment sample (L), cross-sectional area of the sediment sample (A), inside cross-section area of the manometer (a), the initial height of the water at t=0 (h_0) and the final height of the water at t=1 (h_1).

on and allowed to flow into the reservoir tank and into the sample chamber through the inlet tubes which were connected to the water reservoir and a graduated manometer, respectively.

As the sediment began to saturate, air bubbles present in the system were eliminated through an outlet port located at the top of the chamber. Once the sediment was saturated, the initial head value as recorded as h_0 . The water was turned off and the stopwatch started at the exact same moment. The final head value (h_1) was recorded after approximately two hours (actual time recorded in seconds). The hydraulic conductivity was calculated using the recorded parameters using equations 3:

$$k = \frac{aL}{At} \ln \frac{h_0}{h_1}$$

Permeability

Sediment permeability (the capacity of the sediment to transmit fluid) is controlled by size and interconnectedness of interstitial pores, and the tortuosity of fluid flow paths; such factors are in turn controlled by the grain-size distribution, grain shape, and porosity [Spinelli, Giambalvo and Fisher, 2004]. Permeability takes into account what type of fluid is moving through the sediment. These fluid parameters are: dynamic viscosity of fluid (μ), density of fluid (ρ), and acceleration due to gravity (g). Permeability can be calculated using the measured hydraulic conductivity (k) in equation 4:

$$(4) K = k \frac{\mu}{\rho g}$$

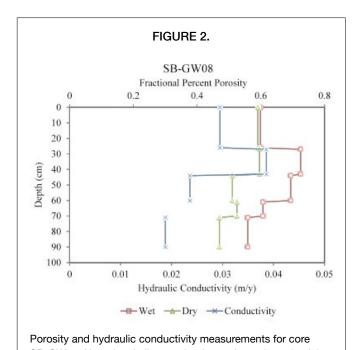
RESULTS AND DISCUSSION

Stream Environment: SB-GW08

The SB-GW08 core - 95 cm long - exhibited high total porosity values ranging from 55.9-72.5% for wet porosity measures and from 47.0-59.6% for dry porosity measurements. These measurements fall directly within the standard porosity of clay sized sediments [Fetter, 2001]. In deep sea cores, porosity decreased with depth due to overburden pressure using in situ measurement techniques [Gealy, 2007]. This trend is not seen in core SB-GW08 since the length of sample from 26-43 cm displayed the highest porosity and hydraulic conductivity (Table 1). For this core, both wet and dry porosity measurements presented nearly identical trends except for the section ranging from 60-70 cm (Figure 2). Section 60-70 cm displayed was tan colored and granular while the rest of the sediment core was brown and muddy. This large change in porosity in the 60-70 cm section may be due to the high percentage of swelling (67.5%) seen during the wet porosity testing.

TABLE 1. Porosity and hydraulic conductivity measurements for Core SB-GW08.

Sample Depth (cm)	Wet Porosity (%)	Dry Porosity (%)	Wet Swelling (%)	Hydraulic Conductivity (m/y)
0 – 26	59.9	59.1	26.5	0.0295
26 – 43	72.5	59.6	36.4	0.0386
43 – 60	69.4	51.1	41.7	0.0236
60 – 70	60.7	52.5	67.5	Limited Sample Volume
70 – 95	55.9	47.0	16.8	0.0188



SB-GW08. Note the similar trends of porosity and conductivity.

Tidal Environment: SB-GW19

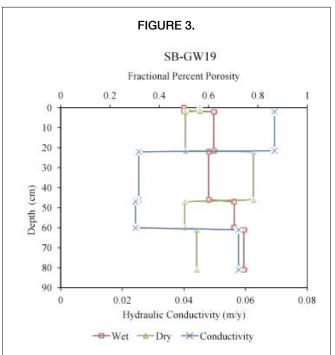
Tidal environments receive intermittent influxes of both marine and fluvial sediments as dictated by the local tidal flow (i.e. only 1-2 meters in Corpus Christi Bay) [Furnans, 2004]. Compared to the SB-GW08 core, SB-GW19 displayed no trend with depth for porosities and conductivities. This is expected as the deposited sediment characteristics will vary depending on the source (i.e. tidal flux). Furthermore, there was no trend between hydraulic conductivity and porosity. For instance, the highest conductivity value was measured between 1.5-21.5 cm while the highest porosity was recorded deeper at between 60-81 cm (Table 2). Therefore, for this location the porosity and conductivity measurements indicate that higher porosity does not mean high transmissivity rates as shown for core SB-GW08. This suggests that effective porosities are lower than total porosities, resulting in lower conductivity values. However, it does not correlate with the swelling seen in the section from 60-81 cm, which had an average swell of 30.5% during the wet porosity test but did have both high porosity and conductivity (Table 2).

These contrasting findings support the need for further analysis of such elements as grain size distribution, organic content, and mineralogical composition. Core

TABLE 2. Porosity and hydraulic conductivity measurements for Core SB-GW19.

Sample Depth (cm)	Wet Porosity (%)	Dry Porosity (%)	Wet Swelling (%)	Hydraulic Conductivity (m/y)
0 – 1.5	50.0	56.4	78.1	Limited Sample Volume
1.5 – 21.5	62.1	50.6	11.8	0.0694
21.5 – 46	60.0	48.3	30.9	0.0253
46 – 60	70.4	50.4	27.7	0.0243
60 – 81	74.3	55.2	30.5	0.0577
81 – 89.5	75.0	50.7	57.7	Limited Sample Volume

SB-GW19 analyses indicate large differences between the two methods of porosity such as section depth 46-60 cm where there was a recorded difference of 20% in measurements (Table and Figure 3). There is no observed trend between conductivity and wet and dry porosity measurements. The wet porosity method does appear to show a gradual increase of porosity with depth, with the exception of the section from 21.5-46 cm. The dry porosity method displays a back and forth changing pattern as expected in a tidal or dynamic environment (Figure 3).



