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False Confessions: Does Gender or GPA Matter?

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False Confessions: Does Gender or GPA Matter?

In criminal law, confession evidence is considered to be one of the most powerful pieces of evidence in a courtroom. However, questions have been raised regarding police interrogation tactics, the danger of false confessions, and the impressions that a false confession may leave on a jury. This study looked at the correlation between the likelihood of providing a false confession and the GPA and gender of the participants. It was expected that those with a GPA below 2.5, along with males, would be more likely to provide a false confession. The experiment was set up for the participants to believe they were participating in a typing task. They were told not to press the ALT key. After the computer shut down, the researcher accused the participant of pressing the forbidden key.

False Confessions: Does Gender or GPA Matter?

In criminal law, confession evidence is thought to be a prosecutor's most compelling piece of support. However, questions have been raised regarding police interrogation tactics, the danger of false confessions, and the impressions that a false confession may leave on a jury. Police regularly use deception and coercive methods of interrogation that could possibly cause an innocent person to confess to a crime that he or she did not commit. Federal and state courts have instituted guidelines for the admission of confession evidence in order to lessen the risk that a confession elicited by coercive interrogation tactics that may in turn be a false confession, is allowed into the courtroom. In general, a confession is barred if it was obtained through brute force, extended isolation, sleep or food deprivation, threats of harm or punishment, promises of immunity or leniency, or barring exceptional circumstances without notifying the suspect of his or her constitutional rights (Kassin, 1997).

In order to measure the genuine validity of confession evidence, one would have to assess the combined frequency with which truly guilty people confess and truly innocent people do not. Thus, two different types of flawed outcomes are possible: false negatives, which is when a guilty suspect fails to confess, and a false positive, which is when an innocent suspect confesses. The United States legal system was founded on the ideal that it is better to release eight guilty people than to convict one who is innocent. Therefore, the false positive error presents the more significant problem (Kassin, 1997).

Kassin and Wrightsman (1985) developed three separate categories of false confessions based on various cases and historical anecdotes: voluntary, coerced-compliant, and coerced-internalized. A voluntary false confession is a self-incriminating statement that is given without external pressure from the police. There are several possible reasons that a person would offer a

false confession, such as protecting a friend or relative, a need for acceptance, self-punishment, or recognition. On the other hand, a coerced-compliant false confession comes about when a suspect provides a confession only after being intensely interrogated. This type of false confession occurs when a suspect confesses in order to escape or avoid an aversive interrogation or to secure a promised reward. Lastly, there are coerced-internalized false confessions. These are false confessions in which an innocent person actually comes to believe that he or she committed the crime in question. In the case of coerced-internalized false confessions, it is possible that the suspect's memory of his or her actions have been changed, which could mean that the original contents are irretrievable (Kassin, 1997). The coerced-internalized type of false confession is very unique. With this type of false confession, the suspect may actually create a false memory of the crime, or he or she may come to a point where it is impossible to distinguish between true and false memories. Much research has demonstrated that false memories can develop following many different types of training procedures.

For instance, Mazzoni and Memon (2003) examined whether imagining an event could create false memories. These results showed that people can develop both a belief in and a memory of an event that definitely did not happen to them by simply imagining its occurrence. Imagination, alone, without any additional suggestive procedure, increased participants' likelihood of saying that an event had occurred in their childhood, and also produced false memories of the event (Mazzoni & Memon, 2003). In a study by Carneiro, Fernandez, and Dias (2009), the researchers looked at the relationship between the identifiability of word lists and false memories in adults and children. False memories for critical words that were either easy or hard to identify were analyzed in adults and in children. They found opposite results in children and adults. Lists with highly identifiable critical words produced fewer false memories for

adults but more false memories for children. These results suggested that, if they can identify critical words, adults use an identify-to-reject strategy to edit out false memories, whereas, in children, theme identification does not lead to the use of a monitoring strategy like this (Carneiro, Fernandez, & Dias, 2009).

In addition to the findings that the simple act of imagining an event that did not occur and theme identifiability of words can influence false memories, Zaragoza, Payment, Ackil, and Drivdahl (2001) found that confirmatory feedback also influenced false memories. They conducted a study where, in two experiments, adults who witnessed a videotaped event subsequently engaged in face-to-face interviews during which they were forced to confabulate information about the events they had seen, that is, they were told to come up with fake details about what they witnessed. The interviewer selectively reinforced some of the participants' confabulated responses by providing confirmatory feedback and provided neutral feedback for the remaining confabulated responses. One week later, examination of the participants' memories revealed that they had created false memories for the event. The results also showed that the confirmatory feedback increased false memory for forcibly confabulated events, increased confidence in those false memories, and increased the likelihood that participants would freely report the confabulated events one to two months later (Zaragoza, Payment, Ackil, & Drivdahl, 2001).

While forced confabulation, confirmatory feedback, and the imagining of an event that did not occur have been shown to have an impact on the likelihood of creating false memories, Reysen (2007) examined the effects of social pressure on false memories. Participants studied lists that were created to elicit false memories and then worked in conjunction with virtual confederates on a recognition memory task. In Experiment 1, the participants worked with one

or two confederates to complete multiple study-test trials. On the group tests, participants were implicitly pressured to recognize words that did not appear on the studied lists. Experiment 2 utilized a more difficult recognition test involving one long study phase followed by one long test phase. After the group tests in both experiments, participants completed surprise individual recognition tests. In both experiments, social pressure influenced the participants' responses on group recognition tests and subsequent individual recognition tests. It was found that social pressure affected both veridical and false memories (Reysen, 2007).

In a study by Loftus (2005) examining the misinformation effect, the impairment in memory for the past that arises after exposure to misleading information was examined. The misinformation effect has been studied for the past 30 years, and several issues have been addressed. Some of these are the conditions under which people are especially susceptible to the negative impact of misinformation, and also when they are resistant. Loftus (2005) suggested several ways that misinformation can enter consciousness and cause contamination of memory. For instance, when witnesses to an event talk with one another, when they are interrogated with leading questions or suggestive techniques, or when they see media coverage about an event, misinformation can contaminate their memory.

While misinformation can taint one's memory with misleading information, one's memory might also become tainted when he or she uses details from an event that actually occurred to prove that a false memory occurred. Lampinen, Meier, Arnal, and Leding (2005) looked at content borrowing, which is when details from presented items are errantly borrowed to confirm the occurrence of a false memory item. Content borrowing is thought to be one of the processes that cause false memories to occur. In their study, evidence for content borrowing occurred for more than half of the false memory judgments that the participants reported. The

results of their study supported the idea that false memories are constructed because of content borrowing, that is, that people seem to take pieces of a true memory as evidence for a false memory (Lampinen, Meier, Arnal, & Leding, 2005).

Misinformation and content borrowing are specific types of memory errors. Kimball and Bjork (2002) examined the interplay of two broader types of memory error: forgetting and false memories, that is, errors of omission and errors of commission. The effects of two manipulations known to inhibit retrieval of studied words, which are directed forgetting and part-list cutting, on the false recall of an unstudied “critical” word following the study of its 15 strongest associates were examined. Participants cued to forget the first of the two studied lists before studying the second list recalled fewer List One words but used the missing critical word more often than did the participants cued to remember both lists. On the other hand, providing some studied words as cues during recall reduced both recall of the remaining studied words and intrusions of the critical word. The results of this study suggested that forgetting can increase or decrease false memories, depending on whether such forgetting reflects impaired access to an entire episode or retrieval competition among elements of an episode (Kimball & Bjork, 2002).

Although, false memory research is important when talking about false confessions, especially when discussing coerced-internalized false confessions, there has also been a large body of research conducted with false confessions themselves. In a study by Bem (1966), subjects participated in individual experimental sessions disguised as research on lie detection. After crossing out certain words on a list of words, each subject was trained to say true statements in the presence of a “truth light” and false statements in the presence of a “lie light.” The subject was then required to state aloud that he had previously crossed out certain words and had not crossed out certain other ones. Half of these confessions were false, and each of them

were made in the presence of the “truth light” or the “lie light.” The results of the study showed that false confessions made while the “truth light” was on produced more subsequent errors of recall and less confidence in recall accuracy than either false confessions in the “lie light” or no confession at all. This study supports the possibility that false statements can distort an individual’s recall of his or her past behavior as a function of the credibility cues present at the time these statements are emitted (Bem, 1966).

In addition to Bem’s (1966) research on false confessions, Kassin, Goldstein, and Savitsky (2003) tested the hypothesis that the presumption of guilt that underlies police interrogations activates a process of behavioral confirmation. In Phase One of their research, 52 suspects who were either guilty or innocent of a mock theft were questioned by 52 interrogators that had been led to believe that most suspects were either guilty or innocent. Interrogators armed with guilty instead of innocent expectations selected more guilt-presumptive questions, used more interrogation techniques, judged the suspect to be guilty, and exerted more pressure in order to get a confession, especially when paired with an innocent suspect. During Phase Two, neutral observers listened to audiotapes of the suspect, the interrogator, or both. They perceived suspects in the guilty expectations condition as more defensive and as somewhat more guilty. The results of the study indicated that a presumption of guilt sets in motion a process of behavioral confirmation by which expectations influence the interrogator’s behavior, the suspect’s behavior, and ultimately the judgments of the neutral observers. Kassin, Goldstein, and Savitsky (2003) believe that the results of their study may underestimate the risks incurred in criminal justice settings. These risks pertain to the following: police are trained to have confidence in their ability to divine guilt from a suspect’s interview behavior and to use psychological interrogation techniques, the police are motivated by career aspirations to solve

cases, the police pressure suspects over the course of hours of interrogation, and the presumption of guilt is a self-generated hypothesis (Kassin, Goldstein, & Savitsky, 2003).

In addition, Kassin, Meissner, and Norwick (2005) conducted a study where college students and police investigators watched or listened to ten prison inmates confessing to crimes. Half of the confessions were true accounts, but half were confabulated confessions merely used for the study. Their findings were consistent with other recent research. In general, the students were more accurate than police at determining which confessions were false, and the accuracy rates were higher among those presented with audio-taped as opposed to video-taped confessions. Investigators were also significantly more confident in their judgments and also prone to judge confessors as guilty. In order to determine if police accuracy would increase if the guilty response bias were neutralized, participants in a second experiment were specifically informed that some confessions were true and some were false. This manipulation eliminated the investigator response bias, but it did not result in increased accuracy or lower confidence. These results suggest that false confessions are difficult to detect, and that false confessions are a problem that requires further investigation (Kassin, Meissner, & Norwick, 2005).

Research has suggested that several different things have the potential to contribute to the likelihood of a false confession. First, there are police interrogation tactics that were identified by Kassin and McNall (1991) as minimization, maximization, and communicating promises and threats by realistic implication. Maximization refers to the use of “scare tactics” that are meant to intimidate a suspect believed to be guilty. In contrast, minimization refers to a less harsh technique in which the interrogator attempts to lull the suspect into a false sense of security by offering sympathy, tolerance, excuses for the suspect’s accused behavior, moral justification for the suspect’s accused action, excusing the suspect’s behavior by placing blame

on the victim, and/or underplaying the seriousness of the suspect's charges. Finally, interrogators attempt to get a confession by using threats of harsh punishment or promises of leniency in sentencing (Kassin, 1997).

In contrast to the explanation given by Kassin (1997), Gudjonsson and Clark (1986) suggested the concept of interrogative suggestibility in order to explain individual differences in response to police interrogation questions. Interrogative suggestibility is defined as the extent to which, within a closed social interaction, people begin to accept messages that are communicated during formal questioning, as the result of which their subsequent behavioral response is affected (Conti, 1999). Gudjonsson (1991, 1999) also suggested that these particular characteristics of a suspect can affect his or her suggestibility. For example, a person who is suspicious is less suggestible than a person who is trusting. Poor memories, low self-esteem, lack of assertiveness, and anxiety also have the potential to affect suggestibility (Conti, 1999).

Consistent with this idea, Eysenck (1964) also agrees that an innocent suspect with particular personality characteristics is more likely to provide a false confession. Introverts are more susceptible to police interrogation tactics than extroverts. Because most criminals are extroverts, interrogation methods are intended to be used on a classic extrovert criminal. Therefore, these interrogation tactics may have a devastating influence on a person with an introverted personality (Conti, 1999). Another personality trait associated with false confession was reported by by Gudjonsson, Sigurdsson, Bragason, Einarsson, and Valdimarsdottir (2004). They found that false confessions and false denials were both significantly associated with antisocial personality traits and the Eysenck Personality Questionnaire Psychoticism score was the single best predictor. They also reported that males were significantly more likely to report false confessions than females. Gudjonsson, Sigurdsson, Finnbogadottir, and Smari (2006) also

found a relationship between false confessions and perceptions of parental rearing practices. The female participants in the study who claimed to have made a false confession to parents or teachers were more prone to anti-social behavior and reported the least love from their mother in childhood. Similarly, a study by Redlich and Goodman (2003) found that younger and more suggestible participants were more likely than older and less suggestible participants to take responsibility for something that he or she did not do.

In addition to studies looking at relevant personality traits associated with false confessions, research has also looked at interrogation tactics and their relationship to false confessions. For example, Russano, Meissner, Narchet, and Kassin (2005) developed a novel experimental paradigm in order to study the effects of psychologically based interrogation tactics on the likelihood of eliciting true and false confessions. The results of the study indicated that when an interrogator gave an explicit offer of leniency and used the minimization technique guilty persons were more likely to confess than innocent persons. That is, when the interrogator offered a deal and used minimization, the number of both true and false confessions increased.

Kassin and Kiechel (1996) demonstrated that false incriminating evidence can lead an individual to accept guilt for a crime that he or she did not commit. In the study by Kassin and Kiechel (1996), subjects were participating in what they thought was a reaction time experiment. Each subject was asked to fill out a questionnaire regarding his or her typing experience, spatial awareness, and speed of reflexes in order to bolster the credibility of the experimental cover story. The subject and confederate were then taken into another room, seated across from the researcher, and given the instructions for the task. The confederate was instructed to read a list of letters aloud, and the subject was to type these letters on the keyboard. After three minutes, the subject and confederate were supposed to switch roles. Before the session began, the

subjects were instructed on the proper use of the computer. They were specifically warned not to press the “ALT” key positioned near the space bar because if they did, it would cause the program to crash and the data would be lost. After one minute, the computer “ceased” to function, and a highly distressed experimenter accused the subject of pressing the “ALT” key. All of the subjects initially denied the charge, at which point the experimenter tinkered with the keyboard, confirmed that the data had been lost, and asked, “Did you hit the ALT key?” Overall, 69% of the 75 subjects signed the confession, 28% exhibited internalization, and 9% confabulated details to support their false confessions (Kassin & Kiechel, 1996).

The present study uses a paradigm similar to that used by Kassin and Kiechel (1996), however, instead of looking at whether the subjects display evidence of compliance, internalization, or confabulation, the present study will look at the relationship between the likelihood of providing a false confession and the grade point averages of the student participants. This study also uses the police interrogation techniques of minimization, maximization, and threatening to try to elicit a false confession from the participants. It was hypothesized that the students with the lower grade point averages, those below 2.5, would be more likely to provide a false confession. Consistent with past research (see Gudjonsson, Sigurdsson, Bragason, Einarsson, and Valdimarsdottir), it was also hypothesized that males would be more likely to falsely confess than females and the use of the threatening technique would be the more convincing technique in trying to elicit a false confession.

Method

Participants

Thirty – three undergraduate students from Concord University were used in the study. The sample contained 16 males and 15 females. However, two of them were not used in the

analysis due to computer problems. The participants were participating for extra credit in one of their courses, either an introductory psychology or sociology course.

Materials

One computer was used for this study, along with a room with a table and two chairs. A list of words for the participants to type was also required for the study. In addition, a “confession” for the participant to sign was used (see Appendix 4), along with a questionnaire regarding the participants’ typing ability, typing experience, and grade point average (See Appendix 2). Lastly, a questionnaire regarding the pressure felt to confess was used (See Appendix 3).

Procedure

Participants were recruited on the assumption that they were participating in a speed typing study. In each session, there was one participant and one confederate. Like in the Kassin and Kiechel (1996) study, in order to gain credibility for the experimental cover story, the participants were asked to fill out a questionnaire about their typing experience and ability, along with their estimated cumulative grade point average. The subject and confederate were then taken into a small room where the computer was located and where they were then instructed in regards to the task (See Appendix 7). The confederate read a list of words aloud, and the subject was instructed to type these words on the computer. After two minutes, the subject and confederate are supposed to switch roles. However, before the session began, the participants were instructed to not press the “ALT” key because the pressing of this key would cause the program to crash and all data to be lost. After one minute, the computer shut down, and then the researcher accused the subject of having pressed the “ALT” key. After the accusation, the

researcher then asked the confederate if he or she saw the participant hit the “ALT” key, and he or she would say “yes”.

Two types of interrogation techniques were used to try to elicit a confession from the participants. Minimization involved minimizing the seriousness of the situation. Things like “You probably did not realize that hitting that button would really cause the computer to lose all the data” or “I’m sure it was just an accident” were stated. After some of these statements were made, the participant was prompted to sign a confession. They were told that the confession was needed to continue the research with the other participants. If the participant refused to sign the confession, the threatening technique was used. Then, things like “I’ll have to call my research advisor to take care of this if you do not sign a confession” were said. There was a specific script so that each participant was subject to the same statements for the same amount of time (See Appendix 6). While the interrogation was taking place, the confederate kept track of the participants’ responses when he or she was initially asked if the ALT key was pressed, when it was confirmed that the data was gone, when the confederate confirmed that the participant was seen pressing the ALT key, and after the threatening technique was used.

After the minimization and threatening techniques were used, if a confession was still not elicited, then the subject was reported as not falsely confessing. The primary dependent measure in this study was whether or not the participant signed the confession. Immediately after the “interrogation” was over, the participant was fully debriefed about the true purpose of the study. It was stressed that the participant did not cause any damage to the computer or the data. The subject was informed that the study did not pertain to speed of typing, but that it pertained to the likelihood of eliciting a false confession (See Appendix 1). After the debriefing, the participant was asked to take a short survey about the pressure he or she felt to confess. They rated the

pressure he or she felt to confess on a Likert Scale ranging from 0 to 5, with 0 indicating no pressure and 5 indicating extreme pressure. They were asked to answer this question in regard to each of the different parts of the “interrogation” procedure. That is, in regard to both the minimization technique that was used and when the threatening technique was being used.

Results

A total of 33 participants were involved in the study. However, only 31 of them were used for analysis because of computer problems. From the 31 participants, one of the males did not agree to sign a confession. He had a 2.5 GPA, and the average GPA of those 30 participants who signed the confession was 3.16.