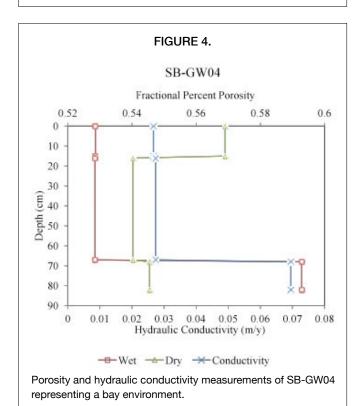
Porosity and hydraulic conductivity measurements for core SB-GW019. Note the lack of trend with depth of the dry porosity and conductivity.

Bay Environment: SB-GW04

Bay environments are expected to be relatively stable in the Corpus Christi Gulf Coast due to the low tidal change as well as the large barrier island protecting inshore environments from large storm events. Though the area is affected by microtidal changes (1-2m), the core showed consistent porosity and conductivities from 0-67cm while the conductivity from the 67-82 cm section nearly tripled (Table 3 and Fig. 4). This change at 67 cm may indicate a change in lithology which may influence groundwater — surface-water interactions. Core SB-GW04 analyses indicate a strong positive trend between the wet porosity and hydraulic conductivity measurements (i.e. both porosity and hydraulic conductivity increase at depth) (Figure 4) which is also seen in core SB-GW08.

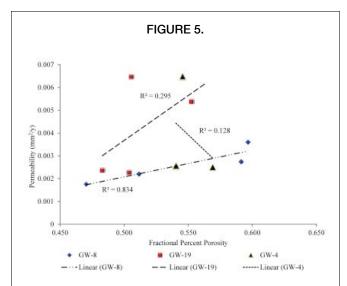
TABLE 3. Porosity and hydraulic conductivity measurements for Core SB-GW04.

Sample Depth (cm)	Wet Porosity (%)	Dry Porosity (%)	Wet Swelling (%)	Hydraulic Conductivity (m/y)
0 – 15	52.9	56.9	42.9	0.0267
15 – 67	52.9	54.0	29.6	0.0274
67 – 82	59.3	54.6	33.7	0.0695



Permeability

The wet porosity values were compared with the calculated permeabilities for each core (Figure 5). Only core SB-GW08 showed a positive correlation (R²=0.834) between porosity and permeability. This correlation indicates a more stable depositional environment for the sediments, which indicates a relationship in which the stream setting is not influenced by other factors (i.e. tidal flux). This could also be explained by different types of mineralogy and organic content of the upstream sediment that would influence porosity and conductivity measurements (i.e. swelling effects).



Comparison of porosity and permeability of all three cores. Note the high correlation observed for SB-GW08.

CONCLUSIONS

A decent trend was observed between porosity and hydraulic conductivity for the analyzed samples (Figures 2, 3, and 4). During the wet porosity testing phase a high degree of swelling was observed in nearly all the samples. All samples exhibited high porosity values (51.5-66.1%) (Tables 1, 2 and 3) which may indicate the presence of clay sized particles as described by Fetter (2001). These values are also consistent with porosities characteristic to freshly deposited cohesive muddy beds (i.e. 80 to 90%). However, these beds dewater with age [Rijn, 1993]. For this study, both porosity and hydraulic conductivity follow similar trends with depth (Figures 2, 3, and 4). Also, hydraulic conductivity was observed to increase as the porosity increases.

However, this trend contradicts the accepted theory that clay-sized particles may display high porosity but usually low conductivity due to poorly connected pores (i.e. low effective porosity). This indicates that further analysis such as comparing grain size to porosity and to hydraulic conductivity is necessary

Sediment cores SB-GW08, SB-GW19, and SB-GW04 represent stream, tidal and bay environments respectively. All three cores show hydraulic conductivities representative of an aquitard. This study indicates that, although permeabilities are low (0.00175- 0.00647 mm²), water flow through these types of sediments is possible. Therefore, even at a slow rate, groundwater and surface water interaction is possible. This interaction would most likely occur during extreme weather events such as long term drought or rain. This exchange will occur because of changes in hydraulic gradients, an important factor affecting conductivity values (i.e. steeper gradients will result in faster flow rates).

This research indicates that further research is necessary for improved hydrologic characterization of these sediments and improved understanding of the extent of groundwater and surface water interaction to determine mineralogical composition and grain size distribution. For instance, samples characterized by poorly sorted silt and clay sized particles will most likely have low conductivity values due to lack of interconnected pores (i.e. low effective porosities). Samples exhibiting high swelling rates such as for clay minerals will be characterized by high porosities and low conductivity values. Clay minerals also tend to hold to charged particles which may keep contaminants in the system for an extended period of time. Future research will investigate how grain size distribution, mineralogical composition, and organic matter content influences porosity and conductivity values.

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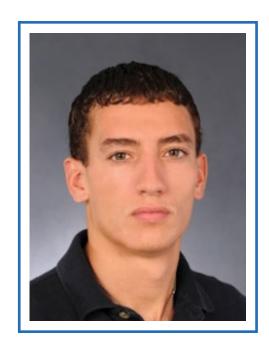
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INVESTIGATING OYSTER SHELL THICKNESS AND STRENGTH USING THREE IMAGING MODALITIES: HYPERSPECTRAL IMAGING, THERMAL IMAGING AND DIGITAL PHOTOGRAPHY



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ABSTRACT

A comparative study of three imaging technologies is conducted to nondestructively assess the thickness and strength of oyster shells grown in various environmental conditions. Oyster shell thickness and strength are expected to be dependent on factors affecting the oyster's environment. Oysters have been grown in protective cages and without cages in both intertidal and subtidal zones. Hyperspectral imaging is used to detect possible differences in hyperspectral properties among oyster shells from each of the four growth conditions. Thermal imaging is utilized to identify hot spots in the shells based on heat capacitance indicating density or thickness of the shells. Finally, a visible-range camera is used to photograph the shells. The three technologies are compared to evaluate the effectiveness of each in identifying oyster shell thickness and strength. The local thickness of the oyster shells has been measured with a micrometer caliper, and shells broken with a crush tester to establish a baseline for shell strength. The results from the three methods demonstrate that thermal imaging correlates the best with the invasive stress test results and weight measurements. Using hyperspectral data and principal component analysis, classification of the four oyster shell groups is achieved. Visible-range images mainly provided size, shape, and color information.