When initially asked about pressing the ALT key, a significantly larger number of women denied pressing the key compared to men who expressed uncertainty when asked about pressing the key, $\chi^2(1) = 6.19, p = .013$. Overall, participants were also more likely to make a reluctant confession after the confederate confirmed that she saw the participant press the ALT key, $\chi^2(2) = 11.231, p = .004$. After the interrogation, participants were then asked to rate the pressure he or she felt to confess. However, no significant effect was found between rating of pressure and whether the participant was male or female, $t(29) = -1.561, p = .129$. Lastly, a one – way analysis of variance was calculated and no significant effect was found between GPA and when the participant admitted that he or she had pressed the ALT key, $F(1, 23) = 2.44, p = .132$.

Discussion

It was hypothesized that participants who had grade point averages below 2.5 and were male, would be more likely to provide a false confession. It was also hypothesized that participants would feel more pressure to confess when the threatening technique was used. In regard to gender, the results of this study were expected to mirror those of past research, with

males being more likely to provide a false confession. Results of past false confession research, such as that by Kassin & Kiechel (1996), have had serious implications for the criminal justice system, and mock jury studies have shown that confessions have more impact than eyewitness and character testimony. Past research, such as that by Kassin and McNall (1991), has caused some police interrogation tactics to be scrutinized, and some confessions elicited in extreme circumstances, such as food or sleep deprivation, are now deemed inadmissible as evidence. The results of this study were expected to mirror the results of past research and yield implications for the forensic setting.

The results of the current study showed that females were significantly more likely to deny pressing the ALT key than males when initially asked. This suggests that females are more likely to deny accusations of something they did not do compared to males. Males were also found to be more likely to express uncertainty when initially asked about pressing the ALT key compared to females. These ideas are consistent with past research, such as that by Gudjonsson, Sigurdsson, Bragason, Einarsson, and Valdimarsdottir (2004), which has shown that males are more likely to falsely confess.

Almost all of the participants signed the confession, which was not consistent with the hypothesis or past research. There were some variables that had the potential to confound the results of this study. First, it was predicted that students with GPAs below 2.5 would be more likely to provide a false confession. However, only three participants had GPAs that fit this description. This could be partly due to the fact that students with GPAs of 2.0 and below could be on academic probation or suspended from the university, making it difficult for them to participate in this research project. It is possible that if a wider range of GPAs were included in the study, the results would have looked different. Second, both the interrogator and the

confederate were female. These factors could have had a positive or negative effect on the participants' reaction to the interrogation and the accusations. The study was also limited in the number of participants that were available. The study was conducted at a small university, and the participants were recruited from classes on the basis that they would receive extra credit. This made it difficult to ensure that the participants who volunteered to participate in the study actually showed up.

The results of this study and other research on false confessions would yield the most implications in the forensic arena, particularly the area of interrogation tactics. This brings about a question regarding the external validity of the present study, along with past research. To what extent can these results generalize to a real police interrogation and the behavior of actual crime suspects? One difference in the present study and an actual interrogation is the consequences of the participants' actions. While an actual criminal is facing jail time or other severe consequences, the only negative effects or consequences the current research participants were facing was a guilty feeling for losing the research data or having to wait for the research advisor to show up. Because the consequences of not signing the confession were not harsh, the participants could have merely signed the confession to be cooperative, to end the session sooner, or for a variety of other reasons.

Although the results of this study did not support the hypothesis that females and participants with higher GPAs would be less likely to provide a false confession, the results showed other significant effects. For instance, women were more likely to initially deny the accusation than men. Also, participants, both male and female, were more likely to provide a reluctant confession after the confederate confirmed that she saw the participant press the ALT key.

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Debriefing Script

This study was not a typing speed study. It actually pertained to eliciting false confessions. You did nothing wrong. The computer did not crash and you did not cause any data to be lost. The computer shut down due to a timer and the error message that appeared was created specifically for this research. There are absolutely no negative consequences to participating in this study. The true purpose of the study was withheld in order to measure your willingness to sign a confession. You are asked not to talk about this study with anyone else in order to attain the most accurate results possible. If you would like to talk to someone about your participation in the study, here is the information for the Student Counseling Center. It is located on the second floor of the Bonner House and is open from 8:00am - 4:00pm. The phone number is (304) 384-5290.

Questionnaire #1

1. Do you consider yourself to be a good at typing?
2. Have you ever taken a typing class?
3. About how many words per minute do you think you type?
4. Are you a Freshman, Sophomore, Junior, or Senior?
5. What is you estimated cumulative GPA?
6. Sex: F M

Questionnaire #2

1. How much pressure did you feel to confess when things like “You probably didn’t realize that hitting the key would cause all the data to be lost” or “I’m sure it was just an accident” were stated? Rate the pressure below (0 indicating no pressure and 5 indicating extreme pressure).

0 1 2 3 4 5

Please indicate why you choose the rating that you did.

2. How much pressure did you feel to confess when things like “I’ll have to call my research advisor to take care of this if you do not sign a confession” were stated? Rate the pressure below (0 indicating no pressure and 5 indicating extreme pressure).

0 1 2 3 4 5

Please indicate why you chose the rating that you did.

Confession

I, _____, was participating in a typing task and hit the “ALT” key that I was instructed not to hit. By hitting this key, I caused the computer to crash and data to be lost.

Interrogation Script

Confederate: (Confederate will exit the room where the participant was typing and “inform” the researcher that the computer is no longer working.)

Researcher: (Researcher will enter the “typing room”) Did you press the ALT key?

Subject: Response

Researcher: (Researcher will check the computer and confirm that the data has been lost.) Ok.

All of the data is gone and the computer’s crashed. Are you sure you did not press the ALT key?

Subject: Response

Researcher: (said to the confederate) Did you see him/her press the ALT key?

Confederate: Yes I did.

Subject: Response

Researcher: You probably did not realize that it was such a big deal. It’s OK. Anybody could have done it. I’m sure it was just an accident. I am going to ask you to sign a confession to note how the data was lost for my research advisor and so I can continue doing the research with the other participants. If you would just sign this, it would be very helpful. (Depending on whether the participant signs the confession, we will move on to the next part of the script.)

Subject: Response

Researcher: Well, if the confession is not signed, then I will have to call my research advisor to take care of this, and it could take a while. I’m going to ask you to sign it one more time.

Subject: Response

Researcher: (No matter what the participant's response is, he or she will be fully debriefed about the study at this point.) Ok. Now we are going to debrief you about the study and ask you to answer a few questions.

Directions for typing Task

A blank notepad application is shown on the computer screen. The other participant will read you a list of words and you are to type as many of them as you can as accurately as you can. Do not worry about capitalization. Spell the words the best you can. Continue to type straight across the screen, leaving one space between each word. If a timer pops up while you are typing, please ignore it. I will let you know when it is time to switch places. If you need any help, please come and get me.

(To the confederate) Read the words at a steady, but fast pace.

The Creation of the Perfect Woman:
1950s June Cleaver vs. Bettie Page

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McNair Final Project

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The 1950s was an era when the perception of women changed drastically. This was a time when the image of the perfect woman was being created and molded producing two opposite images of what many believed to be the perfect woman. Media played a pivotal role in the creation of the two images. First, the mainstream media sought to create the image of the beautifully feminine woman every good man would be happy to make his wife and mother of his children. The woman he would be proud to introduce to his parents and his boss. June Cleaver became the face associated with the wholesome woman. Yet, at the exact same time when sex and intimacy were being ignored in mainstream media some of the most provocative photographs and videos of all time were being made and distributed in America. This led to the creation of the second perfect woman. With the emergence of magazines such as *Playboy* the image of the beautiful, sexually aware woman was being created. Bettie Page found her fame in the midst of the creation of the two images. Her story is one that gives proof of the existence of the created image of this sexually aware creature.

The Kinsey report¹ was conducted prior to the 1950s but was released in 1952 and introduced new ideas and concepts about human sexuality that had not been considered by the general public or professionals before this time. The report suggested women were sexual creatures just as men were and have sexual desires that many of them fulfill. This was an image of women that some members of society did not want to acknowledge nor encourage. My thesis holds that parts of society encouraged and created the two images of women that are primarily focused upon in this study. The first image that women were to be proper and nurtured for

¹ Kinsey, Alfred, Pomeroy, Wardell B., Martin, Clyde E., Gebhard, Paul H., *Sexual Behavior In The Human Female*, Philadelphia and London: W. B. Saunders Company, 1953.

Kinsey, Alfred, Pomeroy, Wardell B., Martin, Clyde E., *Sexual Behavior In The Human Male*, Philadelphia and London: W. B. Saunders Company, 1949.

marriage and family reinforces the idea that women are not sexual creatures and the study was false. However, the second image created women that were sexual creatures that not only enjoyed their sexuality but understood their role as dominate sexual creatures.

The Coronet Instructional Videos² produced and distributed videos teaching young ladies to be morally responsible. Home Economics classes focused on turning out proper young ladies who not only were prepared to take care of home, husband and children but who felt it to be their obligation to want to do so. They were designed to educate in the sense they are 'educating' young females how to behave and function as young ladies, and future wives and mothers. They also address the role of the males in society. Young men are taught to treat young ladies as delicate and above reproach unless those young ladies do not behave as young ladies should. The video resources portray only two types of people, those that are proper and well behaved under the guidelines the videos lay out and those who are the opposite. So, the videos do cultivate both the images that were created of women; the proper well behaved and the improper sexually aware female.

² <http://www.archive.org/details/WhyStudy1955>

http://www.archive.org/details/MotherTa1952_2

<http://www.archive.org/details/MotherTa1952>

<http://www.archive.org/details/CookingT1949>

<http://www.archive.org/details/DatingDo1949>

<http://www.archive.org/details/HomeEcon1951>



For example in the *Are You Popular* video the good girl verses the bad girl is a prime example of the creation of the perfect woman. The bad girl is not really liked and is loud and dresses very bold. She dates 'all the boys' and parks in cars on her dates. The good girl on the other hand is well dressed, polite and considerate of others. She is careful not to date all the boys and never parks in cars. She is respectful and considerate of her parents' feelings. The video expresses the proper etiquette of dating such as being on time, meeting the parents, the boy assumes the financial responsibility and the boy decides what to do on the date because that can put too much pressure on the good girl. Because the good girl will be responsible her parents trust her. The good boy likes the good girl because she "looks well and is friendly with everyone and considerate with others.... and is fun to be with."³ Videos like this one were showed to students in home economics classes to encourage the proper behavior and cultivation of created the perfect American female.

³ <http://www.archive.org/details/AreYouPo1947>



Coronet films continued this cultivation in videos like *Marriage Is a Partnership*. This video shows the importance of being the good wife in order for the marriage to work. The wife quits her job because it is the husband's place to be the provider for the couple. Financial matters should be settled together, of course the wife may not always agree with the decisions made but they did discuss them anyway. The film refers to the wife's need to cooperate in matters of sex but never mentions the same for the husband. The wife continually apologizes for her feelings and follows the direction of her husband's desires.⁴

Magazines such as *Good Housekeeping* and *Ladies Home Journal* from 1948 - 1959 had articles and advertising encouraging the proper behavior of women. These women were to be beautiful and appealing to attract the right man. The wholesome images of women were used to sell manufactured products. However, many of these images held a slight sexual appeal to them in the way the women are dressed or posing. In this aspect the two created images are brought together in a minor way. Perhaps this is when marketing departments discovered that sex sells products. The articles in the magazines are structured in a manner that women are dependent

⁴ <http://www.archive.org/details/Marriage1951>

on their men for support, both economical and emotional. However, a new trend develops in the articles and advertising, men are encouraged to participate in the raising of the children and the family life. Women are encouraged to try new hobbies and to embrace the convenience of modern appliances. These sources show the mind set of mainstream society in the 1950s.⁵



⁵ Good Housekeeping and Ladies Home Journal 1948-1959



Television played a very pivotal role in the creation of the American wholesome woman. Shows like, *I Love Lucy* enforce this image by repeatedly providing scenarios where the American woman's place is at home with a good husband taking care of her. Lucy, the main character of the show is continually trying to prove she has talent and can be a successful career woman. However, each time she schemes her way into her 'career' of the moment, she is a failure and must be rescued by her darling husband Ricky. By the end of the episode Lucy

⁶http://images.google.com/imgres?imgurl=http://www.meredy.com/lucy01.jpg&imgrefurl=http://www.meredy.com/lucytriv.html&usg=__wD8HIJnvDd8OHDJTZNwJy92aMg4=&h=600&w=497&sz=36&hl=en&start=0&zoom=1&tbnid=0vkDf_HzBPgljM:&tbnh=166&tbnw=137&ei=QdvKTYKJI8PV0QGYq7WHCA&prev=/search%3Fq%3Di%2Blove%2Blucy%26hl%3Den%26biw%3D1276%26bih%3D853%26gbv%3D2%26tbn%3Disch&itbs=1&iact=r&c&dur=500&page=1&ndsp=26&ved=1t:429,r:6,s:0&tx=74&ty=59 accessed April 28, 2011

realizes that had she been the devoted, loving and satisfied stay at home wife that she is meant to be she would not have gotten herself into trouble.⁷

In her book *The Feminine Mystique*, Betty Friedan accuses the women's magazines of the 1950s of creating what she refers to as "the problem that has no name", providing images and articles of women as being stereotypical happy homemakers with limited interests and abilities.⁸ In her book, *The Feminine Mystique*, Betty Friedan expresses her concern for middle-class women during the 1950s.

"Just what was the problem that has no name? What were the words women used when they tried to express it? Sometimes a woman would say "I feel empty somehow...incomplete.? Or she would say, "I feel as if I don't exist." Sometimes... "A tired feeling... I get so angry with the children it scares me... I feel like crying without any reason."

The problem lay buried, unspoken for many years in the minds of American women. It was a strange stirring, a sense of dissatisfaction, a yearning that women suffered in the middle of the twentieth century in the United States. Each suburban wife struggled with it alone. As she made the beds, shopped for groceries, matched slip-cover material, ate peanut butter sandwiches with her children chauffeured Cub Scouts and Brownies, lay beside her husband at night- she was afraid to ask even of herself the silent question- "is this all?" ...

But on an April morning in 1959, I heard a mother of four, having coffee with four other mothers in a suburban development fifteen miles from New York, say in a tone of quiet desperation, "the problem." And the others knew, without words, that she was not talking about a problem with her husband, or her children, or her home. Suddenly they realized they all shared the same problem, the problem that has no name. They began, hesitantly, to talk ABOUT IT. Later, after they had picked up their children at nursery school and taken them home to nap, two of the women cried, in sheer relief, just to know they were not alone."

The "mystique" that Friedan spoke of was the image of the woman as mother, as wife, living through her husband, through her children, giving up her own dreams of that. She concluded:"The only way for a woman, as for a man, to find herself, to know herself as a person, is by creative work of her own."⁹

⁷ http://www.starpulse.com/Television/I_Love_Lucy/Summary/

⁸ <http://www.upress.state.ms.us/books/660>

⁹ Quote is from Zinn, Howard, *A People's History of the United States*. Harper Perennial A Division of Harper Collins Publishers. 1980.

For some woman playing this role and pretending to be fulfilled was not enough even before Friedman's book. Thus the creation of the second image begins.

Camera clubs, men's magazines such as *Playboy*, the film industry and underground pornography distributors were beneficial in the creation of the second image. Women like Bettie Page were photographed and painted in poses that showed their sexual awareness. Those photos were sold and distributed in mass through United States Postal Service, in films and magazine. This new availability of photos and films led to the explosion of interest in the second image of the perfect woman. Although this dual image has its origins in earlier periods in American history, the growing technology and media of the 1950's propelled both images deeper into the American mind.



The wide availability of cameras and film to hobbyists and novice photographers allowed woman like Bettie Page to be photographed and those photos to be distributed in mass

¹⁰http://www.google.com/search?hl=en&rlz=1R2ADRA_enUS422&biw=1259&bih=791&site=search&tbm=isch&a=1&q=bettie+page+christmas&aq=f&aqi=g1&aql=&oq=
Poses like this one were popular among the buyers of the 'under the counter' photos.

numbers. The interest in those photographs of women who were aware of their own sexuality led to the demand for more. As this demand grew changes in how the women were photographed took place. Almost nude and nude photos were sought after. The models were posing very seductively and provocatively. The demand for the photographs grew and models were more willing to pose to please the buyers.



Fetish photographs began to emerge - models posed in high hilled boots and very little else. As the Fetish prompted photo industry grew changes began to occur such as women in dominatrix poses with other women tied up or being physically punished. The sale of these photos reinforced the idea of the second image of the perfect woman.

¹¹http://www.google.com/search?hl=en&rlz=1R2ADRA_enUS422&biw=1259&bih=791&site=search&tbn=isch&sa=1&q=bettie+page+christmas&aq=f&aqi=g1&aql=&oq=
Bettie Page poses for high heeled shoe fetish buyers 1955



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The biography of Hugh Hefner¹³ by Steven Watts as a secondary source is general in the respect that he was a major figure in the creation of the second created image. He has taken this created image and cultivated it into the present. His magazine has offered women the avenue for fame and fortune. This biography definitely encourages the image of the sexually aware woman. These women have gone from being photographed and published in his magazine to being in movies, reality television shows and for some their own books. Bettie Page never posed directly for photographers to be published in *Playboy* magazine. However, some of her photos were purchased by Hugh Hefner and published in his magazine.

¹²http://www.google.com/search?hl=en&rlz=1R2ADRA_enUS422&biw=1259&bih=791&site=search&tbm=isch&a=1&q=bettie+page+christmas&aq=f&aqi=g1&aql=&oq=

Bettie Page posing as dominatrix very suggestive and sexually aware of her power.

¹³ Watts, Steven, *Mr. Playboy: Hugh Hefner and the American Dream*. John Wiley & Sons, Inc. Hoboken, New Jersey. 2008.



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Ms. Page was playmate of the month in January 1955. *Playboy* magazine was created late in the 1940s and found itself in a market that was thriving during the 1950s. This market was a driving force behind the cultivation of the second image of the perfect woman. The photographs were of women who fit the idea of beautiful and very aware of their own sexuality. Several digest sized magazines were published during this time. Some were dedicated to the specific fetishes of the buyers. Spanking of the female models was a very popular choice.

14

http://www.google.com/search?hl=en&rlz=1R2ADRA_enUS422&biw=1259&bih=791&site=search&tbm=isch&sa=1&q=bettie+page+christmas&aq=f&aqi=g1&aql=&oq=
Bettie Page Miss January 1955, *Playboy* magazine



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The comic books that were distributed during the 1950s gave women the ability to play dominating roles such as Bettie Page's Dark Angel character, where they were fictionalized as good or evil. The comics take a general look at gender roles and the multiple character choices given to women. The comics do, however reinforce the created image of the sexually aware woman. The Senate subcommittee that was formed in 1955 to set legal standards by which the comic industry was to follow provides a great deal of insight into the views of mainstream America versus the views of the Americans purchasing the underground comics and photographs. Generally the subcommittee was to set standards by which the comic publishers were to create their story lines (including guidelines for the drawings). However, this speaks volumes about the effort that was put into trying to abolish the image of the sexually aware woman.

¹⁵http://www.google.com/search?hl=en&rlz=1R2ADRA_enUS422&biw=1259&bih=791&site=search&tbn=isch&a=1&q=bettie+page+christmas&aq=f&aqi=g1&aql=&oq=
The spanking of Bettie Page was a popular choice for many buyers.



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The 1950s created and cultivated two very different images of women. The wholesome image was created in part by Coronet Educational Films, womens' magazines and the mainstream media, such as television. Although this image had been around for decades it was clearly forced upon Americans during 1950s. The opposite image was being created and finding great success in media formats such as pin up modeling, camera clubs that embraced the fetish market and men's magazines. Real American women were finding ways to incorporate the two images into their own lives. The mainstream media was portraying the images in advertisements and television shows. Women were choosing to play the role of the wholesome wife or choosing to be the seductive version of Bettie Page.

The irony of the creation of the two images is that the women who were role modeled lived lives very different from their created image. Barbara Billingsley played the character June

¹⁶ <http://www.bing.com/images/search?q=bettie+page+comics&FORM=IGRE7#x0y5695>
Bettie Page was the main character in several comic books

Cleaver. She was a career woman who attended Hollywood parties and held a very public life. She had attended one year of higher education before beginning her career in acting. In her private life she was married three times. She divorced her first husband Glenn Billingsley whom she had two children with. Her Second husband Roy Kellino and third husband William Mortensen both died. Ms. Billingsley raised her children while pursuing her career as an actress.¹⁷

Bettie Page on the other hand had graduated as salutatorian of her high school class. She received her Bachelor of Arts in teaching at Peabody College in Tennessee. She taught high school English then worked as a secretary for several years before starting her modeling career in 1951. Ms. Page was married four times, all ending in divorce. She married her first husband Billy Neal twice. Her third husband Armond Walterson and her last marriage was to Harry Lear ending in 1972. She never remarried. Ms. Page did not have any children. After leaving her modeling career in 1957 she vanished from the public eye.¹⁸

This incorporation and acceptance or denial of the two images are what impacted gender roles and the perception of women in recent American history. Both of the images have played a vital role in the perception of women. Women like Pop icon Madonna have been influenced by photos of Bettie Page. Although Madonna has been credited for many of outfits and poses they are obviously found in the Bettie Page photos from the 1950s. The influence is seen in the International Burlesque Star Dita Von Teese.

¹⁷ http://www.nytimes.com/2010/10/17/arts/television/17billingsley.html?_r=1&scp=2&sq=beaver&st=cse accessed 03/15/2011

¹⁸ Silke, Jim, *Bettie Page Rules*.

Essex, Karen and Swanson, James L., *Bettie Page The Life of a Pin-up Legend*.

These books offered insight into the life of Bettie Page.



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<http://www.bing.com/images/search?q=image+madonna&view=detail&id=3318551EEF9D561FC4ACCC7048B28BD13D49965E&first=211&qpv=image+madonna&FORM=IDFRIR> accessed 04/28/2011



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²¹ <http://images.google.com/imgres?imgurl=http://www.thefirstpost.co.uk/assets/library/teese-426--129492827954463100.jpg&imgrefurl=http://www.thefirstpost.co.uk/73705,people,entertainment,dita-von-teese->

The influence of Bettie Page is seen everywhere from singer Katie Perry, Supermodel Shalom Harlow, the Spring 2011 Paris Collection to Web sites devoted to the pinup model. Women (young and old) are choosing which image they are most influenced by. In an article from Politics Daily, author Joanne Bamberger refers to June Cleaver and uses her image to urge the reader to pay attention to what she perceives the 112th Congress is doing, trying to take back women's rights sending women back to the days of black and white images.

"Put all those things (no taxpayer funding for abortions, denial of funding for family planning, and other issues seen as forcing women back in time) together, and I can't help but sense an effort to re-create the June Cleaver era, when motherhood was a woman's prime directive and reproductive health issues were only whispered about in suburban neighborhoods over coffee cake and Maxwell House."²²

The 1950s were a time when Americans were searching for perfection in every aspect of their lives. Many had found economic prosperity and were searching for that prosperity in their everyday lives. This creation of the two images was intentional and cultivated throughout the decade. The development of technology and the influence the media had over Americans catapulted both images into future to be emulated by women more than fifty years later. Barbara Billingsley's character and Bettie Page's images have withstood the test of time. Their images continue to influence the women today.

cleavage-joins-katy-perry-on-cutting-room-floor-csi&usg=__9NIiWCdkNpzIrtVjSRYOdRmQS9s=&h=312&w=426&sz=58&hl=en&start=110&zoom=1&tbnid=IDfju73N3fCisM:&tbnh=160&tbnw=203&ei=tMLKTcS2NYXdgQfz6d2CBg&prev=/search%3Fq%3Ddita%2Bvon%2Bteese%2Bcsi%26hl%3Den%26biw%3D1276%26bih%3D853%26gbv%3D2%26tbm%3Disch0%2C2618&itbs=1&iact=hc&vpx=971&vpy=403&dur=203&hovh=192&hovw=262&tx=169&ty=120&page=5&ndsp=27&ved=1t:429,r:6,s:110&biw=1276&bih=853 accessed 04/28/2011 (Similar to 1950s fetish photos)

²² <http://www.politicsdaily.com/2011/02/25/are-we-returning-to-the-june-cleaver-era-and-would-june-stan/>
Accessed 05/06/2011

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Measuring Undervote in West Virginia Presidential Elections

By: John McCormick & Roberta Dickerson

Mentor: Dr. J. White

Major: Political Science

Abstract

The authors sought to determine which voting systems most accurately recorded votes in West Virginia elections over the course of three general elections (years 2000, 2004, and 2008). Undervote, defined as the number of votes that go uncounted in an election, was determined by comparing ballots cast to the number of votes for president. Undervote was found to have increased significantly between 2000 and 2008, as well as between 2004 and 2008. No significant increase occurred between 2000 and 2004. The increase in undervote for the 2008 election could not be linked to voting system. Paper ballots were found to have a significant negative impact on undervote in both 2000 and 2004, while punch cards were found to have a significantly positive impact on undervote in 2000 and 2004. Other voting systems were not found to significantly affect undervote rates.

Literature Review

People from democratized countries all over the world come together to engage in a distinct privilege called voting. Voters arrive at the polls anticipating an accurate, secure, and reliable voting procedure. The act of voting is a distinctive constitutional right in America, and is a primary function of a democratic government. The act of voting has evolved over time; women and African Americans were given the opportunity to vote with the adoption of the 15th and 19th amendments to the United States Constitution. Also, the enactment of the Voting Rights Act of 1965, required the federal government to eliminate literacy tests to determine eligibility, enabled federal agencies to oversee elections, and banned discriminatory voting practices. (Mercuri, Lipsio, & Feehan, 2006). Voting participation has significantly changed due to these changes in our society. Technological changes have also altered the voting landscape in America. Substantial voting system changes occurred in the wake of the 2000 presidential election after widespread punch card failures in Florida.

As a result of many similar incidents, Congress enacted legislation entitled Help America Vote Act (HAVA) in October 2002, which allotted \$325 million to precincts across the nation to improve and update their voting machines to more modern technologies. (Di Franco, Petro, Shear, & Vladimir, 2004), (Robertson, 2006). HAVA was accompanied by a \$3.8 billion dollar federal appropriation to produce more reliable, accurate, and secure voting machines around the nation. The HAVA monies were dispersed to states over a three-year period to help localities improve their machines and facilitate the administration of elections. This mandate was passed with a requirement that voting must be accessible to those who may be blind or those with low vision. (Di Franco, Petro, Shear, & Vladimir, 2004), (Cohen, & Katz, 2008). The federal

government's hope was that outdated punch card and lever voting systems would be replaced with electronic voting or optical scanning machines. (Mebane, 2008).

Despite HAVA's existence following the aftermath of the 2000 presidential election, certain procedures were neglected by state governments. The Election Assistance Commission, which was a body created to disburse funds to the states for HAVA, was initially supposed to be take effect 120 days after HAVA was signed into law. However, EAC did not establish itself fully until 2003. (Tobias, 2005).

With the adoption of these new ballot systems and HAVA, it seems that voting system failures are consistently declining. However, problems associated with old and new voting technologies still exist. Consequently, the reliability of new voting technologies should be studied to ultimately find the best and most efficient voting method, or methods, that are accessible to all voters. Voting accuracy, reliability, and security are crucial to ensure accurate democratic elections. Additionally it is desirable to have as pleasant and satisfying electoral process as possible to maximize voter participation. Certain machines, for example, may threaten the electoral process and may affect a voter's behavior and satisfaction depending upon the quality of technology. (Herrnson, 2008)

A review of voting methods is crucial in studying election and election outcomes. Several types of voting methods have evolved and are used today. Contemporary paper ballots were first adopted in Australia in the year of 1856. Therefore this form of voting is also commonly referred to as the "Australian Ballot". (Bellis, 2004). In order to cast a vote via paper ballots, a voter must mark a box next to the candidate or issue to cast a vote. (Bellis, 2004)

Punch cards, or chad ballots, allow voters to insert a card or paper ballot into a machine specially designed to record votes by punching a designated candidate or issue with a pin-type

implement. This creates a hole in the ballot that can then be counted. This form of voting has been steadily replaced by DRE machines and optical scanning. Punch cards were used in the 2000 presidential election in Florida which sparked a recount due to problems with “hanging, dimpled, and pregnant chads.” (Conrad, 2008). By definition a “hanging chad” is when one corner of the chad is still hanging to the punchcard. A “dimpled chad” is one in which no clear hold has been punched through, but there is an indentation. Pregnant chads occur when a hole has been punched through the chad, but the chad still hangs to the punch card on all four ends. (Bellis, 2004).

Lever machines had been introduced in most major U.S. cities by the 1930’s. (Bellis, 2004). By 1960, mechanical lever machines were used in more than half of the world’s nations for elections. With this system, voters pull down the levers to indicate their choices for a candidate or issue. Lever machines are no longer in use in American elections as a result of HAVA. Many of these machines have been replaced by DRE technology or optical scan ballots. (Bellis, 2004)

Direct Recording Electronic Machines are some of the newest voting formats and have significantly replaced the use of mechanical lever machines. There are no ballots involved with using DRE machines. The candidates and issues are stored in the computer and voters select their choices via a touch screen computer. The votes of one voter are automatically added to the other votes when a choice is selected. (Bellis, 2004). While computer voting may be intuitively trusted over manual counts, punch cards, and lever pulls, many concerns about DRE have been expressed. Concerns have steadily risen as to the accuracy, security, and reliability of these voting machines in America. As a result, Florida and California replaced this technology in their precincts due to skepticism amongst voters and the plan to replace their current DRE systems.

Among the many problems associated with this technology, is that the machines either “freezing up” or “failing to start”. (Seglison, 2008).

Although DRE machines were intended to ensure voting reliability and accuracy, they have failed to meet these lofty expectations. Many DRE machines have security weaknesses and production defects. Likewise, critics contend that DRE’s can easily be subjected to “undetectable manipulation”. (Mebane, 2008). Although DRE’s may not have “Chad” problems to consider, many usability problems occur with this touch-screen technology. Credibility can often times be lost when the voting population believes that their vote may not count due to such problems and system errors. Voting participation decreases as a result. There is discussion about whether paper trails should be added by attaching printers capable of producing a paper record of the vote’s selections. This would allow validity checks, to ensure that votes are properly tabulated. Voters would gain confidence in the voting system, possibly increasing participation. This would insure a reliable, secure, and accurate vote. (Tobias, 2005). Sadly, even in 2009, many places exist where there is still no voting record for DRE machines. It is important to keep in mind that usability and other problems associated with touch screen voting machines may distort election outcomes. (Conrad, 2008).

A final voting system is the Optical Scan, whose usage has become increasingly common in the last decade. More people voted this past year using optical scan methods than at any other time in American history. (Seglison, 2008). Voters shade in the oval, rectangle, or arrow of their candidate or issue. This method resembles standardized testing, a method very familiar to the younger generations. (Bellis, 2004).

In summary, voting in America has evolved, particularly in terms of voting eligibility and voting methods. Historically, and in true democratic fashion, the United States has extended

voting privileges to most adult citizens, regardless of gender, race, or disability. The government and citizenry are in constant pursuit of ensuring the most accurate and fraud-free methods, ranging from paper and pencil type ballots to sophisticated touch screen technology. That we are still in search of the perfect instrument to ensure that voters' wishes are accurately and completely recorded and counted is a testament to the value Americans place on their democratic privileges and principles. Eventually, a perfect system may be devised, but it is more likely that voting will continue to be an ideal for which we strive.

Purpose/Introduction

Coverage of the election process in America is often reserved for slow news days, but the debacle surrounding the presidential race in 2000 was more of an oddity that garnered unprecedented coverage throughout the nation. While there was a veritable whirlwind of information regarding electoral votes, exit polls, and other election-day standard fare, an unusually fervent interest was placed on literally how voters had cast their votes. The extremely close margin between the two candidates, coupled with the malfunction of voting systems in Florida, had conglomerated into one of the strangest and most controversial elections in American history.

The notorious punch card malfunctions prompted congress to pass the Help America Vote Act in 2002. This act provided federal money to states for use in the replacement of voting systems, with an eye specifically on faulty punch card systems and antiquated lever machines. The final deadline for states to eliminate all lever and punch card technologies in every district was extended to 2006, and by 2008 many Americans were voting with the most sophisticated voting technology ever created. This technology, commonly referred to as "touchscreen" or Direct Recording Electronic (DRE), has not been without its critics. Heightened awareness about

voting system failure and “technological disenfranchisement” (Robertson, 2006) has led to concerns about security as well as concerns about accuracy (Conrad et al, 2008, Tobias, 2005). While the implementation of HAVA and the push in many districts toward DRE voting was meant to bolster voter confidence while increasing accuracy in the election process (Tobias, 2005), it is unclear whether or not these changes have had a significant impact on either front. Voters and poll workers have been less receptive to these new technologies than the government had anticipated, with many complaining of system crashes, erroneous distribution of votes, and general confusion from voters and poll workers alike (Tobias, 2005, Seligson, 2008, Conrad et al, 2008, Nichols and Strizek, XXXX). These changes have prompted many districts across America to abandon their newly adopted DRE technologies for more traditional optical scan ballots (Seligson, 2008).

West Virginia offers an excellent opportunity to examine the effects of voting system changes on election accuracy. During the 2000 presidential election, West Virginia’s fifty-five counties employed five distinct voting technologies; punch cards, lever machines, paper ballots, DRE, and optical scan ballots were all in use. With the mandates set forth by HAVA, West Virginia counties began the arduous process of selecting new voting technologies to replace existing systems. By 2008 West Virginians were no longer utilizing lever machines or punch cards, and were casting votes on traditional paper ballots, DRE, optical scan, and AutoMARK (a variation of optical scan). It is important to note that these changes occurred in different counties at different times between 2002 and 2008, creating three voting technology landscapes that are vastly different within the political confines of one state. These changes create the backdrop for a natural experiment in the field of voting technologies, allowing researchers to examine changes in election accuracy over an eight year period that covers three general presidential elections.

The authors hypothesized that paper ballots would prove the most accurate means for vote casting, followed by optical scan ballots, and that punch card ballots and DRE voting technologies would prove to be significantly less accurate than other voting systems. The authors sought to determine which voting technologies were best suited for maintaining the integrity of West Virginia elections. Because the office of president is the most recognizable office on the ticket and is least susceptible to roll-off (Nichols and Strizek, XXXX) the authors postulated that a comparison of official county by county “ballots cast” numbers and the actual number of successful votes for the office of president would be the best indicator of voting technology accuracy.

Methods

The researchers conducted a study various methods to analyze data in order to calculate the undervote in the 2000, 2004, and 2008 presidential elections in West Virginia. In every election, a number of votes that are cast go uncounted whether it be from contested ballots, voting system failure, human error, or abstention. My co-author and I ran tests to determine the percentage of votes that were uncounted in each of West Virginia’s 56 counties in the given three years. The undervote is calculated by subtracting the total number of ballots cast from the total number of ballots received in a given election. The changes in undervote rate were observed as well. We used SPSS to determine whether or undervote was linked to socioeconomic factors by totaling in the percentage of the population who is below the poverty line and looking at educational factors in relation to the voting systems used. We determined the economic and education levels with census data in order to produce conclusive results.

We compared the voting systems to one another in comparison to the undervote in all 56 counties. We determined what voting systems were used in each county. Percentage of

undervotes were determined by collecting official election returns to determine ballots casts as opposed to the actual number of presidential votes that were received. In order to accurately depict the correct numbers for this particular column, we called each county and collected information about the voting system they used in the 2000, 2004, and 2008 presidential elections. As well, we had official data from the Secretary of State's Office for the 2000 and 2008 elections. The numbers we received from the official election returns were recorded from the Secretary of State's website. The author's tested the DRE machines, optical scan, punch cards, lever machines, automark, and paper ballots. By observing each voting system in comparison to the percentage of undervote recorded, we determined if voting systems had a significant relationship to the percentage of undervote in each of the three elections. We recorded all 56 counties in West Virginia, along with the total number of ballots casts, and total number of ballots counted. The difference between the number of ballots cast and the number of ballots counted yields the number of uncounted votes, also known as the undervote. Along with the calculation of the undervote, we calculated the percentage of undervote within each particular county in the years of 2000, 2004, and 2008.

Results

In 2000, ten counties used paper ballots, twelve used punch cards, 29 used optical scan machines, three used lever machines and only one county used the DRE machine. During this time automark was not in use. In 2004, ten counties used paper ballots, nine used punch cards, 19 counties used the optical scan machines, as well as 13 who used DRE, three still used the lever machine, and only one county in 2004 used the automark. In 2008 more counties were using the DRE machine more than any other voting technology in the presidential election. The rate of punchcards also decreased within the years to a user rate of 0. The use of optical scan

machines also decreased to 15. However the user rate of DRE machines increased to an overwhelming 35 counties out of the 56. The lever machine was no longer in use during the 2008 presidential election in any of the 56 counties. The user rate of automark didn't drastically change in all three years; with three West Virginia counties still using it.