INTRODUCTION

Oysters form an integral part of ecology, as they act as sieves, filtering the water around them. In addition, they serve as a significant food source and are important for the fishing industry and seafood consumers. Oysters and oyster reefs have been studied for many years to understand the environmental impact on their health and growth patterns. This study is focused on investigating three imaging technologies as potential nondestructive tools to assess oyster shell thickness and strength.

Oyster shell characteristics are expected to correlate with the oyster's environment. To simulate different environmental growing conditions, four sets of oysters were grown in intertidal caged, intertidal uncaged, subtidal caged, and subtidal uncaged environments. Caged oysters are protected from predators. Intertidal zones represent areas between high tide and low tide, where the oysters are exposed to the sun during low tide, and are submerged during high tide. In contrast, oysters growing in subtidal zones are always submerged under water. Oyster growth in intertidal and subtidal environments has been investigated by multiple researcher groups [1-4] with multiple findings, depending on location and duration of study. Oyster shell displays varying size and strength depending on the environmental stresses, including predators, food availability, and other biological elements [5-6].

In this research, digital hyperspectral, thermal, and photographic images are investigated as potential nondestructive tools to demonstrate the differences in oyster shell thickness and strength among shells grown under the four conditions listed. The objectives of this research include the comparison of the three different imaging modalities to demonstrate the differences among the four sets of oyster shells, in particular shell thickness and strength. Shell weight was also measured for a baseline of the physical properties of shells.

For oyster shells, hyperspectral imaging provides a more superficial analysis of the shell, such as its texture and spectral characteristics based on the material's optical properties that can then be used for pattern recognition and classification. Thermal imaging offers information about the hot spots, which are expected to occur at thick and dense locations on the oyster shell. Visual photographs provide comparative output to human vision in the visible spectral range and are used for representing what we see. The three methods are analyzed and compared to ground truth tests accomplished by thickness measurements with a caliper and strength measurements using a crush tester.

Instruments, software, oyster growing, measurement, and imaging methods are described in Section 2. Section 3 includes the collected data and results. Section 4 covers the analysis and discussion of the results. Section 5 summarizes conclusions and future work.

INSTRUMENTS AND METHODOLOGY

In this section, the experimental details are presented for oyster growth, imaging modalities, and physical measurements.

Oyster Growing and Sampling

Oysters were grown on 10 3-inch PVC pipes for each of the four oyster groups on a total of 40 pipes. The 3-inch pipes were set out in ten different locations in the East Flats in Corpus Christi Bay under four different conditions: intertidal caged (oysters grown in intertidal zones in protective cages), intertidal uncaged (oysters grown in intertidal zones without the protective cage), subtidal caged (oysters grown in subtidal areas in protective cages), and subtidal uncaged (oysters grown in subtidal areas without the protective cage). After 60 days, pipes with oysters were retrieved and the spat which settled on the pipes were collected and brought back to the laboratory to be observed and counted. Since these oysters were juvenile oysters, their shells were delicate and easy to break. Some of the oysters were too small to handle; therefore, it was not possible to retrieve all oysters from the PVC pipes. The total number of harvested and tested oysters varied for each of the four groups. The number of oysters sampled from the pipes included 13 from the intertidal caged,

23 from the intertidal uncaged, 17 from the subtidal caged, and 29 from the subtidal uncaged groups.

FIGURE 1.



Sample juvenile oysters on PVC pipes: yellow – intertidal caged; pink – intertidal uncaged; blue – subtidal caged; orange – subtidal uncaged.

The oysters were then taken off the pipes and shells collected. After the shells dried, they were placed in black petri dishes for imaging with the visible-range camera and hyperspectral imaging system and on aluminum plates for thermal imaging.

2.2 Hyperspectral Imaging

Hyperspectral data cubes were acquired with a laboratory-based Hyperspectral Imaging System in reflectance mode. At the beginning of the measurements, a highly reflective material with 99% reflectance was imaged as a reference to normalize the oyster hyperspectral data and compute reflectance. Hyperspectral images from oysters produce both spatial and spectral data. The oysters were scanned for 1 cm at a time. These hyperspectral data occupied computer memory space of up to 2.42 GB for high resolution images. Afterwards the data was viewed and analyzed using the software tools ENVI, MATLAB and MS Excel.

2.3 Thermal Imaging

Oyster shell samples from four oyster shell groups were placed on an aluminum plate and inserted in an incubator for heating. This allowed all oyster shells to

be taken out of the oven at the same time to synchronize the cooling process for all shell groups. Five oyster shells from each group for a maximum total of twenty oyster shells were placed on the aluminum plate at a time. Heating and thermal imaging were repeated until all the shells were imaged.

The oyster shells were heated to 200, 230, and 260°F and imaged using a thermal camera. Such high temperatures were necessary to allow measurement of temperature gradients within and across oyster shells before the shells returned to room temperature.

2.4 Visible-range Digital Photography

Digital images of each oyster shell group were captured to depict any distinguishable features before any instrument was used to test the thickness and strength of the oysters. The shells were organized and photographed inside the painted black petri dishes.

2.5 Weight, Thickness, and Strength Measurements

After the shells dried, they were weighed using a digital scale to the nearest milligram. Weighing occurred before imaging.

Shell thickness was measured with a caliper. To accommodate measurement of concave surfaces, a wire was added to the underside of the device. Since oyster shells are not uniform in thickness, five different points on each shell were measured and averaged. One measurement corresponded to the middle of the shell, and the remaining four were taken from points between the center and edge of the shell. The thickness results were averaged for each oyster shell group, and used for comparison with the three imaging modalities.