The paper ballots used in the 2000 presidential election yielded to an undervote of 1.7566%. The optical scan machines were next in line with an undervote of 1.7766%. Lever machines contained a 2.0087% undervote rate. Punch cards followed closely behind with an undervote rate of 2.2983%. And the DRE machine contained the highest undervote rate with 3.1243%. These results yielded to a total undervote of 1.9239% for the year of 2000. In the 2004 presidential election, the lever machine had the lowest undervote rate with 1.0040%. Paper ballots followed close behind with a 1.3104 %. The optical scan machine received an undervote of 1.6952%. Followed by the optical scan machine, the DRE machine obtained a rate of 2.0511%. Punch cards received an undervote rate of 2.3053, and automark with an overwhelming 4.4505%. The overall rate of undervote in West Virginia in the 2004 election was 1.8363%. In 2008, results slightly varied. During this year, automark received the lowest undervote rates with 2.3944%. Optical Scan machines followed with a 3.3835%. DRE machines received a 3.5967% undervote, which was slightly lower than the results for 2004. Also the two counties that used paper ballots in the 2008 election received 4.4102%. Our findings revealed that the extraneous variable tested, such as poverty level and level of education, were found to not have statistically significant impacts on undervote rates in 2000, 2004, or 2008. However, significant results were found for paper ballots and punch card ballots in the 2000 and 2004 elections. We used a one-tailed test to calculate results, where $P < 0.05$, which indicates a statistically significant result. Paper ballots were found to produce

significantly less undervote in both elections, yielding a negative effect on undervote. On the other hand, punch cards yielded statistically significantly levels of undervote in both the 2000 and 2004 elections. Also, we found that no one particular voting system produced undervote levels that were statistically distinguishable from other voting systems. No other voting system was found to have a significant impact on undervote in the 2008 election. Between 2000 and 2004 there was not a significant change in the undervote rates at the statewide level. Between 2000-2008 and 2004-2008, significant increases in undervote were recorded. These changes were not found to be significantly linked to voting systems.

Discussion

All voting systems lose votes, whether the fault lies with the user or with the medium by which votes are cast. This study is indicative that some voting systems are, at times, better than others. Paper ballots did not significantly differ in their accuracy than other systems in 2008 but outperformed all other systems in both the 2000 and 2004 elections. This is most likely the result of the simplicity of paper ballots, which are marked upon with a traditional writing instrument and are evaluated by people. The method for counting is important in that when a human is involved the intent of the voter can be taken into consideration; with other voting systems the intent of the voter may not be called into question in any instance other than a manual recount. Still, the authors cannot recommend that counties in West Virginia switch to paper ballots for their elections. They require more manpower and more time to count than any other system due to their inherent lack of automation, which coincidentally is the very feature that bolsters their accuracy.

Let us turn our attention to the other end of the spectrum. The punch card has the ubiquitous distinction of being the least accurate means for recording votes in both elections

studied in which it was in use. In 2000 and 2004 punch cards produced statistically significant positive correlations with undervote. These findings are not surprising and meet the expectations of the researchers. In short, the federal government and the state of West Virginia did the right thing by purging punch cards from West Virginia elections and ensuring increased election accuracy.

West Virginia utilized four other voting systems over the course of the three presidential elections. Our findings indicate that none of these voting systems showed statistically significant differences from one another regarding undervote, nor did they show statistically significant correlations to undervote levels. With that said, it is reasonable to ask whether or not the federal government and the state of West Virginia made the right choice in spending millions of dollars on the proliferation of DRE technology that is no more accurate than other, presumably less expensive, technologies such as optical scan ballots. Given the recent reports of technological errors occurring in DRE precincts around the country, as well as the shift back to optical scan in some states, it seems that the ground this decision rests on may be infirm. An alternate course of action would have been to utilize the existing optical scan technologies, but provide on-site readers that can provide instant feedback before the voter has finished the voting process. This provides the opportunity to correct unintentional mistakes on part of the voter, and alleviates the potential for technological failures that the more sophisticated DRE systems can fall prey to. As voting systems changed over the eight year period examined for this study, changes in undervote could also be expected. No statistically significant change occurred between 2000 and 2004, but a statistically significant increase in undervote was recorded between 2000 and 2008, as well as 2004 and 2008. These changes could not be linked to changes in voting systems. The 2008 election yielded no statistically significant differences between any voting systems,

including the previously more accurate paper ballots. The 2008 election was anomalous in this regard, and further research is needed to determine what caused West Virginians cast less votes for the office of president in the 2008 election.

Subsequent studies may expand the parameters of how undervote is calculated to incorporate other high profile races, such as gubernatorial or senate elections, to aid in the determination regarding whether or not West Virginians cast less presidential votes in 2008 as the result of voluntary abstention. Access to exit polls may also be telling in regard to voter intent.

Additional recommendations for further research include replicating this experiment over a longer time period, extending back to previous general elections and including any subsequent presidential elections to determine whether or not the advancement of voting technologies in the state of West Virginia have improved the accuracy of elections in the long term. Such information may be difficult to find, as the West Virginia Secretary of State's Office was unable to produce a copy of what voting systems were used in 2004 in each county, and phone calls had to be made to each county individually. Even then, many counties were unsure about the technologies that were in use during 2004 and had to consult multiple staff members before an answer could be produced. Given a lack of uniform record keeping between the counties and districts, as well as the passage of time and employee turnover, determining this information may prove very difficult.

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The Cytotoxic Effects of Canola and Corn Oil Mimics on Jurkat Cells

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Abstract

An increasing number of studies are showing that certain food components appear to be beneficial in the suppression of cancer. As a result, the impact of nutrition as an alternative method for cancer prevention and treatment has been receiving particular interest. The purpose of this study was to examine the effect of omega-3 fatty acids in the suppression of cancerous cells *in vitro* growth. Treatments using free fatty acids in ratios mimicking those found in commercially available canola oil (7% alpha-linolenic, 30% linoleic, 54% oleic) and corn oil (59% linoleic, 24% oleic) were done to investigate the cytotoxic effects of these oils on Jurkat T leukemia cells. Cells were treated with an oil concentration of 100 μ M or 150 μ M for 48 or 72 hours. Two parameters were evaluated: fatty acid uptake assessed by gas chromatography and cytotoxicity assessed by loss of membrane integrity through propidium-iodide staining and Trypan blue exclusion, DNA fragmentation through cell cycle analysis, and phosphatidylserine externalization through Annexin V. Membrane integrity was analyzed by flow cytometry and microscopy. DNA fragmentation and phosphatidylserine externalization were analyzed by flow cytometry. The study indicates a significant increase in the cytotoxicity of the oil-treated cells when compared to the non-treated cells and difference in the lipid profiles of the treatments.

Introduction

With over one million new cases projected in the United States last year (Jemal et al., 2009), cancer has become an extremely pressing issue in today's society. Currently, treatments for the disease tend to be very severe. Chemotherapy and radiation therapy, two of the most common types of treatment, can be detrimental to the body, causing side effects such as fatigue, vomiting, and weight loss, among others. As a result, research is being done to find alternative methods of treatment. One such possibility being investigated is dietary changes. The hope is that with expanded research, this could lead to a potential for conventional treatments to remain equally effective at lower doses, possibly resulting in less severe side effects from treatment. One such change that is being considered is an increased consumption of omega-3 fatty acids.

Both omega-3 and omega-6 fatty acids are essential fatty acids. While the longer chains can be synthesized in the body from the shorter chains, the omega-3 alpha-linolenic acid and the omega-6 linoleic acid cannot and therefore, must be obtained in the diet. It is known that both of these fatty acids are important to general health, but omega-3 fatty acids which are found in fish oils and canola oils, have shown to be particularly beneficial in the prevention of cancer. One study by Kim, Park, Park, Chon, and Park found an increase in apoptosis and an inhibition of cell growth in estrogen-positive breast cancer cells when treated with alpha-linolenic acid (2009). In a similar clinical study by Kim, Lim, et al. (2009), a correlation between a high consumption of fatty fish which is high in omega-3 fatty acids and a decrease in the risk of developing breast cancer was observed.

Other research has investigated the use of these fatty acids in the treatment of cancer. Some studies have investigated the effects of omega-3 fatty acids when included in the diet of tumor-bearing mice (Hardman, 2004). Such studies have shown that the implementation of such

diets can slow the growth of some types of cancer. Similar studies in humans have shown an increased response to chemotherapy. Therefore, the addition of omega-3 fatty acids to the diet has the potential to be used as an alternative therapy or along with traditional treatments in controlling cancer (Hardman, 2004).

Other research has focused on the cytotoxic effects of linoleic acid, an omega-6 fatty acid. A study by Cury-Boaventura, Gorjão, Lima, Newsholme, and Curi (2006) researched this effect on human lymphocytes as well as the particular type of cell death that occurred at several concentrations (25 μ M, 50 μ M, 100 μ M, 200 μ M). It was found that the linoleic acid supported both types of cell death—apoptosis and necrosis—with higher rates of necrosis occurring at higher concentrations.

A similar study looked at the effects of arachidonic acid, which can be synthesized from linoleic acid. The research by Verlengia et. al (2003) investigated the cytotoxicity and cell proliferation as well as gene expression in Jurkat cells when treated with arachidonic acid. It was found that there was a loss of membrane integrity in the treated cells as well as a change in cell cycle, signal transduction, and anti-apoptosis gene expression.

While the studies previously discussed have shown evidence of the cytotoxicity of both omega-3 and omega-6 fatty acids, they have not compared the effects of the two. For certain cancer cells, it has been shown that omega-6 fatty acids can enhance tumor growth while omega-3 fatty acids can inhibit tumor growth (Kim, J. Y. et al. 2009). One study showed that “omega-3 fatty acids [can reduce] prostate tumor growth, [slow] histopathological progression, and [increase] survival, whereas omega-6 fatty acids had opposite effects” (Berquin et al. 2007, p. 1866). In a study by Hardman (2007), cancerous mice were given a diet consisting of either corn oil or canola oil. It was found that the tumor growth rate in the mice receiving the canola oil was

less than in the mice receiving the corn oil. The study implicates that replacing corn oil with canola oil in the diet “could reduce the risk for or slow the growth rate of cancer” (p. 182).

It is also important to consider varying ratios of omega-3 to omega-6 fatty acids. Research by Simopoulos (2006) has shown that a high omega-6 to omega-3 ratio can “promote the pathogenesis of many diseases, including cardiovascular disease, cancer, osteoporosis, and inflammatory and autoimmune diseases” (p. 502). On the contrary, increasing the amount of omega-3 and lowering the amount of omega-6 fatty acids in the diet can be useful in the prevention of these diseases.

While previous studies have shown that omega-3 fatty acids are beneficial in both the prevention and treatment of many diseases, including cancer, it is not entirely clear what ratio is ideal for the control of these diseases. Currently, the typical American diet consists of a very high ratio of omega-6 to omega-3 fatty acids—approximately 15:1 (Simopoulos, 2002). Studies have shown that ratios more in the range of 2:1 to 4:1 can provide several health benefits. This study will look at the use of a varying ratio of the omega-6 linoleic acid which is commonly found in meat and corn oil and the omega-3 alpha-linolenic acid which is commonly found in fish, walnuts, and canola oil in the suppression of cancer. It will use corn oil, representative of the high ratio, and canola oil, representative of the more moderate 4:1 ratio, to determine if there is a difference in cytotoxicity when Jurkat T leukemia cells are treated with these two ratios.

Materials and Methods

Cell Culture and Fatty Acid Treatment

Jurkat Clone E6-1 cells were grown in RPMI-1640 media supplemented with 10% fetal bovine serum, 100 units/ml penicillin, and 0.1 mg/ml streptomycin and incubated at 37°C with 5% CO₂. Canola and corn oil mimics were made by dissolving free fatty acids in ethanol in ratios

similar to that found in commercially available canola oil and corn oil. The canola mimic consisted of 7% α -linolenic acid, 30% linoleic acid, and 54% oleic acid. The corn mimic consisted of 59% linoleic acid and 24% oleic acid.

Each experiment consisted of four plates—a non-treatment (cells in media only), an ethanol control (cells treated with ethanol containing no free fatty acids), a canola mimic treatment, and a corn mimic treatment. Cells were seeded at 3.0×10^5 cells per ml (1.5×10^6 cells per plate for all experiments except those to be used for gas chromatography, which contained 1.5×10^7 cells per plate) with either a 100 μ M or 150 μ M concentration of canola oil mimic and corn oil mimic and treated for 24 hours or 48 hours, depending on the analysis to be performed.

Gas Chromatography

Gas chromatography was used to assess the lipid composition of the cells. After being treated at 150 μ M for 72 hours, cells were centrifuged at 300 x g for 10 minutes at 4°C, then washed four times using PBS, centrifuging between each wash. Cells were then homogenized in 3 ml distilled water containing 0.1% butylated hydroxytoluene (BHT) to prevent oxidation of the fatty acids. Chloroform and methanol were used for the extraction of the lipids from the cells. To do so, 2 ml of chloroform and 1 ml of methanol were added to the cells, which were then vortexed and centrifuged for 30 minutes at 300 x g. The bottom phase (containing chloroform and lipids) was removed using a Pasteur pipet and placed in a new tube. Another ml of chloroform was added to the tube, which was again vortexed and centrifuged. The bottom layer was removed and placed in the second tube and the top layer was discarded. The chloroform was evaporated under nitrogen. Then, 300 μ l of iso-octane was added to each tube for analysis. A fatty acid methyl ester standard which contained stearate, oleate, linoleate, alpha linolenate, gamma linolenate, homogamma linolenate, arachidonate, eicosapentaenoate, docosapentaenoate,

and docosahexaenoate was used to identify the peaks of the samples, which were reported as the percent of total fatty acids and measured as the area under the curve.

Trypan Blue Exclusion

To assess membrane integrity, cell counts were performed on cells treated at 150 μM for 72 hours. A 1:1 dilution was made by combining 15 μl of cells with 15 μl of Trypan Blue and inserted into a hemacytometer. Viable cells remained colorless while dead cells took on a blue appearance, allowing the two to be distinguished from each other so that both living and dead cells could be counted.

Propidium-Iodide Staining/Annexin V Assay

Propidium-Iodide staining was used to evaluate cell viability and an Annexin V assay was used to evaluate early apoptosis, both in cells treated at 100 μM and 150 μM for 48 hours. Treated cells were pelleted by centrifuging for 5 minutes at 300 x g at 4°C. After removing the supernatant the cells were washed twice with PBS, centrifuging between washes. The cells were resuspended in 300 μl of a 0.1 M HEPES, 0.14 M NaCl, and 2.5 mM CaCl_2 annexin V binding buffer then divided into three 100 μl samples—one receiving 5 μl Annexin V-Pacific Blue conjugate and 5 μl propidium-iodide, one receiving 5 μl propidium-iodide only, and one receiving neither. The cells were incubated for 15 minutes at room temperature in the dark.

The cells were then analyzed using flow cytometry. Cells having undergone a loss in membrane integrity were able to take in the propidium-iodide stain, so the Annexin V negative/propidium-iodide positive population in the cells receiving only propidium-iodide was used to determine cell viability. Annexin V is able to bind with the phosphatidylserine on the outer membrane of cells in an early apoptotic state, so the Annexin V positive/propidium-iodide negative population in the cells receiving both was used to determine early apoptosis.

Cell Cycle Analysis

DNA fragmentation and the cell population in the S1, G, and S2 phases of the cell cycle were assessed using cell cycle analysis. After being treated at 100 μM and 150 μM for 72 hours, cells were pelleted by centrifuging for 5 minutes at 300 x g at 4°C. The cells were then washed twice with PBS, centrifuging between each wash. Cells were fixed by adding 3 ml of 70% ethanol one drop at a time while vortexing and refrigerated for 24 hours. Cells were repelleted and the ethanol was removed. The cells were then washed twice with PBS. After staining the cells with 200 μl of a solution made up of PBS with 0.1% triton-X 100, 0.1% Na₃-citrate, 30 g/ml RNase, and 20 g/ml propidium-iodide, they were incubated for 30 minutes at room temperature in the dark. Flow cytometry was used to measure the cell population that had undergone apoptosis and the cell population in each of the phases of the cell cycle.

Statistical Analysis

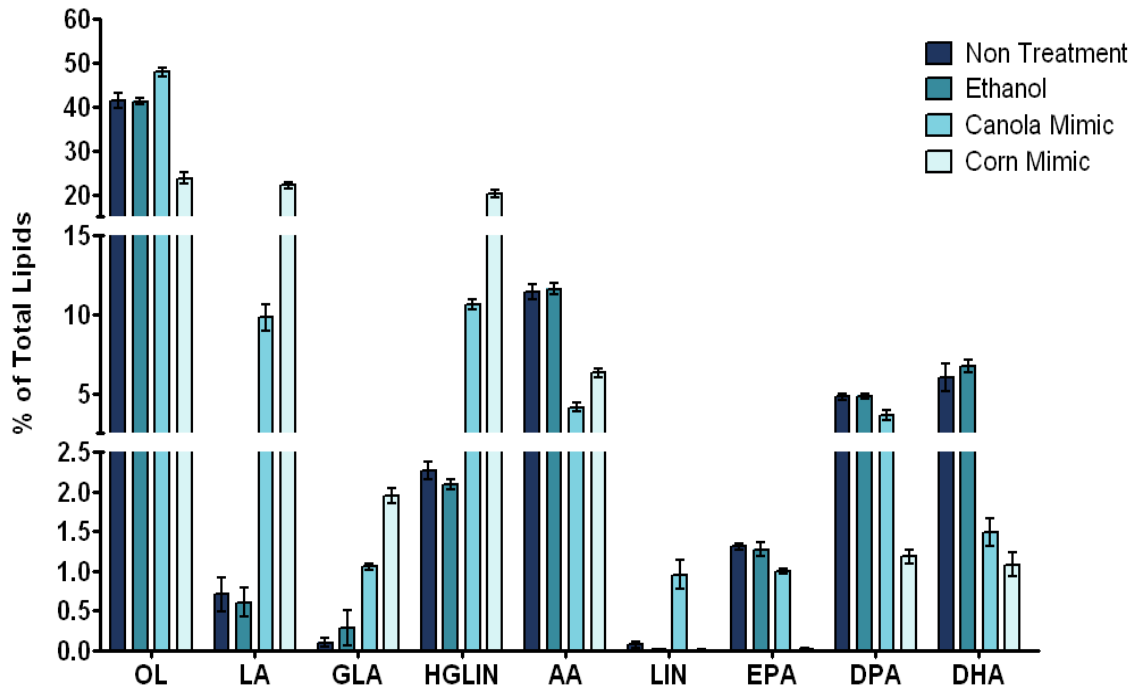
The statistical analysis of all experiments was done using PRISM software and the Newman-Keuls Multiple Comparison Test to determine significant differences between treatments and of treatments compared to controls. All results are presented as means \pm standard error of the mean (SEM) of 3 or 4 experiments with the exception of those from the Trypan blue cell counts, which was of 9 experiments.