Shell strength tests were first conducted with a digital force transducer fitted to a wooden frame in the HOPI lab. A nail tip was embedded in a plexiglass plate attached to the force gauge for contact with the oyster shell. Sand was added as weight onto the plexiglass until the shell broke. The minimum force required to break the shell was then recorded as an indicator of shell strength. This equipment was later replaced with a higher-precision piezoelectric force sensor to better represent the small forces required to break the shells.

COLLECTED DATA AND RESULTS

In this section, the data collected from oyster shells, including oyster count, imaging data, and other physical measurements (weight, thickness and strength) are presented.

3.4 Oyster Count

Table 1 shows the number of oysters that remained on the PVC pipes at the time the oysters were collected. This table is significant in that it suggests a high probability that predators existed in the intertidal zones due to the large number of oysters collected from intertidal caged zones. In the subtidal groups, the number of oysters in each set in the two groups was comparable; however, curiously, in 7 out of 10 sets, more oysters were counted on the uncaged pipes than on caged pipes, suggesting no predator influence on the oysters. Only a small number of oysters were sampled for imaging, since some shells broke, and others were too difficult to separate from the PVC pipes due to their small size.

TABLE 1. Total number of oysters counted on PVC pipes and sampled for imaging

PVC	Oyster Group				
#	Intertidal		Subtidal		
	Caged	Uncaged	Caged	Uncaged	
1	lost	3	3	4	
2	21	10	3	5	
3	12	7	1	3	
4	6	5	2	0	
5	14	1	5	4	
6	11	3	4	10	
7	4	2	6	lost	
8	4	5	3	4	
9	5	2	1	2	
10	7	7	4	7	
Total Collected	84	45	32	39	
Total Sampled	13	23	17	29	

3.5 Visible-range Digital Images

Figures 2 and 3 show the digital photographs of the oyster shells from all four groups. Digital images are useful for shape, size, color, and texture analysis. However, unless shell thickness or strength can be correlated to these parameters, the images provide limited information on the oyster shell parameters of interest. Photographic

images do provide a valuable reference for results using other imaging technologies and measurements. In this study, shape was visually and qualitatively identified to directly relate to weight. This direct relationship of weight to shape has to be verified in all studies, since density variations could affect results.

FIGURE 2.





Digital visible-range image of all oyster shells tested from the intertidal caged (left) and uncaged (right) groups.

FIGURE 3.





Digital visible-range images of all oyster shells tested from the subtidal caged (left) and uncaged (right) groups.

3.4 Hyperspectral Data

Hyperspectral images provide both spatial and spectral information. Spatial information resembles visible-range photography, with the exception that the spatial information in single hyperspectral image frames represents a much narrower spectral band. Spectral information, on the other hand, can be obtained from each pixel on the spatial image frame, and represents the material optical properties of the shell under investigation.

3.4.1 Spatial Representation

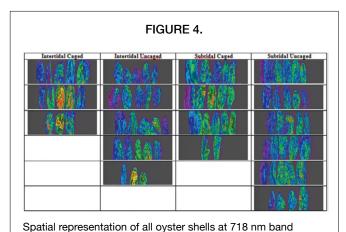
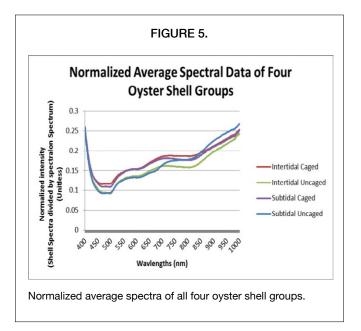


Image processing methods are suitable to calculate the average image frame from multiple image frames depending on the information that is of interest. Image frames that show high contrast among images can also be chosen for analysis. Figure 4 shows the hyperspectral image frame for all the sampled oyster shells from the four oyster groups around the 718 nm spectral band. Black represents low intensity range or background. White and purple represent highest pixel intensity values. Orange-yellow falls in the middle range.

3.4.2 Spectral Representation

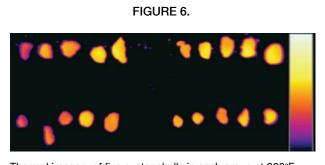
hyperspectral image frame.

Figure 5 shows the average normalized spectra from intertidal caged, intertidal uncaged, subtidal caged, and subtidal uncaged oyster shell groups. Although the spectra are highly correlated and spectral overlap is observed at different wavelength ranges, subtle differences can be observed between caged and uncaged and between intertidal and subtidal spectral plots; these are differences that can be extracted and quantified. One popular method to do so is principal component analysis.

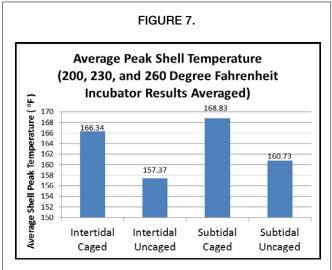


3.5 Thermal Images

Figure 6 shows sample thermal images acquired at 200°F from five oyster shells in each group. Temperature gradients within and among oyster shells and oyster shell groups are apparent in this image, with most of the hot spots towards the center of the shells and low spots around the rim of the shells, as would be expected, since the edges will be thinner than the center.



Thermal imagery of five oyster shells in each group at 200°F: Intertidal uncaged (top left), intertidal caged (top right), subtidal uncaged (bottom left) and subtidal caged (bottom right). (Color bar on the right represent a range from 100 to 200°F from bottom to top.)



Average peak temperature of each oyster shell group from thermal imagery. The results from 200, 230 and 260°F have been averaged.

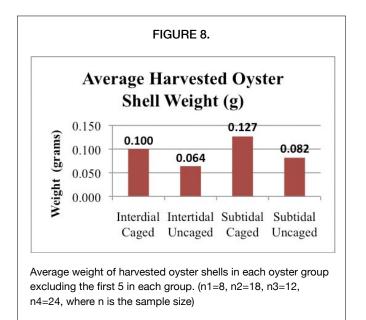
Figure 7 shows a bar chart representing the average peak temperature obtained for all the shells in each of the four shell groups. FLIR Tools software was used to identify the peak temperature for each shell. The peak values were then averaged over all shells in each group and over the three temperature measurements at 200, 230, and 260°F.

3.6 Oyster Shell Weight, Thickness and Strength Measurements

Oyster shell weight, thickness, and strength were measured using traditional methods to establish a baseline for the imaging technologies.

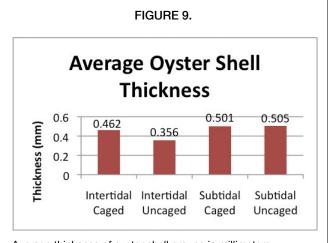
3.6.1 Weight Measurements

Figure 8 shows the bar chart of the average oyster shell weight in each oyster group measured with the high-precision scale.



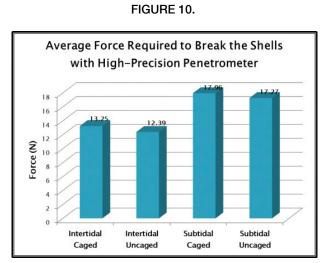
3.6.2 Thickness Measurements

Figure 9 shows the average thickness for the oyster shells in each of the four categories: intertidal caged, intertidal uncaged, subtidal caged, subtidal uncaged. The overall thickness from each oyster shell was averaged in each oyster category.



Average thickness of oyster shell groups in millimeters. (n1=13, n2=23, n3=17, n4=29, where n is the sample size)

3.6.3 Strength Measurements



Average force needed to break the shells penetrated by the high-precision instrument. (n1=8, n2=18, n3=12, n4=24, where n is the sample size)

ANALYSIS OF RESULTS

4.1 Oysters Samples

From Table 1, differences among the four oyster groups can be seen: For the intertidal groups, the total number of caged and protected oysters (84) was almost twice the number of uncaged and unprotected oysters (45). This suggests that predators had an impact on the oysters and their growth in the intertidal zones because more oysters survived inside the caged environment. A comparison of subtidal caged vs. subtidal uncaged oysters shows comparable numbers for oyster growth. It is safe to conclude, therefore, that in the subtidal area where the oysters were grown and sampled, predators do not have a significant impact on the oysters, since the uncaged population was larger than the caged population. In comparing intertidal and subtidal regions, better oyster living conditions can be assumed in the intertidal zones, considering that even the intertidal uncaged total oyster count was larger than both of the subtidal oyster groups. So with predator and environmental health conditions established with Table 1. differences can be seen both between the intertidal caged and uncaged oysters and between the subtidal and intertidal oyster groups; however, no difference between the subtidal caged and uncaged oysters can be established from the count data.

4.2 Digital Photography

Qualitative analysis of digital photographs reveals that subtidal oyster shells overall could grow larger than the intertidal shells. The size thus correlates with the weight of the oyster shells. The fact that a higher percentage of oysters were sampled from subtidal zones (Table 1) could be attributed to larger, heavier, and stronger shells that came off the pipes without breaking. The digital images show the size and shape changes and coloration of the oyster shells. These images can be analyzed using image processing techniques to investigate possible trends associated with the color and texture of these juvenile oyster shells, but such analysis was not pursued in this paper.

4.3 Hyperspectral Imaging

4.3.1 Spatial Images

The spatial image frames from the hyperspectral image cube obtained from oyster shells in Figure 7 visually provide size, shape, and color (in this case, pseudocolor) information. Because the oysters were grown in open marine environments, many uncontrolled factors were likely to affect their shells. Different intensities for different wave bands can be attributed to algae growth, sun bleaching, and other abiotic factors in the environment. Image frames could be investigated using regular 2-D image processing methods to segment and analyze these image frames for pattern recognition and classification. The preliminary work on spatial image analysis can be found in [8].

4.3.2 Spectral images

Qualitative visual analysis of the hyperspectra from the oyster shells reveal subtle differences at specific wavelengths that can be attributed to different oyster groups (Figures 9-14). The raw and normalized average spectra from the four groups show similar profiles for intertidal and subtidal caged oyster shells, and separately for intertidal and subtidal uncaged oyster shells from about 400 to 700 nm. This suggests that differences in spectra from caged and uncaged oyster groups are generally observable. In the normalized average spectra, both subtidal spectra appear to overlap and the intertidal spectral profiles follow a parallel trend beyond about 840 nm. Significant differences are observed within 700 and 840 nm. Looking at the individual spectra in Figures 9-12, the high correlation

of the spectra both within and across oyster groups is apparent. These reflectance spectra take shape based on materials' absorption properties, surface texture, color, as well as other experimental factors. Absorption properties are affected by the makeup of the shell but also the optical density. Although differences in the spectra are identified, how these differences could relate to shell thickness and strength requires further investigation. The devised classifier to separate the four oyster shell groups can be found in [8].

4.4 Thermal Imaging

During the thermal tests the oyster shells were subjected to heat. Thermal images were then captured to identify hot spots and correlate heat capacitance associated with thickness of the shells for the four oyster shell groups. The thicker or denser shells are expected to have a higher heat capacitance, assuming all other parameters are the same. Two trends were observed from the thermal images: Firstly, the intertidal uncaged oysters displayed the lowest average peak temperatures compared to the other oyster groups, suggesting lowest heat capacitance among the oyster groups. Secondly, the average and peak heat results for uncaged oyster shells were lower than their caged counterparts. If the physical measurement results (weight and breaking force (strength)) graphs are compared, it can easily be seen that thermal imaging results follow a close trend with shell weight and strength, which also appear correlated, when only measurements collected with the high-precision piezoelectric crush tester is used. These results are promising, suggesting that thermal imaging could offer an alternative method to comparing shell thickness and strength among shells and shell groups without breaking the shells.

4.5 Weight, Thickness and Strength Measurements

From Figure 3, shell weight among the oyster groups varied notably. On the average, subtidal caged oyster shells weighed the most, followed by intertidal caged shells, then subtidal uncaged, and finally intertidal uncaged shells. The caged shells were consistently heavier on the average than their uncaged counterparts. In addition, subtidal caged shells were on the average heavier than the intertidal caged shells. Similar trends were observed for average shell weight of subtidal uncaged and intertidal uncaged oyster shells.