Results

Fatty Acid Uptake

Gas chromatography was used to assess the fatty acid uptake of cells treated at 150 μM for 74 hours. A significant difference was observed between the lipid compositions of the cells treated with the canola mimic and the cells treated with the corn mimic (Figure 1). The lipid composition of alpha-linolenic acid (LIN) for the canola treated and corn treated cells was 0.953

$\pm 0.184\%$ and $0.003 \pm 0.003\%$, respectively. The lipid composition of linoleic acid (LA) for the canola treated and corn treated cells was $9.810 \pm 0.814\%$ and $22.013 \pm 0.803\%$, respectively. Also, canola treated cells were able to synthesize the longer chain omega-3 fatty acids eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA), and docosahexaenoic acid (DHA) (with lipid compositions of $0.998 \pm 0.033\%$, $3.653 \pm 0.324\%$, and $1.490 \pm 0.179\%$) at a higher rate than the corn treated cells (with lipid compositions of $0.013 \pm 0.013\%$, $1.183 \pm 0.089\%$, and $1.080 \pm 0.146\%$). Likewise, the corn treated cells were able to synthesize the longer chain omega-6 fatty acids gamma linolenic acid (GLA), homo-gamma linolenic acid (HGLIN), and arachidonic acid (AA) (with lipid compositions of $1.948 \pm 0.090\%$, $20.085 \pm 0.825\%$, and $6.320 \pm 0.284\%$) at a higher rate than the canola treated cells (with lipid composition of $1.058 \pm 0.040\%$, $10.628 \pm 0.303\%$ and $4.130 \pm 0.270\%$).



OL—oleic acid
 LA—linoleic acid
 GLA—gamma linolenic acid
 HGLIN—homo-gamma linolenic acid
 AA—arachidonic acid

LIN—alpha-linolenic acid
 EPA—eicosapentaenoic acid
 DPA—docosapentaenoic acid
 DHA—docosahexaenoic acid

Figure 1. Lipid composition of cells treated at 150 μ M for 72 hours.

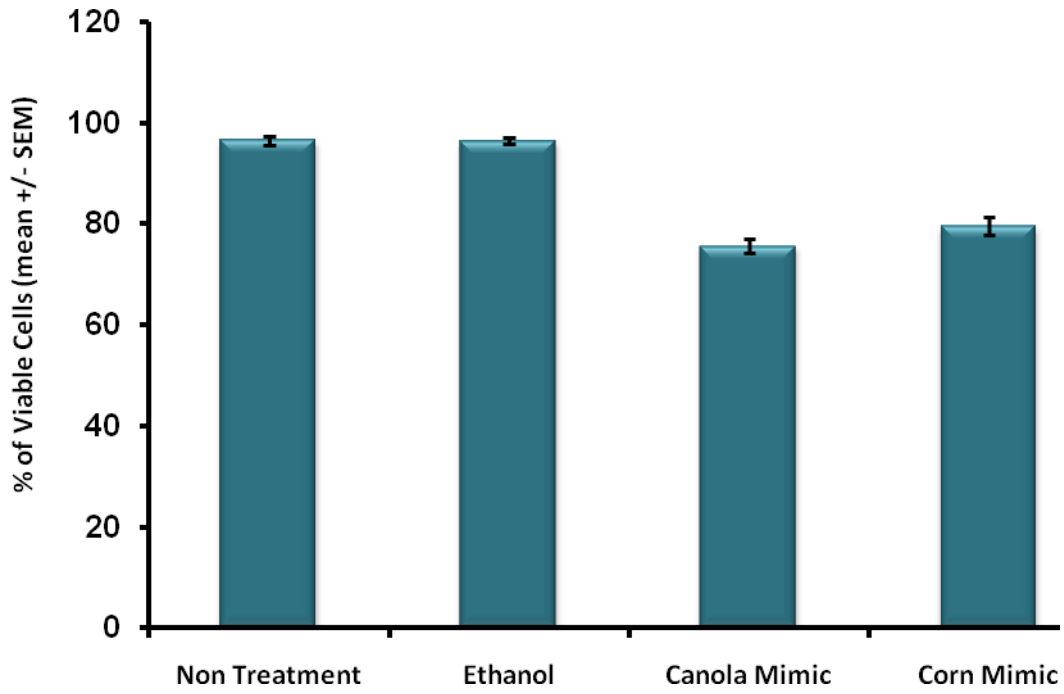
Fatty acid uptake by cells was assessed using gas chromatography. When comparing the canola treatment with the corn treatment, the corn treated cells had a significantly higher uptake of linoleic acid and were able to synthesize longer chain omega-6 fatty acids at a greater rate and the canola treated cells had a significantly higher uptake of α -linolenic acid and were able to synthesize longer chain omega-3 fatty acids at a greater rate.

Cytotoxicity

Several parameters were used in assessing cytotoxicity, the first being membrane integrity. This was done using both Trypan blue exclusion and propidium-iodide staining. The Trypan blue exclusion measured the viability of cells treated at 150 μ M for 72 hours. The percentage of viable cells for the non-treatment, ethanol control, canola mimic treatment, and corn mimic treatment were $96.56 \pm 0.89\%$, $96.44 \pm 0.65\%$, $75.67 \pm 1.33\%$, and $79.56 \pm 1.80\%$, respectively, showing a significant decrease in cell viability and membrane integrity for treated cells (both with canola mimic and corn mimic) compared to non-treated cells (Figure 2A).

The propidium-iodide staining measured the viability of cells treated at 150 μ M for 48 hours. The percentage of propidium-iodide positive cells (non-viable cells) for the non-treatment, the ethanol control, the canola mimic treatment, and the corn mimic treatment were $11.57 \pm 0.97\%$, $10.00 \pm 1.84\%$, $42.88 \pm 5.45\%$, and $53.00 \pm 3.21\%$, respectively, again, showing a significant decrease in cell viability and membrane integrity of treated cells compared to non-treated cells (Figure 2B).

A. Trypan Blue Exclusion



B. Propidium-I

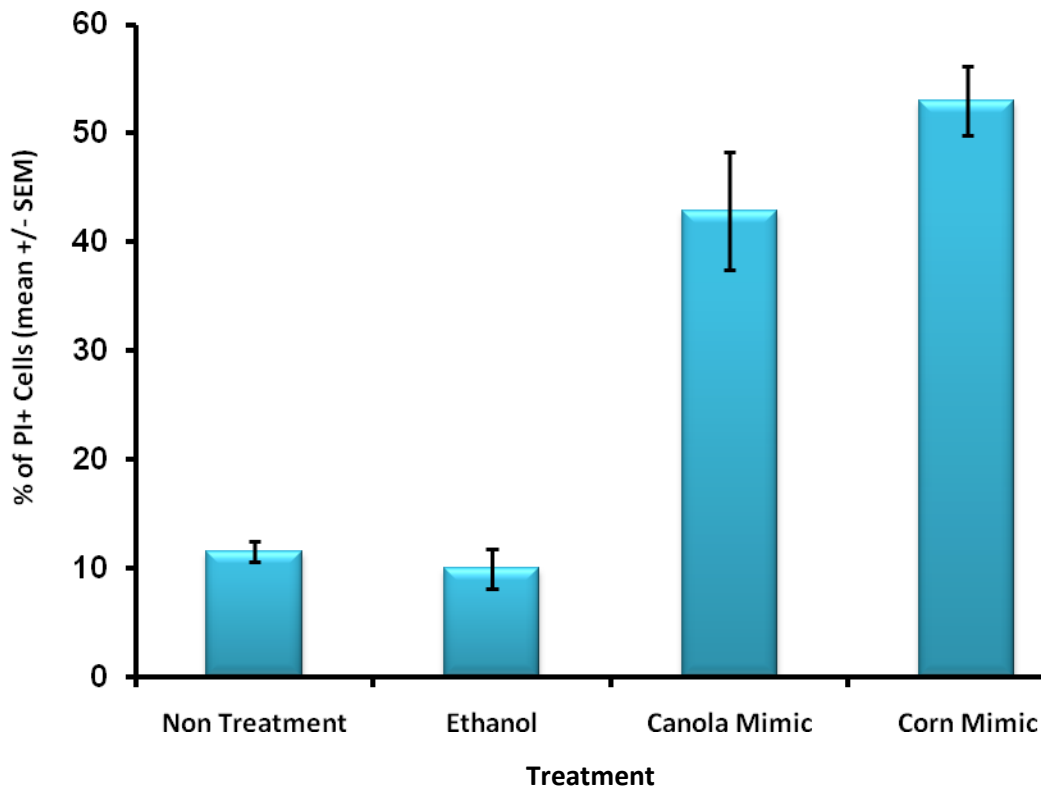


Figure 2. Membrane integrity of cells treated at 150 μ M.

A, In cells treated for 72 hours, Trypan Blue exclusion showed a significant decrease in the percentage of viable cells in the treatments when compared to the controls. **B**, In cells treated for 48 hours, flow cytometry was used to show the uptake of propidium-iodide stain and showed a significant increase in the percentage of cells that had experienced a loss of membrane integrity in the treated cells when compare to the controls.

Phosphatidylserine externalization was assessed to determine early apoptosis and was measured in cells treated at 100 μ M and 150 μ M for 48 hours using Annexin V. The percentage of Annexin V positive/propidium-iodide negative cells (indicative of an early apoptotic state) was $4.28 \pm 0.64\%$, $4.40 \pm 0.66\%$, $13.9 \pm 0.46\%$, and $14.0 \pm 3.18\%$ for cells treated at the 100 μ M concentration and $5.33 \pm 0.86\%$, $3.78 \pm 0.29\%$, $19.65 \pm 1.79\%$, and $18.68 \pm 1.41\%$ for cells treated at the 150 μ M concentration in the non-treatment, ethanol control, canola mimic treatment, and corn mimic treatment, respectively (Figure 3). For both oil concentrations, there was a significant increase in phosphatidylserine externalization, and thus early apoptosis, in both the canola treated and corn treated cells when compared to the non-treated cells.

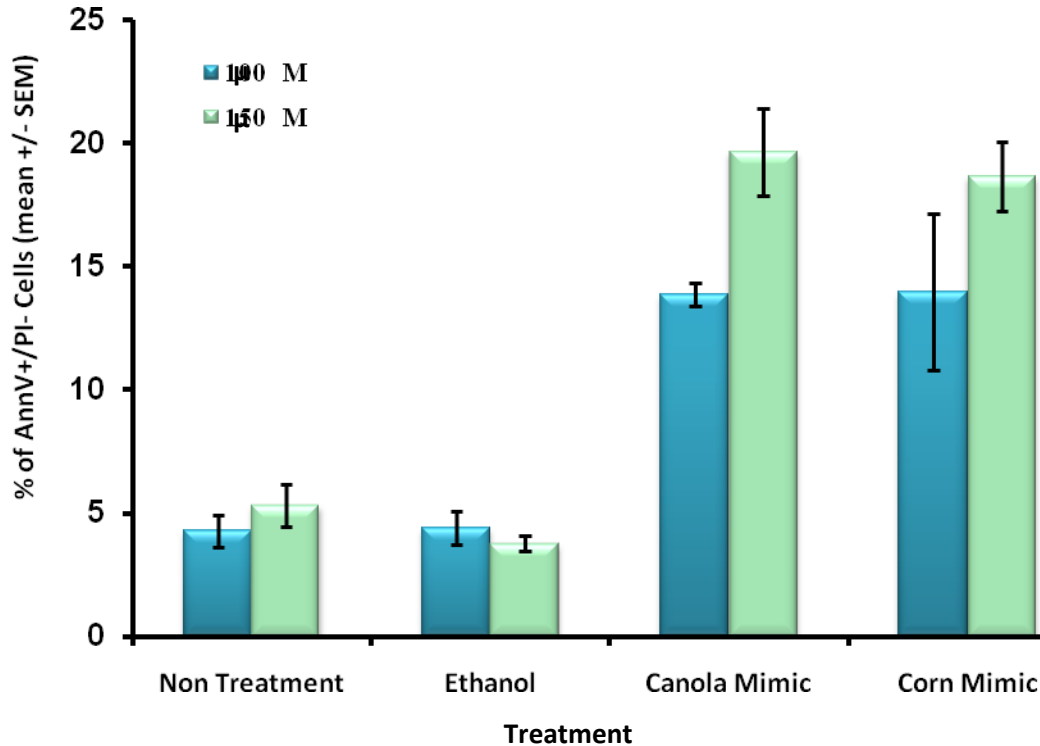
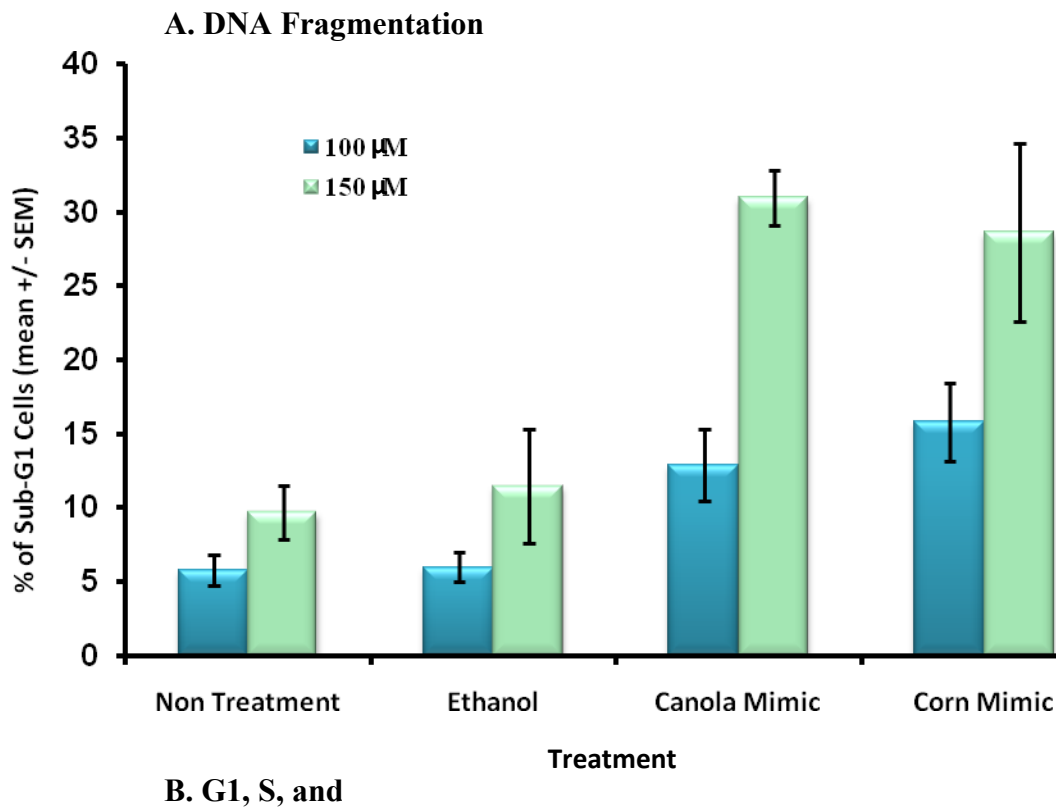


Figure 3. Phosphatidylserine externalization in cells treated at 100 and 150 μ M.

The early apoptotic marker in cells treated for 48 hours was assessed by flow cytometry using Annexin V. The percentage of early apoptotic cells increased significantly in the treatments compared to the controls for both concentrations.

DNA fragmentation was also assessed to determine late apoptosis in cells treated at 100 μ M and 150 μ M for 72 hours using cell cycle analysis. For cells treated at 100 μ M the percentage of cells experiencing DNA fragmentation was $5.78 \pm 1.05\%$, $6.00 \pm 1.01\%$, $12.92 \pm 2.43\%$, and $15.82 \pm 2.65\%$ for the non-treatment, ethanol control, canola mimic treatment, and corn mimic treatment, respectively. For cells treated at 150 μ M the percentage of cells experiencing DNA fragmentation was $9.70 \pm 1.81\%$, $11.47 \pm 3.85\%$, $30.98 \pm 1.90\%$, and $28.62 \pm 6.02\%$ for the non-treatment, ethanol control, canola mimic treatment, and corn mimic treatment, respectively. For both oil treatments, there was a significant increase in DNA fragmentation, and thus late apoptosis, when compared to the non-treatments (Figure 4A).

The G1, S, and G2 phases of the cell cycle were also assessed for cells treated with the 150 μ M concentration. A significant decrease in the percentage of cells in the S phase was observed for the canola and corn treated cells when compared to the non-treated cells, with the percentage of cells in this phase being $26.80 \pm 2.02\%$, $28.20 \pm 2.47\%$, $18.08 \pm 1.71\%$, and $16.70 \pm 1.96\%$ for the non-treatment, ethanol control, canola mimic treatment, and corn mimic treatment, respectively (Figure 4b). A significant difference was not observed for the G1 and G2 phases.



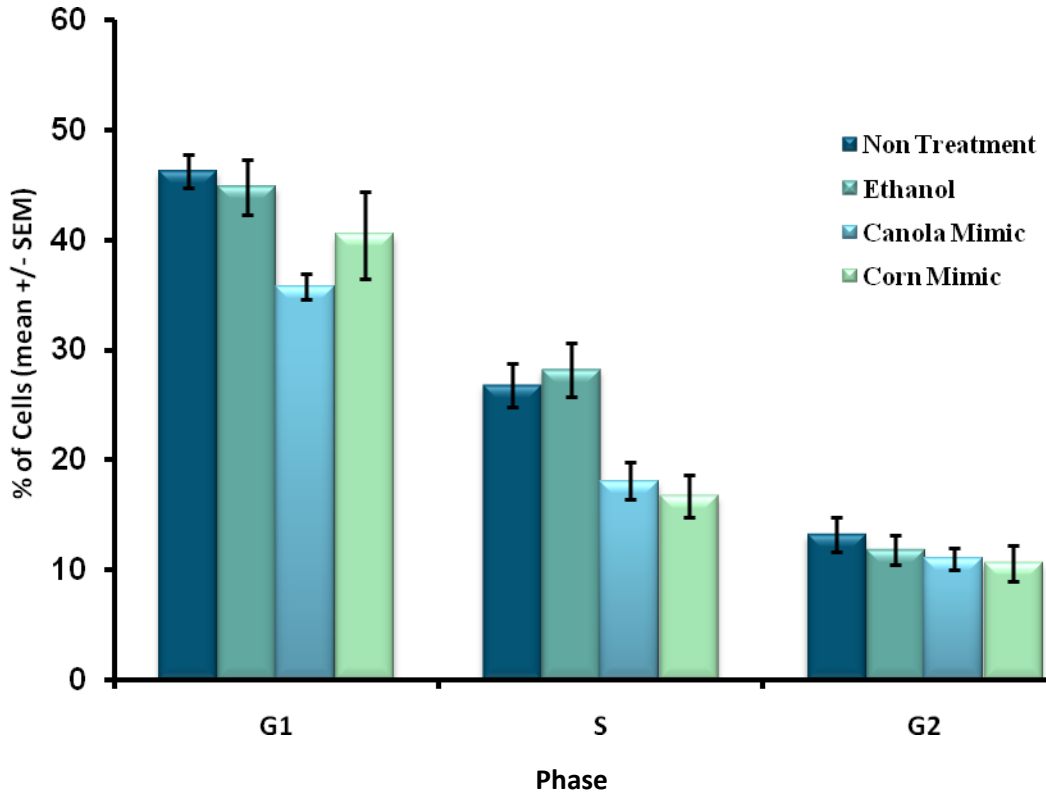


Figure 4. Cell cycle analysis of cells treated at 100 and 150 μ M for 72 hours.