Thickness measurements proved challenging due to the non-uniform and highly textured surface of the shells, requiring the averaging process. Average shell thickness was computed for individual shells and an overall average computed for each group. Intertidal uncaged oyster shells were found to have the lowest average thickness. The average thickness of caged oyster shells was higher than their uncaged counterparts in both intertidal and subtidal categories, although the difference in the subtidal oyster thickness measurements are insignificant; subtidal groups' oyster shells were thicker than both intertidal shells. In the intertidal groups, the caged oysters had relatively thicker shells than the uncaged oysters.

The average strength measurements included only those shells measured with a highly precise penetrometer. The results follow the trends in weight and thickness measurements among the four oyster shell groups. In both cases, the subtidal shells required more force to break than the intertidal shells. The challenge of effectively measuring the breaking force should be pointed out. Due to the non-uniformities of the shell, it is expected that strength of the shell will not be uniform throughout. Therefore, the point of contact of the crush tester on the shell plays a significant role in the recorded measurements, and should be taken into account.

Overall, weight and strength measurement plots correlate in their general shape. Thickness measurements show almost equal results for the subtidal oyster shells.

CONCLUSION

The physical tests themselves reveal valuable information about the oysters' environment and their growth response to the conditions around them. The oyster counts in intertidal caged and uncaged group shows that oysters are exposed to predators in the harvested intertidal zones. This is based on the number of oysters that grew on the caged pipes, which was almost twice the number of oysters from the uncaged pipes. The number of oysters that were collected from subtidal zones did not show a notable difference between caged and uncaged oysters, suggesting no difference in impact by predators. However, being constantly immersed in deeper water produces other biotic and abiotic effects on the oysters. It is important to point out here that some bias is introduced through the sampling of the

shells: It was possible to sample only 13 out of the 84 (15.5%) intertidal caged oyster shells when compared to 51.11% intertidal uncaged oysters, suggesting fragility and small size of the intertidal caged group. Similarly, only 17 out of 32 (51.1%) of the subtidal caged oysters were sampled when compared to 29 out of 39 (74.4%) subtidal uncaged oysters, which is more challenging to explain since predation is not expected to affect the oyster numbers in this case.

The overall goal of this research was to correlate imaging results with physical tests based on the sampled oyster shells, and the results are very promising: Visible-range digital images archive what the human eye sees as an initial assessment of shells. The digital photographs showed that the oyster shells from the subtidal group could grow much larger than those from the intertidal group. The average size and weight were found to be directly related for this data set when compared to qualitative digital image analysis and physical measurements.

The hyperspectral images provided two separate kinds of information on the oyster shells. Spatial data are similar to photographs but at very narrow bandwidths. Spectral data includes spectral signatures based on the optical and material properties of the shell. Projections of data points were used as features to identify and classify the four oyster shell spectral groups; however, whether this information could be expanded to relay weight, thickness, and strength information remains for further investigation.

Thermal images obtained from heated samples proved to be the most promising technology. Thermal imaging results followed weight and strength trends most closely when compared to measurements obtained with high-precision instruments. Thermal images showed thickness differences through average peak shell temperature based on fixed-area hot zones in the thermal images around the center of each oyster shell.

In summary, average weight and shell strength plots correlated well with each other. Similar trends were also observable from thermal images, which suggests that this technology can be utilized to conduct a comparative analysis among given shells for shell weight and strength.

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INDUCTION OF THE GEHD PHOSPHOLIPASE IN NON-CLINICAL STRAINS OF STAPHYLOCOCCUS EPIDERMIDIS UNDER HEAT-STRESS



by EMILIO R. VASQUEZ

ABSTRACT

Staphylococcus epidermidis (S. epidermidis) is a Grampositive organism that inhabits the surface of the skin as a member of normal flora. While usually a commensal, previous research has seen S. epidermidis act as an opportunistic pathogen, especially in stressed environments. Rosacea is a condition characterized similarly to acne and has detrimental side effects to affected individuals. While the exact cause for rosacea is still largely unknown, past research

has indicated that clinical strains of S. epidermidis may have a role and that these organisms are stressed by higher skin surface temperatures to produce a lipase of ~45 kDa. Other work had found a similar phospholipase, the 45 kDa GehD lipase encoded by the GehD gene in Staphylococcus species but this GehD lipase was not induced with heat. This research project will investigate whether non-clinical strains of S. epidermidis can be stressed with heat to produce the GehD lipase.



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INTRODUCTION

Staphylococcus epidermidis (S. epidermidis) is a Grampositive, catalase positive, coagulase negative coccus. S. epidermidis is not generally known to be pathogenic outside of nosocomial or hospital acquired infections (HAIs). These infections caused by S. epidermidis are due to the ability of the bacterium to form biofilms which are aggregates of S. epidermidis cells embedded within an extracellular protein or carbohydrate matrix attached to the surface. Catheter tubes and surgical instruments used in invasive procedures are common targets for these biofilms (Ziebuhr et al., 2006). Rosacea is among other conditions in which S. epidermidis is implicated to have a role. Rosacea manifests in two ways: ocular rosacea and cutaneous. Whitfeld et al. reported in 2010 that approximately 45 million individuals worldwide are affected by a type of rosacea. Cutaneous rosacea is characterized similarly to common acne, where individuals usually present with flushing or redness and higher skin temperatures of the face in affected areas,

and in some cases pustules and inflammation (Oltz & Check, 2011). While dermatologists have not cited the condition as one detrimental to human health, rosacea may do sociological and emotional damage leading to self-esteem issues in individuals with a physical appearance as is seen in acne.

While S. epidermidis is implicated to have a role in rosacea, the exact mechanism is not yet known. Clinical trials investigating S. epidermidis isolated from rosacea patients reported consistent hemolytic activity (Dahl et al., 2004). The postulated mechanism of inducing a -hemolytic protein from these organisms was heat, suggesting that cutaneous and ocular rosacea could be attributed to an upregulated protein stimulated by heat. The protein, a lipase, was further examined on a polyacrylamide gel and found to have a mass of approximately 45 kDa. In another study involving S. epidermidis, a lipase was induced chemically rather than using physical means of heat and found to be ~45 kDa as well (Bowden et al., 2002). Both of these studies involved clinical isolates. This research project investigates the ability of non-clinical strains of S. epidermidis to become -hemolytic under heat stress and identification and verification of the expected protein is carried out by running Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDS-PAGE) and compared against controls that are without heat stress. These factors of study have been fit into this hypothesis:

"Non-clinical S. epidermidis can be heat-stressed into producing an extracellular lipase."

The study will employ qualitative methods of analysis such as visual observations of the gels under ultraviolet light.

MATERIALS AND METHODS

The methods explained here were built upon an already existing lab protocol for Biochemistry labs but tailored specifically for the hemolytic protein and *S. epidermidis* (Larkin PD, accessed 6/10/2013). For this version of the research article, only the pre-trial is listed. These steps were performed for the pre-trial and the project is currently a work-in-progress.

Bacterial Strains. S. epidermidis used was a sub-strain of the lyophilized form received June 03, 2012 from Carolina Biological Supply Co.

Media. The organism was recovered from the lyophilized state using Bacto® Brain Heart Infusion broth (BHIB). For experimental trials, the organism was plated onto

already prepared Blood Agar Plates (BAP), consisting of Columbia Nutrient Agar containing 5% sheep's blood (BD Diagnostics).

Incubation and Induction. S. epidermidis was streaked onto BAP. There are two groups: the experimental group was incubated for 48 hours at 37°C and the control group was incubated for 48 hours at 30°C. The streaking for the experimental group was done in triplicates.

Sample Preparation. Colonies of S. epidermidis that exhibit hemolysis were removed from the plates and resuspended in an overnight culture of 30 mL of BHIB. These overnight cultures were split into two main groups: three experimental groups (I - III) that were grown in 37°C and the control group (C) which was grown in 30°C. The overnight cultures were spun down in an AllegraTM 21R Centrifuge (Beckman Coulter) at 6900 x g for ten minutes. The pellet was retained while the supernatant BHIB was discarded. The pellet was then resuspended in TE buffer (0.01M Tris-Cl, pH 8, 1mM EDTA) (Amresco®). The organism was then heated and frozen repeatedly in order to lyse cells using dry ice/ethanol bath and boiling at 45°C. The bacterial lysate was transferred and centrifuged once more (9700 x g, 10 minutes). The supernatant was taken and 25 μL of SDS loading dye (IBI Scientific) containing 0.001 % Bromophenol Blue (BPB) + 25 µL of Mercaptoethanol (Amresco®) mix was added to form the cell free extract or CFX.

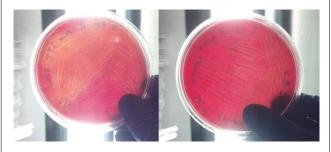
Protein Purification via Gel Filtration Chromatography. The protein soup or CFX was filtered through the Sephadex-100 gel in the C 10/40 Column (GE Healthcare Life Sciences) using TE as the column topping buffer. The protein eluent of the samples that drains through the column, called "fractions," was collected in tubes while keeping the buffer volume at the top of the column constant with the flow of the fractions. For the filtrate, a total of four tubes containing 25 μL aliquots were collected of fraction product; three experimental samples and one control sample. SDS loading dye containing BPB was added to these samples, and 10 μL was loaded onto SDS-PAGE gels.

SDS-PAGE. Pre-cast polyacrylamide (10% polyacrylamide Bio-Rad Mini-PROTEAN®) gels were used for each run. Samples were loaded into gel wells and each gel was electrophoresed using a Bio-Rad Mini-PROTEAN® Gel tank and SDS running buffer (G Biosciences®) containing 30% (w/v) glycerol, 10% SDS, 0.01% Mercaptoethanol, and 0.012% BPB. The gels were stained with 0.025% Coomassie Brilliant

Blue (Amresco®) in 45% methanol and 4% glacial acetic acid, then destained overnight in 45% methanol and 5% glacial acetic acid. The gels were visualized using fluorescent light with the Kodak Gel Logic transilluminator.

RESULTS

FIGURE 1. Induction of hemolysis on BAP



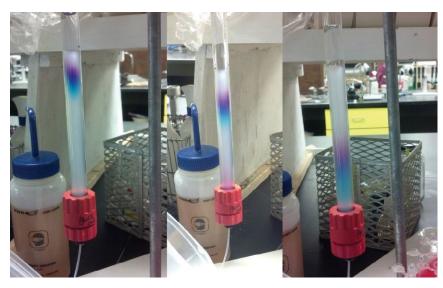
Hemolytic activity of *S. epidermidis* on BAP. The dual image above depicts *S. epidermidis* plated on BAP and incubated for 48 hours at 37°C (right) and 30°C. The control incubated at 30°C shows very little hemolytic activity while the experimental group shows significantly more hemolysis.

FIGURE 3. BioRad Mini Protean Electrophoresis Tank



The image above shows a model BioRad Mini-PROTEAN II Electrophoresis Cell, the type of apparatus used for this experiment. The pre-cast BioRad Mini PROTEAN 10 well gels were used for resolving the proteins by size, shape and charge down the gel in order to determine protein size (in kDa). The cell was plugged into a power source and run in SDS buffer for 90 minutes at $160, \pm 2.0 \text{ V}$ with constant amperage.