A, Late apoptosis of cells was assessed by cell cycle analysis using flow cytometry. When comparing the treatments to the controls, there was a significant increase in apoptosis for the canola and corn treated cells at both concentrations. **B**, Cell cycle analysis was used to determine the population of cells in the G1, S, and G2 phases of the cell cycle. When compared to the controls, a significant decrease in the percentage of cells occurred in the S phase of both the canola and corn treated cells.

Discussion

Omega-3 fatty acids have been shown to have many health benefits, particularly in the prevention and treatment of certain types of cancers. The ratio of omega-3 fatty acids, particularly alpha-linolenic acid, to omega-6 fatty acids, particularly linoleic acid, is an important factor in the benefit of these essential fatty acids.

As expected, the cells treated with the canola oil mimic exhibited a difference in their lipid profile when compared to the cells treated with the corn oil mimic. The canola treated cells

were able to successfully take in both the alpha-linolenic acid and the linoleic acid. Due to the presence of the alpha-linolenic acid, these cells were able to synthesize the longer chain omega-3 fatty acids for utilization by the cell at a higher rate than the corn treated cells. On the other hand, the corn treated cells were able to successfully take in the linolenic acid, which they used to synthesize the longer chain omega-6 fatty acids at a higher rate than the canola treated cells. However, because of the lack of alpha-linolenic acid in the corn treated cells, they synthesized the longer chain omega-3 fatty acids at a significantly lower rate than the canola treated cells.

Again as expected, a significant increase in the cytotoxicity was observed for both the canola mimic treatment and the corn mimic treatment when compared to the non-treatments. This was consistent with the findings of other studies which found an increase in cell death when treated with alpha-linolenic acid (Cury-Boaventura et al, 2006) and linoleic acid (Kim, Park, et al., 2009). Canola and corn treated cells both experienced an increase in the loss of membrane integrity, phosphatidylserine externalization, and DNA fragmentation, all indicating the cells are experiencing a higher rate of apoptosis. Canola and corn treated cells also exhibited a difference in the cell population found in the S phase of the cell cycle, indicating that once the treated cells reach this phase, they undergo apoptosis rather than moving into the next phase.

However, there was no observable difference in the cytotoxicity of canola treated cells when compared to corn treated cells. Cells from both treatments seemed to experience apoptosis at similar rates for both 100 μ M and 150 μ M oil concentrations. This indicated that the 4:1 omega-6 to omega-3 ratio in the canola oil mimic may not provide an increased benefit in the suppression of Jurkat Clone E6-1 cells compared to the corn oil mimic, containing omega-6 fatty acids but no omega-3 fatty acids.

Conclusion

This study showed that there is a difference in the fatty acid uptake of cells treated with canola oil and cells treated with corn oil. There is also an observable increase in the cytotoxicity of treated cells compared to non-treated cells. However, there was not a significant difference in the cytotoxicity of cells when comparing the two oil treatments. This will be further investigated by determining the highest oil concentration the cells can withstand without an elevated death rate to be used for gene expression.

Acknowledgements

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The Effects of The Media on Self-Image

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Major: English Literature

May 2, 2010

Abstract

This manuscript documents the process, the procedure, the methodology and the results of an experiment conducted on the effects of the media on individuals' self-image in selected different races. In the past, when this experiment had been conducted, the researchers had focused on specific races; either all black and/or all white. During the research I examined the effects on Caucasian and African-American students at West Virginia State University. The results of the experiment are as follows; student with the influence of the posters created characters that were the complete opposite of themselves and they took an awful long time creating them. The Caucasian participants were creating characters with darker skin color whilst the African-American participants with the poster as the media's influence created characters that were lighter in skin color. Participants without the posters on the other hand created characters that were more realistic looking and essentially took less time creating their characters.

Introduction/ Literary Review

Robin Gerber, author and motivational speaker quoted in her speech "We don't need Afghan-style burquas to disappear as women. We disappear in reverse—by revamping and revealing our bodies to meet externally imposed visions of female beauty." Nothing is as commonplace as the wish to be considered attractive and for as far back as we can trace history, women have always been forced to perceive themselves in a certain way; as objects rather than human beings. There are several texts that I got a chance to read that deals with the media's influence on the characters and by reading them; I developed an interest in researching how the media affects self-image in different races.

In Linda Glovach's *Beauty Queen*, she created a character who was so absorbed in looking good as depicted by the media that she pushed herself towards her own downfall. Sam, the protagonist wanted to be an actress and live the good life like Marilyn Monroe and all the divas of Hollywood. The problem with this is that all these people she looked up to so much had very tragic ending and lives. She wanted to be like her mother who used to be a model but is an alcoholic now. To her, her mother was the most beautiful woman she had ever seen and she wanted to look just like her.

Even though her mother had turned out to be a drunk, she had all the telltale sign of destruction in the path she had taken but she was still insistent on getting all the material things she wanted and living the good life. During her conversation with Angelo (her best friend), he had told her he had a daughter who he lost to drugs. That should have woken her up and changed her mind about drugs but she commented that the drugs gave her the courage to dance at the club and dancing gave her money.

Literature from the renaissance and the medieval period often had characters especially females, who couldn't do many things just because they were women. In most of his plays, female characters who Shakespeare wrote were seen as not idealistic women. They were strong willed, thought for themselves and even owned properties which in that particular time period, only men from certain social class were allowed to. His characters that didn't seem to be like the above described women were seen as the ideal women. Most of the literature from this time had stories with women who went against their norms were either dead by the end of the play or they faced horrible endings.

All throughout the media, women are taught how to dress, how their bodies should look like in order to be considered "beautiful" so much to the point that a woman's worth all relies on her looks. Women who go against these "norms" or what women are supposed to be are usually given names, laughed at, or just have had something horrible done to them to the point that they eventually conform to the standards. The media is used as a form of control of women to get them to be the "objects" of men's fantasies and dreams.

In certain cultures, the females are taught to make themselves presentable so they can "get a good man" while they are still young. This somehow becomes more like a goal to these young women when they are encouraged to focus more on their physical appearances than achieving statuses like higher education. The young men in these families are encouraged to pursue higher education and higher statuses. This is generally based on the ideals that women are for domesticated jobs like cleaning the house and taking care of their children. Men are the bread winners so they go out work and bring the money home.

The above are all things that contribute to how women see themselves. Everywhere they look, there is a form of media telling them how to look and act; in a sense they lose themselves

trying to catch up to what the media expects them to look like. These are all awful things to comprehend but for a young black woman, the list keeps going. As black women, they have fought through slavery, and even fought through having the same rights as men (i.e. Voting rights, equal pay for equal jobs) but they are nowhere near being free. Not only do they have to face the pressures of the media like all other types of women do, they also have to deal with the issue of their skin color. Throughout history, skin color has been the root of all sorts of problems for how blacks see themselves but for black women, it's nearly impossible.

“In the 1940s, American psychologists asked a group of black children which of two nearly identical dolls they liked most. The only difference in the dolls was color. One was white and the other black. The black children invariably picked the white one. Asked which doll was good, most children again picked the white one. Most of the children described the black doll, as the one that looked more like them, as *bad* and as *ugly*. The psychologists concluded this was proof on internalized racism.” This may be an old experiment and a reflection of the time. These children had been conditioned not only by the media but also passed down to them by their ancestors to think that being black in a way, a curse.

But a recent study came up with the same results. An 18-year-old filmmaker, Kiri Davis, recreated the experiment with 21 young black children at a daycare center in New York. In her powerful seven-minute documentary, *A Girl Like Me*, Kiri presented the children, aged 4 and 5, with two nearly identical dolls; a black one and a white one. Then, like in the original experiment, she asked which they would rather play with and which they thought was *nice* and which was *bad*. The children still picked the white dolls just like they had done before. This proves that the study wasn't just relative to the time, because the media still depicts that the most beautiful women, even if black, have lighter skin colors. The media finds way to make its

audience unappreciative of what they look like and therefore positive self image for these audiences are impossible to achieve.

Again, most children saw the white doll in positive ways. And the black doll was described in negative terms. “These children, even though they’re 4 and 5 years old, they’re kind of like a mirror and they show exactly what they’ve been exposed to by society,” said Ms Davis. We are bombarded with messages about what it means to be beautiful, good and likeable. We see ourselves through the perception of others. And often we are not happy about the verdict.” (Wycliff)

We often want to appear different. C.J. Walker, the first African-American millionaire, hawked skin lighteners and hair strengtheners to blacks at the turn of the 20th century. One of the most popular products in contemporary India claims to make black skins look whiter. Millions of men and women, uncomfortable with their body images, turn to plastic surgery and hair implants.

In Tony Morrison’s the Bluest Eye, she focuses on the aspect of internal racism. The main character, Pecola focuses more on the idea portrayed in the media throughout her life that being fair-skinned is what is considered beautiful that she works very hard to achieve that look. She begins to loathe herself so much so that she prays for blue eyes. When the children are playing with the dolls in the novel, they assumed the dolls are pretty because the doll possesses white features. “To Pecola, they are simply pretty. She eats the candy, and its sweetness is good. To eat the candy is somehow to eat the eyes, eat Mary Jane. Love Mary Jane. Be Mary Jane.”(Morrison) Pecola wished she could be white so badly that she equates loving the candy and eating it to being like the girl whose picture is on the candy wrapper. Although, her family life was not what she would have picked; her father is the worst kind of parent and her mother

considers herself a victim; she never did anything to show her daughter that it was okay to be black and that being beautiful should have nothing to do with your skin color. There was nothing in her life to counter the effects of the media on her life.

“Although they are free, relative to their slave ancestors, Morrison's representation of African Americans implies a continued enslavement by cultural prejudices. Their internal enslavement is far more difficult to identify, and so more difficult to eradicate. It implies, of course, a long history of violence, slavery and discrimination, but the process of learning self-depreciation described in the novel is, for the most part, conducted through commercialized market forces: Hollywood movies and their byproducts -- Shirley Temple mugs (Morrison 16), Mary Jane chocolates (Morrison 37), Jean Harlow hairstyles (Morrison 96), etc. Ironically, the target-audience for these products is the White middle-class consumer and not minority ethnicities.” (Morrison)

However, when consumers such as Pauline Breedlove (Pecola's mother) find themselves entirely excluded from marketed notions of desirability, they begin to see themselves through the (blue) eyes of others, thus perceiving a distorted self-image. The more a character becomes convinced of the White beauty-ethic, the more he or she feels innately inadequate.

“Increasing frustration and rejection develop into a conviction of ugliness -- external and internal -- that results in pathological behaviors ranging from indifference to abuse, both of self and others.”(Blumenthal)

The characters in the novel feel inadequate with themselves because throughout their lives, they have been taught that nothing dark is ever beautiful. Even in the English language, black and white are used as synonyms for evil and purity respectively. White represents

innocence, purity and everything good whereas the dark is fearful, evil and unattractive.

According to Jacques Lacan's psychoanalysis of the self, the human body is seen as a fragment.

We only see parts of ourselves and as compared to what others see us. When we look at others, we see them as a whole and therefore the only way to see and appreciate ourselves is to see it from others' point of view. If we are consistently being told that the only form of beauty is to be fair-skinned, with colored eyes, the odd of being able to look at yourself and see beauty if you have none of these characteristics is very hard to do.

Far too often, in our pursuit to stop something from happening, we end up subconsciously encouraging it. With as far as the African-American image has come throughout the media in American history; from the animalize features and portrayals to actual human beings, it is easier to focus on African American self-image which in turn leaves other races in the swamp. The media's influence affects everyone. For example; it is okay for a Hispanic and an African American woman to have curves in the media but usually not for a Caucasian woman.

To be considered beautiful in the media, a Caucasian woman has to have African-American features; big plump lips, tanned skin etc. for an African-American woman, your natural hair is not considered beautiful in the media therefore weaves and braids, long straight weaves makes you more attractive and also the lighter your skin color, the more beautiful you are. The media has become such a tangled web of contradictions that no matter what you look like, they will help you find the flaw in you. How then can anyone develop a positive self-image when you have the media as a giant sitting on your shoulders telling you nothing you have is what is accepted.

Almost all of the texts I have discussed in this essay have been about how much the media influences self-image in different races, but they usually pay more attention to the African

American race more than any other race. In my research, I decide to research how it affects not just African Americans but also Caucasians as well. And with the results I received, it is obvious that perhaps more attention should be focused to other races as well as Caucasian and African Americans.

Methodology

In this research, I asked participants to create their ideal selves using the real life simulation game *The Sims 3*. Students were set up in a room with computers running the game that allows them to create their ideal selves. Participants were selected at random by putting up flyers and inviting student to come by and help with the research. 20 participants created their characters in the room with posters on the walls that represented the media at the time. After three hours, the posters were taken down and ten more participants showed up to create their characters.

Participants

The participants for this research were selected from a range of college students at WVSU. There was no particular selection method for choosing the participants as all I did was put up flyers about looking for students to take part in this research and they showed up to help. Since WVSU has both traditional and non-traditional students, the age range for my participant was between 20 and 35.

The Proposal

1. All throughout the media, we are told how to dress, how to behave, what's considered beautiful and what's not. This depiction of beauty defined by the media influence us on several levels. Our identity is constructed on the ideologies that the media presents to us. The lighter the skin, the more beautiful the person is considered. Different body shapes

are accepted more than others and therefore if someone does not have the acceptable looks by the media, their self-image could be negatively affected. The question then becomes, how does the media affect how we see ourselves; in different races. In this research, using posters as the control, participants will be asked to create their ideal self. Students will be set up in a room with computers running the Sims 3 video game in order to create their ideal selves. 50% of the participants will have posters that represent the media in the room and the other 50% will not have the posters? I am hoping to see if the participants in the room with posters will be influenced by what choices they make in creating their characters that represent their ideal self.

<ul style="list-style-type: none"> • African-American Participants 	<ul style="list-style-type: none"> • Caucasian Participants
<ul style="list-style-type: none"> • 30 students selected at random 	<ul style="list-style-type: none"> • 30 students selected at random
<ul style="list-style-type: none"> • 15 African-American Males • 15 African American female 	<ul style="list-style-type: none"> • 15 Caucasian Males • 15 Caucasian female

2. A total amount of 60 students will be selected from two categories of races. 30 African-Americans and 30 Caucasians students will be chosen to represent each of the selected races. Out of the 30 students, 15 will be males whilst the other 15 will be females.
3. Student participants will be selected at random to participate in the research project. Participants will be selected from students on campus and the student body. I plan to

stand in the student union and in front of classrooms to ask students to participate. In order to eliminate any particular pattern, I will just randomly select students. A total amount of 60 students will be selected from the two categories of races. 30 African-Americans and 30 Caucasians to represent each of the selected races. Out of the 30 students from each race, 15 will be males whilst the other 15 will be females. I could offer students extra credits for their participation but I will be talking to the individual professors once students are chosen and I start collecting the data.

4. N/A
5. The McNair Scholars Program at Concord University will be the source of funding for the project.
6. The project was started in the summer of 2009 and will end in May 2010.
7. The questions that students will be asked will be as follows.
 - What is your gender? M/F (circle one)
 - What's your class standing?
 - What is your race? Choose one.
 - Black or Hispanic
 - Caucasian
 - Other
 - Prefer not to respond
 - Results of this experiment will be posted on <http://www.wikispaces.com> and participants will be given copies of the site so they can follow up on the results.

- If at any point you decide to withdraw your participation in this experiment, you are free to do so.

8. Students will be asked to create their ideal self in the videogame “The Sims 3”.



9. Individual names will be kept completely out of the reports. Since race and gender are the most important aspects of the research, they will serve as the indicators of the subjects.

10. The object of the research is to see how the poster (as they represent media) does/doesn't influence the participants in their decision making. The choices they make from the available options in the game to represent their “ideal self” may or may not be influenced by the posters. I cannot therefore tell the participants that I'm testing to see how the posters affect them nor can I tell them that I'm testing to see how the media (posters) affect their perception of beauty. After the research is over, I will tell the participants about the intention of the research but not before.

Consent

My name is Edna A. Frimpong and I am an English Literature student at West Virginia State University. I am doing a study about The Effects of the Media on Self-Image as a McNair Scholars Program Research Project. If you agree to participate, it would involve filling out a questionnaire and creating a character in the Sims videogame that would take about 20 minutes of your time. There are no risks associated with the study. You are under no requirement to participate in this study and should feel free to decline. Even if you decide to participate, you may withdraw from the study at any time. You will not be penalized for not participating or for withdrawing. No information that identifies you personally will be collected. Your participation will be anonymous and all information will be kept confidential. The results will be shredded by the instructor at the end of the study to ensure the confidentiality of your responses. If you have any questions or concerns about the study, please contact my program Mentor, Dr. Jessica Barnes, phone #: (304) 766- 3073. If you are interested in the findings of this study, please feel free to visit the website in the handout you will receive upon your participation in the project.

If you are still interested in participating in this experiment, read the consent on the back carefully and sign. Thank you for your participation.

Consent Form

I agree to take part in this study, which has been explained to me. I have been given an opportunity to ask questions about the study. I understand that any questions I answer will be anonymous, and that my identity will not be disclosed at any point. I also understand that my participation is completely voluntary, and I may withdraw from the study at any time. I am 18 years old or over, and am legally able to provide consent.

signature of participant & date

Materials

The materials I used in this research involved the Sims 3 video game, posters purchased from Wal-Mart, desktop computers capable of running the videogame and a three-question survey that asked participants their gender, race and their class standing. Using the game required some pre-knowledge of how to play it on my side so that I could help participants who had never tried the game before.