FIGURE 2. Column Chromatography and Gel Filtration



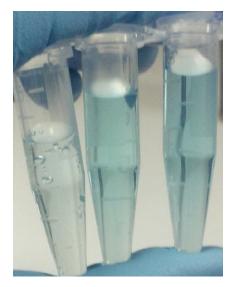


Figure 2 – The image above shows Sephadex G-100 gel (Aldrich) used for filtration sitting in the C 10/40 Column (GE Healthcare and Life Sciences). Fraction collection from this column was based on gravity filtration. The samples were inserted into the column and fell to the top of the gel. From the top of the gel (white portion in the column, the immobile phase shown on the left), samples traveled through this gel or immobile phase, passed through the microbeads and were collected through the tubing at the bottom. On the left, TE buffer is resting on top of the gel as to not allow the top of the gel to dry out. To the right depicts the resulting protein product from the column contained in 1.7 mL microfuge tubes. Notice that the more concentrated the product was, the darker the blue dye observed was.

FIGURE 4. Gel Staining Materials



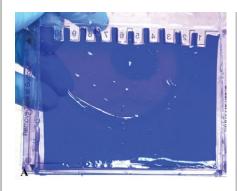


The above image shows the process in which the gel was stained and destained (left) and the reagents used for the staining and destaining process (right). On the right, the reagents shown (from left to right) are the destaining solution and Coomassie Brilliant blue solution (reusable) from the procedure to be reused for the next trials. Both the Coomassie Blue & destaining solutions were prepared using Dr. Buck's recipe, as adapted from Ausubel (1999). Shown to the left is the container dedicated to staining on the Rocking Platform (VWR) on setting 5.

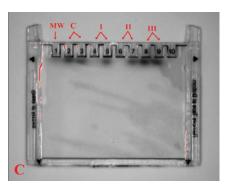
DISCUSSION

The gels did not show proteins that had migrated as hypothesized. The gels exhibited no banding and it appeared that the samples remained toward the top of each lane. Protein samples migrated very little. One possibility is that the proteins were not completely treated to run- even though they were treated with -mercaptoethanol (BME) which would have allowed the proteins to run; perhaps a larger aliquot of BME is needed or an alternative treatment of dithiothreitol (DTT) may be better. Also the staining process for the gel may have to be modified. While the same process was used from the Biochemistry II lab protocol, staining directions were for larger gels so the volumes of staining solution used on the mini polyacrylamide gels may have been too excessive and over-staining of the gel may have resulted. Normally the gel should have been translucent and the bands easily visible. Another possible problem with the experiment could be that the Mini-PROTEAN electrophoresis tank could be not completely functional, although this remains only speculation, as a small current was observed during the gel runs and there was a slight migration of the protein samples into the

FIGURE 5. Polyacrylamide Gel Images







This figure shows an example of a polyacrylamide gel. Image A shows the Polyacrylamide gel once it has been stained in Coomassie Blue. B shows the gel under EPI white light and high contrast- lane 1 is unused, lanes 2&3, 4&5, and 6&7 are experimental groups I – III respectively, 8&9 are control (C) and lane 10 is molecular weight marker. C shows the gel under low contrast- this is a different gel run than A or B and it is seen that the samples refused to run. Gel run parameters: 10% Polyacrylamide, 160 V, 2 hours.

very top of the gels, as well (see Figure 5 *C*). For future researchers who decide to continue this project, these parameters will have to be further investigated. Another possibility is that no protein was induced; possible options include running two-dimensional protein gels. Another concern is whether large enough volumes of cells were grown in order to isolate protein. Much larger volumes of bacteria (250-1000 mL) may have to be grown at both 30 °C and 37 °C in order to produce enough protein.

Due to the lack of proper results, no statistical tests were performed. The experimental parameters will have to be optimized before viable data can be obtained from this project. However it must be noted that when incubated at higher temperatures (37°C, 48 hours) on BAP, *S. epidermidis* appears to exhibit hemolytic activity while the control group incubated at 30°C exhibited significantly less hemolytic activity. There must be a biochemical explanation for this observed phenomenon.

The biochemistry step of the project is still unfulfilled and the researcher who takes on the project will have to complete it. Once the biochemistry component is complete, the next step of the research would be the molecular biology aspect. The protein must be isolated and sequenced in order to determine if nonclinical strains of S. epidermidis can be heat stressed to produce a lipase and to determine the implications of the lipase on affected individuals. The lipase can be compared to already existing Staphylococcal lipase protein sequences in GenBank. In order to sequence the lipase for identification, the protein sample will have to be extremely pure. As of today, there are many staphylococcal proteins already sequenced, including a very similar lipase in S. epidermidis, the RP62A lipase, which has shown at least 35% similarity in amino acid sequence with the Staphylococcus aureus lipase NCTC8530, while another 35% of amino acid residues revealed structurally and functionally conserved regions in the same lipase (Simons et. al, 1998). Once the protein from these non-clinical strains is isolated, it must be sequenced and compared against the protein and gene sequence of the GehD lipase which is available online. This lipase could be a main molecular factor that has a role in rosacea and S. epidermidis could be heat stressed to produce it.

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TEXAS A&M UNIVERSITY-CORPUS CHRISTI A BRIEF HISTORY

Texas A&M University – Corpus Christi began in 1947 as the University of Corpus Christi (UCC) which was affiliated with the Baptist General Convention of Texas. In 1970, Hurricane Celia causes more than \$1,000,000 dollars in damage to the campus. In 1971, the Baptist General Convention of Texas sold UCC to the state of Texas and the Texas Legislature authorizes the Texas A&I University System to establish a state-supported upper-level institution of higher education in Corpus Christi. In 1973, Texas A&I University at Corpus Christi opens its doors on 4 September 1973 to 969 students as an upper-level institution of higher education. In 1977, the Texas Legislature changes the name of the University to Corpus Christi State University. In 1989, Corpus Christi State University joins the Texas A&M University System. In 1993, the Texas A&M University System Board of Regents renames the institution Texas A&M University - Corpus Christi and a year later it becomes a four-year comprehensive university and

enrollment increases to 5,000 students. In 2004, the Board of Regents approves the College of Nursing and Health Sciences which opened in 2005. In 2005, Dr. Flavius Killebrew becomes President/CEO and initiates Momentum 2015, a ten year plan to establish Texas A&M University – Corpus Christi as the flagship university of South Texas. Today the University has over 10.000 students.

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

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