- Materials**
- The Sims 3 game
 - Posters
 - Survey
 - The computers

The Sims 3 videogame gives its players limitless possibilities to create characters of all shapes and sizes, races and nationality. Since the players can control just about every aspect of their characters from their hair color to the size of their chin and other facial features, there really is nothing to stop players/participants from creating their ideal self. Everything is customizable and that gives participants limitless options.

To eliminate bias, I went to Wal-Mart and asked for any posters they had. There were several animation posters but only 6 of real people they had left. They included one of Kim Kardashian, one of WWE superstar John Cena, three from the cast of Twilight and the last of Megan Fox from the Transformers' movie series. I noticed that all of these actors/actresses were Caucasian and that was okay because it represented what was important when it came to the media.

Results

Participants

- **Thirty participants, 10 in a room without posters and twenty in a room with posters.**
- **6 hours; first three hours 20 participants showed up. 10 participants showed up in the last 3 hours.**
- **Students at WVSU**

African-American Participants	Caucasian Participants
10 Altogether	20 altogether
5 males , 5 Females	8 males, 12 females
4 (No posters); 2 female, 2 males	6 (no posters); 2 female, 4 males

Procedure

The data collection took place over a 6-hour period. In the first three hours, I had 20 people show up whilst the posters were mounted on the walls. The second half of the data collection brought me ten more participants and at the time I had the posters down. As shown in the above slide, out of the 30 participants, 20 were Caucasian whilst the remaining 10 were African American. All of the participants were students from WVSU.

Conclusion

Through my research I found out that when it comes to our self image, the media does have a lot of influence on us not just in body image only but also in how we perceive ourselves racially. My African American participants who were in the room with the posters created characters that looked nothing like them, had lighter skin colors than the creators did and they looked over the top. The Caucasian participants created their character to look dark skinned because according to one participant, for a white person, its more beautiful to be more tanned.

I had a participant ask me how to make their character darker because she thought her character was too white and she didn't like that. Body shapes and sizes were changed and over-exaggerated in a way that if the creator was skinny, they created their characters to look curvier whereas the curvy people were creating characters that were skinnier than they were. In general, the participants with the posters created characters that were not life-like and usually looked nothing like their creator and seemed over the top.

One of the participants spent close to an hour creating his character because he wanted every piece of clothing to match. He spent minutes trying to find the right shade of green in order for his shoes to match his sweater. (See Appendix) Another participant spent several minutes trying to find the right color of glasses to match his suite. All the females created characters that were either smaller than they were or if they were slimmer, they made their characters seem curvier. (See Appendix) With the posters, it was all about the opposite. They seemed to think their ideal self should be better looking than their actual self,

The participants in the room without the posters created characters that seemed more realistic, looked like the creators and they spent less time creating their characters. The participants without the posters thought their ideal self were quite possibly their actual selves.

The participants, particularly the males, created characters that were either with jeans and tee shirts. One of the female participants in the room without the posters created a character that looked exactly like they. She made a shirt of the same pattern as the one she was wearing at the time and it is very easy to recognize the resemblance between her and her character.

Now don't get me wrong, there were some who were exceptions to these generalizations but the common finding/conclusion that I can draw from the data suggest the above results. In all, I learned that when there is an outside influence (the posters representing media), how people see themselves and their self-image changes quite easily and that the media does not discriminate when it come to who it affects. It affects everybody almost the same, regardless of the race and perhaps even gender (but maybe that's the topic of another research). I think it will be interesting to take this research on a bigger population and perhaps even different cultures as well.

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Appendix

Consent Form

I agree to take part in this study, which has been explained to me. I have been given an opportunity to ask questions about the study. I understand that any questions I answer will be anonymous, and that my identity will not be disclosed at any point. I also understand that my participation is completely voluntary, and I may withdraw from the study at any time. I am 18 years old or over, and am legally able to provide consent.

signature of participant & date

Examples of Images
With Posters





Without Posters



Conclusion

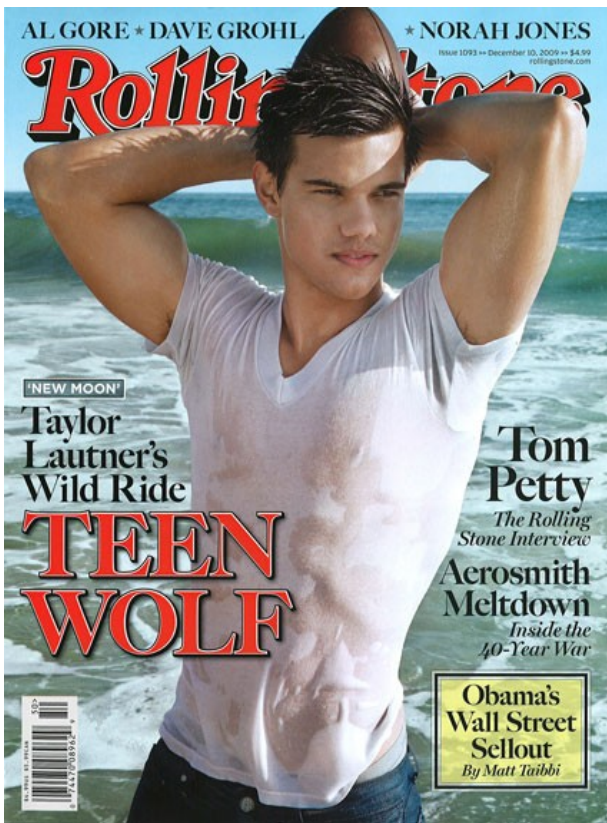
With Posters

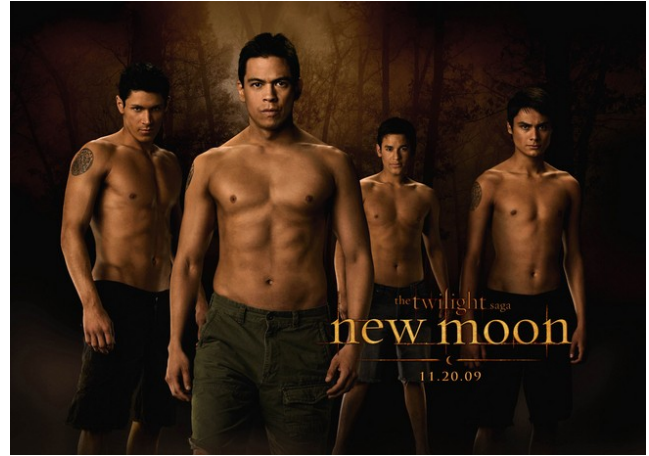
- Dark-skinned participants created characters with lighter skin color
- Light skin participants created characters with darker skin characters
- Spent more time creating their characters
- Characters looked over-the-top

Without Posters

- More realistic characters
- Diverse in body sizes
- Less time creating the characters
- Closely resemble the creators

Examples Of posters





Teaching Strategies for Students with Autism in the Secondary
Special Education Classroom

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Abstract

Students with autism are characterized by a decreased ability to effectively communicate and heightened stress response to perceived threats. A student with autism is very perceptive of visual stimuli at the expense of auditory information absorption and processing. These aspects of the autism make it necessary for teachers to modify lessons, assessments, and even the physical nature of the room. In this preliminary study the teaching techniques of a special educator will be observed to discover how student stress, communication skills, life skills, and behavior are approached.

Introduction

Autism is a neurological disorder that is characterized by the inability to relate to the social world. Though present from birth, diagnosis often occurs by age three, when it becomes apparent that specific milestones have not been met (Frith). The diagnostic criteria include three main factors. The individual must meet all three criteria in order to be diagnosed. According to the Diagnostic and Statistical Manual of the American Psychiatric Association, the first criterion is a lack of reciprocal social interaction. Second, there must be verbal and nonverbal communication impairment. Third, there is the characteristically narrow range of interests and activities (American Psychiatric Association). This narrow range of interests often manifests itself as a fixation or an obsession with collecting a certain type of object.

Lack of social reciprocity is often very difficult to see until the child is old enough that peer interaction is common. If the child has no siblings, and the inability is not so severe, it can go unseen until preschool. Typically, parents become alerted by the child's inability to make eye contact or respond when called. As the child gets older, an intense disinterest in other people becomes more and more apparent.

The communication impairment is usually the first thing parents notice. Hearing impairment is usually suspected when a child fails to begin speaking or respond to others' speech. There is a critical difference, however, between children with autism and children with hearing problems. A child who cannot hear speech will not be able to communicate in the traditional way, but he or she will still manage to communicate through gestures and expressions. A child with autism will not be able to do this. Additionally, if the ability to communicate verbally does eventually occur, the speech will merely be parroting. Children with autism will start speaking by repeating words and phrases that they hear, often right after they hear it. There

is a lack of understanding of the words, and a lack of self generation of the words in the proper context (Frith).

The third criterion listed in the Diagnostic and Statistical Manual is composed of the classic ritualistic behaviors. These are the idiosyncrasies that are not as likely to be confused for other disorders, and are vital in the diagnosis of autism. Typically a child with autism will exhibit an intense interest in specific objects to the point that he or she can examine the object for hours at a time. Older children will often be obsessed with a particular subject or set of objects, such as trains or cars, and spend all of their time learning about or watching them. Additionally there is the insistence on routines and sameness. The child might insist on wearing only the same set of clothes or eating only the same foods, or watching the same video over and over every day. They will often undertake elaborate or strange ritualistic behaviors, and do the same activity over and over in the same manner. The child will forgo regular pretend play in favor of a repetitive activity, such as spending hours lining up all their toy cars in a precise manner (Brill). These rituals are very similar to behaviors seen in Obsessive Compulsive Disorder; however, when combined with the other criteria, there is no mistaking a diagnosis of autism.

Autism in the Classroom

Students with autism can be found in special education classrooms and general education classrooms. Autism is a spectrum disorder, with children falling under different degrees of functionality. High functioning students can typically manage in the inclusive environment, provided special care is made to ensure the student's specific needs are met. A student with autism has many needs that differ from the ordinary student. The school environment is a very difficult place for someone with the peculiarities of autism. Their highly specified daily routines are often interrupted causing stress and confusion, and their difficulties with communication can

cause a great deal of frustration. Individuals with autism pay a lot of attention to objects and surroundings, so much so that the loud noises, crowds, smells, and lights of the school building can cause a sort of sensory overload and become overwhelming (Darrow). It is no wonder that a student with such an inconvenient list of stressors cannot adapt easily or always behave appropriately in school. Problem behaviors, tantrums, and uncooperativeness can occur quite often when a student's needs are not met. In order to minimize problem behavior teachers must strive to identify the student's needs and find ways to reduce the stress of the classroom environment.

Stress and Autism

Individuals with autism have a higher stress response to events than the typical person. In addition to heightened response, autism is also characterized by a higher stress level overall. This means that students with autism find many things to be stressful that typical students do not. Teachers should realize that the misbehavior and tantrums associated with autism are a form of stress response (Lytle and Todd). So, it would seem that promoting good behavior in class would be as simple as eliminating all stressors. This is a very good idea, and teachers should strive for this, however, eliminating all the things that stress a student with autism is no simple matter.

A stress response can be elicited by any novel event, object, or situation. In addition to new things, any deviation from a routine is highly stressful as well. The already heightened state of stress and the inability to effectively communicate needs or fears compounds the stress response further (Goodwin et al). Dr. Groden, at the Groden Center for autism in Rhode Island developed a list of most common stressors for individuals with autism. The list is referred to as the Stress Survey Scale. Listed on the scale are a number of events that could be very stressful to

someone with autism, from having a cold to being interrupted in the middle of a ritualistic behavior.

TABLE 1
Items by Stress Survey Scale

I. Changes & threats	II. Anticipation/uncertainty	III. Unpleasant events	IV. Pleasant events	V. Sensory/personal contact	VI. Food-related activity	VII. Social/environmental interactions	VIII. Ritual-related stress
<ul style="list-style-type: none"> • Having a cold • Having a change in task to a new task w/new directions • Going to the store • Having a change in environment from comfortable to uncomfortable • Moving from one location to the next • Having a change in environment from familiar to unfamiliar • Transitioning from preferred to nonpreferred activity • Having to engage in not-liked activity • Being unable to communicate needs • Needing to ask for help • Participating in a group activity 	<ul style="list-style-type: none"> • Having a change in schedule or plans • Waiting for preferred events • Having unstructured time • Waiting in line • Going home (from school, to visit parents) • Waiting for transportation • Waiting for routine to begin 	<ul style="list-style-type: none"> • Waiting to talk about a desired topic • Having personal objects or materials missing • Following a diet • Receiving a reprimand • Being told "no" • Receiving criticism • Having something marked incorrect • Having a change in staff, teacher, or supervisor • Losing at a game 	<ul style="list-style-type: none"> • Receiving a present • Playing with others • Receiving activity reinforcement • Having something marked correct • Being allowed to attend a party or favored event • Receiving tangible reinforcement • Having a conversation • Receiving verbal reinforcement 	<ul style="list-style-type: none"> • Being in the vicinity of noise or disruption by others • Being touched • Receiving hugs and affection • Feeling crowded 	<ul style="list-style-type: none"> • Waiting at a restaurant • Waiting for reinforcement • Waiting for food 	<ul style="list-style-type: none"> • Being in the vicinity of bright lights • Being unable to assert oneself w/others • Someone else making a mistake 	<ul style="list-style-type: none"> • Having personal objects or materials out of order • Being prevented from completing a ritual • Being prevented from carrying out a ritual • Being interrupted while engaging in a ritual

These heightened stress levels arise from biochemical differences that individuals with autism suffer from. Physiological studies show that people with autism have much higher levels of cortisol, a stress hormone. Individuals with autism also have an enlarged amygdala. The amygdala is the threat-sensing region of the brain, which controls the flight or fight stress response. It is no wonder that children with autism have such high anxiety levels and fear new things if they perceive much of their surroundings as threatening. Studies show that 84% of children with autism have an anxiety disorder as well (Roxanne and White). Efforts should be made to keep the classroom environment relaxing. Psychologists recommend that teachers avoid using loud noises, such as clapping or whistling to get the class's attention, keep doors to the hallway closed, and turn down the announcement speaker's volume. Teachers should also keep all cabinets closed, and stimulatory decorations and displays to a minimum. Children with autism will often flap their hands or rock back and forth when stressed, and the repetitive movement seems to be a self-soothing activity as much as it is a signal of distress. Teachers can provide an

area where the student can go to try and calm themselves, such as a rocking chair or therapy ball in the corner of the room (Lytle and Todd).

Efforts should be made to encourage self-soothing behaviors, as it encourages independence. Independence is a very important goal for someone with autism. Although complete independence is rare and unlikely, some independence is necessary in the inclusive environment. Students need to be able to overcome stress, stay on task, communicate needs, and transition from one activity to the next with minimal assistance.

Transitions

Due to the inherent dislike of change, the student with autism has a great difficulty in moving from one activity to the next. Transitions are a major aspect of daily life, especially in a classroom. Teachers will face many challenges in dealing with this particular idiosyncrasy of autism.

Although the difficulty of transitioning between activities is most relevant in an inclusive environment, where transitions are taken for granted, problems do still arise in the special education classroom. The stress of the transition can bring about episodes of the typical stress responses seen in students with autism: tantrums, obstinacy, and violence. It is important for a teacher to minimize the stress associated with change so that class is not interrupted, but more importantly so that the student can learn to be independent. The inability to transition between activities significantly hinders a student's ability to be independent in the classroom for more than a few consecutive minutes. Ideally, the student should be able to handle moving from activity to activity without mediation.

For daily transitions, such as going to lunch, or going from a reading lesson to a physical education lesson, teachers can employ a visual activity schedule. This is a series of pictures that

show what the student will be doing for that day, in chronological order. This schedule can be taped to the student's desk, or to a textbook or notebook, so that the student can continually refer to it. (Banda et al)

Figure 1. Example of Between-Activity Schedule



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Communication Skills

The inability to communicate one's needs effectively can be very frustrating. Lack of communication takes control away from an individual, and can be highly stressful, as is seen in students with autism. It is one of the expectations of the inclusive environment that students with language delays make improvements through their interactions with students and teachers in the general education classroom (Yianni-Coudurier). It is not expected, however, that the teacher make great strides in improving the student's language abilities through specific lessons, because the teacher would be otherwise preoccupied with his or her own subject matter. Nonetheless, steps can be taken to improve communication without the long and difficult process of improving language ability.

The utilization of visual cues is the most helpful way to improve communication with a student who has autism. Autism is characterized by a strong ability to absorb visual information,

and an impaired ability to absorb auditory information. Using pictures to demonstrate what is wanted of the student, such as a picture of the student sitting down, is very effective. The use of pictures also allows the student to have more control over their day. A series of pictures can be presented to the student as options for a range of things, from what food the student would prefer, to what physical state they wish to communicate that they are in (Banda). Giving the student a little more control is a necessary and good step towards a higher level of independence.

Keys to Success

It is well documented that success in a classroom comprised of individuals with autism revolves around stability. The components of classroom stability can include anything from daily routine to the physical nature of the room. Teachers should be mindful of the students' experience in school, and try to predict when problems may arise. For environmental stability, students should maintain the same seat every day. Dr. Scott Iseminger, of Krejci Academy, a therapeutic day school for children with autism, suggests an innovative way to ensure physical stability while incorporating the flexibility often needed for an active student. Students can be offered two seats and switch between the two at intervals. The suggestion was for a music class setting in which the student changed seats between songs, but the idea can be utilized in different classrooms with different cues. This effectively provides a way for the student to be active while still within predictable physical boundaries (Iseminger). Besides seating arrangement, the layout of the room should be maintained. A predictable environment is very important for minimizing stress (Lytle and Todd). Furniture, decorations, and other major aspects of the room should be kept within the same layout from the beginning of the year to the end.

The class's routine should be established on the first day and maintained thereafter. The first day is new and unpredictable for students with autism, and the stress can be difficult for

them. It is important that the teacher try to overlook the stress and get through the class period as intended, because anything that happens within the first day will be expected to happen every day afterward. If a student is pulled out halfway through the class to help calm him, then he will expect this to happen every day. The basic class routine should be adhered to as closely as possible. One teacher recounted a disastrous first day when the power went out in the school 10 minutes into class time. The next day her student with autism got up and turned the lights after 10 minutes had passed (Iseminger).

Obviously, the daily routine of a class does not remain the same throughout the year. Sometimes instead of lecturing, a teacher will show a video. Sometimes instead of learning indoors, the teacher might take the students out for a lesson outside. These changes happen all the time in an inclusive environment. It is not impossible to help a student with autism deal with or prepare for changes of this sort. Autism does not necessarily cause an affinity for similitude, but rather a fear of the unknown. It is this fear of the unknown that the teacher must contend with. When a change will occur, the teacher should begin to prepare the student well in advance, and utilize visual information. Visual information is concrete and offers much more to a student with autism who is much more inclined to learn from visual cues (Banda et al). Calendars with pictures of events that will be happening are the best way to help a student prepare for change. If the teacher plans on showing a video at the end of the week, she should announce this change and show a picture of the T.V. in the class playing the video, while explaining what will happen. Every day before the day of the video, the teacher can mention again what will happen at the end of the week, and point out the picture on the calendar. Any change in routine can be dealt with similarly (Iseminger).

If effort is made to prepare a student for changes in their routine, stress related behaviors can be prevented. So, by reducing the amount of stress the student experiences, the behaviors can be controlled. It is important to realize that all behaviors have a source. If the behavior is not conducive to a healthy learning environment, then teachers should try to reduce the incidence of that behavior. The most effective practice would certainly be to eliminate the source that drives that particular behavior. Tantrums, panic attacks, outbursts, self-harm, and obstinacy in students with autism are behaviors that signify stress. Teachers and students alike will have a more successful time if these problems are addressed at their source, and stressors are eliminated.

Research Proposal

Current research on autism in the classroom focuses primarily on the students. This case study will focus on a high school special education teacher with the unique opportunity of having a classroom exclusively comprised of students with autism. The aim is to observe how the teacher displays versatility and innovation in response to a classroom of students with a wide range of needs and abilities.

All of the goals of a special educator ultimately revolve around helping students reach a higher level of independence. For students with autism, there are several major obstacles standing in the way of success which can be improved upon in the classroom. These obstacles include but are not limited to: transitioning between and within activities, coping with stress, and ineffective or limited communication.

Many of the difficulties encountered in the classroom, such the wide range of problem behaviors associated with autism, are tied to these three obstacles. My objectives as an observer are to document how the teacher deals with these obstacles. Specifically I will look for how the teacher executes the following:

- communication with students
- improving students' communication abilities
- minimizing problem behaviors
- maintaining a stable, stress-free learning environment
- Increasing students' level of independence
- motivating students

Observations will be conducted with minimal interaction and documented by written comments. The purpose of this study is to collect as much information as possible.

I will make note of:

1. All the materials that the teacher uses
2. Specific strategies and teaching models employed
3. Methods of assessing students

The classroom is entirely contained. The students have all of their classes, as well as their lunch, in the one classroom. In order to experience as wide a range of daily situations as possible, the observations will be conducted at varying times of day: morning or afternoon. All observations will take place within a five-day school week. After the final day of observation, I will interview the teacher in order to clarify or gain a second perspective on what was observed and documented. This interview will be created after the five days of observation.

Observations

The Class:

There is one teacher, three teaching aides, and a volunteer grandmother.

There are only four students in the special education class. Each student has been diagnosed with autism. One student, Shane, is high functioning. Tori, Tyler, and Rose have severe autism.

At each corner of the room is a desk. At the front is a Smartboard and a large calendar. Along one side of the room are cabinets which are marked off with colored tape. The other side of the room has two sinks and a small cot. At the back of the room are more cabinets, a counter, fridge, and microwave. There are two large, semi-circle tables and four regular desks for the students. There are also two rocking chairs and a large ball for rocking.

Beginning of the Day:

Students sit together at a semi-circular table. The teacher begins by asking students what day it is. They go over what day of the week and month it is. There is a large calendar at the head of the room. Each day it is a different student's job to place the day card up on the calendar to show what day it is.

A worksheet is passed out. Students are helped to place this date at the top of their page along with their names. Rose is given two worksheets. One she works on and one that she proceeds to fold into an accordion fan. The teacher explains that Rose is very crafty and cooperates best when given materials to cut, fold, or glue while she works on school work.

Aide 1 reads a short book to the students about a man who adopts a cat. Afterward, students are each asked questions about the story. To answer, they are given picture cards that depict several answer options. Students point to the appropriate card to indicate their answer.

Each student is asked the same question in turn, and gives his or her answer. Shane, hears the previous question and, knowing that he will be asked the same thing, points to the answer before he is asked. Tyler points to the same answer on his turn even after the teacher asks a different question.

After each lesson is a 10 minute break. Tyler refers to his folder to see what to expect next. His folder contains picture cards of classroom activities on Velcro. After each activity,

Tyler places the appropriate card on the other side of the folder, on an empty piece of Velcro. To signify transitions, an aide sets a timer. Tyler lies down on the cot and watches for the timer. Shane and Rose rock in the rocking chairs.

After 10 minutes, the timer sounds and Tyler gets up. The students gather for a math lesson. Aide 2 turns on the Smartboard. There are a series of numbers at the top of the screen. Each student comes up to the board and drags each number into place so that they are in ascending order. The teacher makes note of their progress. She explains that before the Smartboard was used, the students had great difficulty in sequencing numbers in chronological order.

Students are then given a break. After the break all four students break away to do separate activities. Shane and Tori go to computers to practice with the reading software. Tyler and Rose write sentences.

The reading software gives a set of words to read aloud, which progressively become more difficult. Shane reads words at the highest difficulty level of all the students. The activity is timed, and an aide sits with each student to record their progress. Shane does very well in the practice round, but when the timer is turned on he becomes flustered and nervous. He messes up on several of the words. The aide has him go through it several times.

Lunch:

The students eat lunch after the general education students have left the cafeteria. Rose, Shane, and Tyler eat hot lunch. Tori brings her own lunch. She refuses to eat anything else for lunch every day. The teacher cuts the pizza into bite size pieces and gives Tori a fork.

After lunch the students are taken outside for exercise. They, and the teachers, all walk one lap around the school before coming back in. During this walk, the aides quiz students about what they see, asking about bees, and clouds, and flowers.

End of the Day:

After lunch, the students play games, or do crafts. Rose wants to get into a cabinet for colored paper so that she can make paper fans. The cabinets are all taped in different colors. Red tape means that students cannot open them, yellow means that students must ask permission first, and green tape means that the students may open them and take what they need whenever they want. This cabinet is marked in yellow, so Rose gestures that she wants in it. The teacher does not open it until Rose verbally asks for what she wants. The teacher points to her lips to remind the student to use her mouth, and says, “Rose wants...”

Rose answers that she wants paper. The aide praises Rose and gives her paper, glue, and stickers to make accordion fans.

An aide turns on the smart board and opens Google Earth for Shane. Shane looks up each of the teachers addresses to find their house on Google Earth. He then zooms out and searches for cities, pivoting the map around skillfully.

In the last hour of class, the teacher brings out her recipe book and a couple of blenders. The students are to make milkshakes. They are given picture instructions of what they will need and the steps to make the milkshakes. Each student washes their hands and then takes turns adding ingredients that they need and pushing the blender buttons.

While they are drinking the shakes, the teacher brings up a game similar to Cake Mania, in which customers come up and request certain foods (cakes, sundaes, ice cream cones, etc.) The

students need to arrange the correct sequence of items to make the food before the customer gets tired of waiting and leaves. Due to the built in time limit, Shane has difficulty playing the game.

Conclusions

The most striking observation throughout the research was how an entirely different approach was used for each of the students. The teacher and aides had different strategies, goals, and expectations for each child. The use of timers, picture schedules, and pictorial answer options during assessments was primarily used for Tyler. This student in particular relied heavily on the timer to cue transitions. The teacher provided him with a folder with pictures of his daily activities on Velcro. When asked how Tyler behaved before the timer and schedule strategy had been implemented, the teacher and aides all agreed that it was almost impossible to get Tyler to transition to a new activity.

The second student, Rose, was taught with a very flexible manner, allowing her free movement throughout the room. The rocking chairs, desk chairs on wheels, and various craft materials were at her disposal as stress relievers. In order to maintain some control of this student's movements and activities, colored tape had been placed along the floor and cabinets to signify levels of accessibility. Green tape around a cabinet meant that students could freely explore this area and take supplies when needed. Areas zoned off or marked with yellow tape signaled to students that they must first ask permission before entering that area or taking those items. Red tape meant that no student was allowed. When asked about this student's progress, the teacher replied that most rules were not observed by Rose until a positive reinforcement plan was used to reward her good behavior. Rose loved paper, glue, and other crafting materials enough that these could be used as rewards. These items were often used to placate Rose while work needed to be done. The teacher and aides often handed two work sheets to Rose: one to

write on, and one to cut up. As long as paper crafting was allowed, this student was fairly cooperative. Students with autism often need a release from stress in the form of movement: rocking, flapping, etc. Sometimes the coping technique is not so obvious, as in the case of Rose's need to cut and fold paper. Teachers need to be mindful that not every aspect of Autism Spectrum Disorder manifests itself according to the text. Every student should be expected to have idiosyncratic tendencies.

With a student as high performing as Shane, a flexible approach to teaching seems to work very well. Shane would have been in an inclusion setting, if it weren't for his anxiety. This student did not require as much attention in academic matters. Shane would often complete assignments with little or no help. The teacher and aides did, however, need to be especially wary of Shane's stress levels. Shane performed well in most activities, unless they were timed. With the addition of a timer, steadily counting down to zero, this student had a great deal of trouble focusing, had increased breathing rate, and heightened levels of frustration. The addition of a strict deadline made assignments almost impossible for this student. The common decision in this case would be to eliminate timed assignments or quizzes entirely. This would not, however, benefit Shane in the long run. The teacher was making an effort to help this student deal with his anxiety in small controlled ways, such as keeping timed quizzes and assignments in the curriculum. The goal is always independence. With a student who is doing so well, and almost ready for an inclusion setting, it does not make sense to take away the challenges that would allow for progress. During free time, the teacher would often bring up games to play on the Smartboard. The Smartboard was Shane's favorite tool in the classroom. These games always, however, have a time limit. This was a great way to get this student motivated towards working on his anxiety. Pairing something that the student likes with a problem that needs to

worked through is an age old strategy in the classroom. It especially works well in the special education setting if it is visual and kinesthetic in nature such as games on a Smartboard.

Very few teaching and behavioral strategies were observed in use for Tori, the fourth student.

This is because Tori adhered to her personal routine so strictly that she rarely deviated from the teacher's expectations or rules. Incentives for this student typically involved more time at the computer to play games. Tori did not use visual cue schedules or timers, and handled transitions very well. No behavior problems or interventions were ever observed with this particular student.

The teachers seemed to rely on a positive reinforcement plan in which Tori was rewarded with extra time for computer games, or time to color, after work was accomplished. The only significant observation with teaching and behavioral strategies occurred during lunch. Tori had the characteristic fixation with a single item of food that many students with autism seem to possess in at least a mild form. Tori would only eat pizza, and never anything else for lunch. Pizza can be eaten by hand, but this does not allow for life skills such as table manners to be taught, so the teacher had Tori's pizza cut into bits every day, and provided her with a fork to eat it with.

The first part of each day was dedicated to academic studies. After lunch, students spent time on life skills or played games aimed at honing a particular skill. One day, the life skill to be worked on was cooking. The teacher kept a notebook of simple 3 step recipes, and would pick one once a week to make with the students. On this occasion, a recipe for a milkshake was chosen. Before beginning, students took turns washing their hands. The teacher then showed picture representations of the necessary ingredients and utensils. The students took turns placing the ice cream, milk, and ice in the blender and pushing the button. The activity was achieved with very little help on the teacher's part. This is another fine example of the pictorial

instructions set. If these students had not been given pictures, but were instead expected to rely on text, they would not have succeeded. If the teacher had given verbal instruction, the students would not have succeeded. When the activity is delineated by a sequence of pictures, the students can see and understand what is expected of them. The instructions are then clear. It is important that teachers realize that the method of information delivery is critical with students who have autism. Students with autism are at a clear disadvantage with traditional teaching approaches. With a decreased ability to process auditory information, these students need the visual cues in order to rise to the level of achievement that they are capable of.

During whole group instruction, the students were always seated together at a large table in the middle of the room. During reading class, the teacher or an aide would read to the students and then ask a series of questions to each student. Students were provided with several pictorial answer options to point to. This worked well with the nonverbal students, who could not say the answer aloud, but could communicate a correct answer nonetheless when presented with pictorial answers. One weakness that was noted with this strategy was in the implementation. The teacher would ask one student a question and then move on to the next student to ask the very same question. Many times, it was observed that the student would simply answer before the question was asked. This method made it impossible to tell whether they knew the answer or whether they had simply learned to imitate the previous response.

When teaching math, technology was often used to make the lesson kinesthetic. Students could drag the numbers around on the touch screen of the Smartboard. The teacher mentioned that before the Smartboard, teaching math was very difficult, as the students did not want to participate. When observing the math lesson, there was very little hesitance and students were actually quite eager to take their turn at the board.

Of course, without an analysis of student assessments, it is impossible to conclude whether academic progress has occurred. As this is a preliminary study meant to introduce a wide array of possible research avenues, the conclusions are quite restricted. However, from this short period of time observing this class, it is apparent that the research possibilities are endless. A more focused study in the stress management of students with autism who are making the transition into the inclusive environment, such as Shane, would be an ideal next step. Other areas of research to consider would be to research various the effectiveness of various new teaching with technology strategies, such as use of Smartboard applications in teaching math.

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Sequence Analysis of ERM homologs and Recombinant Production of the N-terminal Domain of the *Caenorhabditis elegans* ERM

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Abstract

In humans, the ERM (ezrin, radixin, and moesin) proteins have conserved N-terminal and C-terminal domains. These domains can bind to one another or they can connect the actin cytoskeleton with the plasma membrane. A fourth highly conserved member of the ERM family that also participates in intramoelcular interaction is merlin, a neurofibromatosis type II tumor suppressor. Similar proteins have been identified in the nematode *Caenorhabditis elegans*. To better understand the role of the *C. elegans* merlin and moesin, we sought to purify the N-terminal domain using a recombinantly added 6-Histidine tag. To better understand the evolutionary development of the ERM and merlin homologs, a protein sequence analysis was conducted using the program ClustalW2 comparing the conserved identity of the ERM and merlin homologs of *Homo sapiens* and *Drosophila melanogaster*.

Introduction

Understanding the role of the proteins that allow the interaction of the plasma membrane and the cytoskeleton is vital to understanding the regulation of endocytosis, exocytosis, cell signaling, and cell structure. Ezrin (Bretscher 1987), Radixin (Tsukita *et al.* 1994), and Moesin (Lankes and Futhmayr 1991) or the ERM proteins, participate in these membrane-cytoskeletal interactions. Ezrin, is an 80/81 kDa protein (Urushidani *et al.* 1989), is found in microvilli, filopodia, membrane ruffles, and cell-to-cell contact sites (Lozupone *et al.* 2004). The ERM proteins link the membrane to F-actin (Gary and Bretscher 1995). The ERMs belong to the superfamily band 4.1 which are characterized by a conserved domain of ~300 amino acids in a region called an N-ERMAD (N-terminus Ezrin, Radixin, Moesin Association Domain) or FERM (Four-point one Ezrin, Radixin, ad Moesin) domain (Pearson *et al.* 2000).

Phosphorylation and Activation

The ERM superfamily also contains an alpha helical intermediate segment approximately 170 amino acids, linking the N-ERMAD to the C-ERMAD. The C-ERMAD corresponds to the last 100 amino acids (Reczek *et al.* 1997). When the intramolecular association between the N-ERMAD and C-ERMAD is present, the ERMs are in the dormant state (Fievet *et al.* 2004). Reczek *et. al* 1997 found that when Ezrin is dormant, the FERM domain cannot bind the membrane protein EBP50 (ERM Binding Phosphoprotien 50kDa). Berryman *et. al*, 1993 showed that the intramolecular interaction inhibited the C-ERMADs affinity for F-actin.

Phosphorylation releases the two domains, exposing their respective binding sites. The N-ERMAD can associate with the membrane directly through adhesion molecules such as members of the immunoglobulin superfamily (ICAM-1, ICAM-2, ICAM-3) and indirectly with multi-spanning membrane proteins (Fievet *et al* 2004) such as CD-44 (Tsukita 1994; Takai *et al.* 2008) The N-ERMAD tends to bind partners with positive amino acid binding regions (Yonemura *et al.* 1998).

Merlin

A fourth, less conserved member of the 4.1 super family, merlin (moesin-ezrin-radixin like protein) (Trofatter *et. al* 1993), is a neurofibromatosis type II tumor suppressor in humans and its FERM domain shares 60% identity to the FERM domain of ERM proteins (Pearson *et. al* 2000). Merlin type 1 is responsible for the tumor suppression in schwannoma cells of neurofibromatosis type 2, a genetically inherited disease that produces tumors associated with the central nervous system, schwannomas, and multiple meningiomas (Trofatter *et. al* 1993). Phosphorylation of serine 518 shows ability to regulate merlin's tumor suppressing capabilities (Golovina *et al.* 2005). Much like the ERMs, merlin undergoes regulated inter- and intramolecular interactions (Nguyen *et al.* 2001). Merlin has a similar structure to the ERMs, but lacks a F-actin binding site on its C-terminal domain (Nguyen *et al* 2001). It lacks the C-terminal binding site for F-actin both in vivo and in vitro (Huang *i al.* 1998). Actin is instead bound to the N-ERMAD both directly (at residues 1-27 and residues 280-323) and indirectly through β II spectrin (Scoles *et al* 1998) and fodrin (Neill and Crompton 2001).

There exist two isoforms of merlin. The N-terminus of merlin isoform 1 associates with both the C-terminus of merlin isoform 1 and moesin, but does not associate with the C-terminus of merlin isoform 2 (Ramesh 2004). Merlin isoform 2 never enters a dormant state and is said to be open and active (Gonzalez-Agosti *et al.* 1999). Merlin isoform 2, through its N-terminus, can bind F-actin more effectively than merlin isoform 1. Merlin isoform 1, through its participation in a dormant state, partially blocks the binding site for F-actin (James *et al.* 2001). Merlin's binding partners include CD44, which together regulate the growth promoting/inhibiting stages (Ramesh 2004).

Evolutionary Conservation of ERMs and Merlin

Ezrin, radixin and moesin share approximately 75% sequence identity (Berryman *et. al*, 1993) (Figure 2). The ERMs are not redundant, but rather homologous as found through their expression and distribution in tissues and their primary sequences (Brestcher *et. al* 1997). As homologs, ezrin, radixin

and moesin are able to substitute for one another (Pearson *et. al*, 2000) as indicated by the study of mouse moesin knockout where there was no observed phenotype when moesin was suppressed (Doi *et. al* 2000).

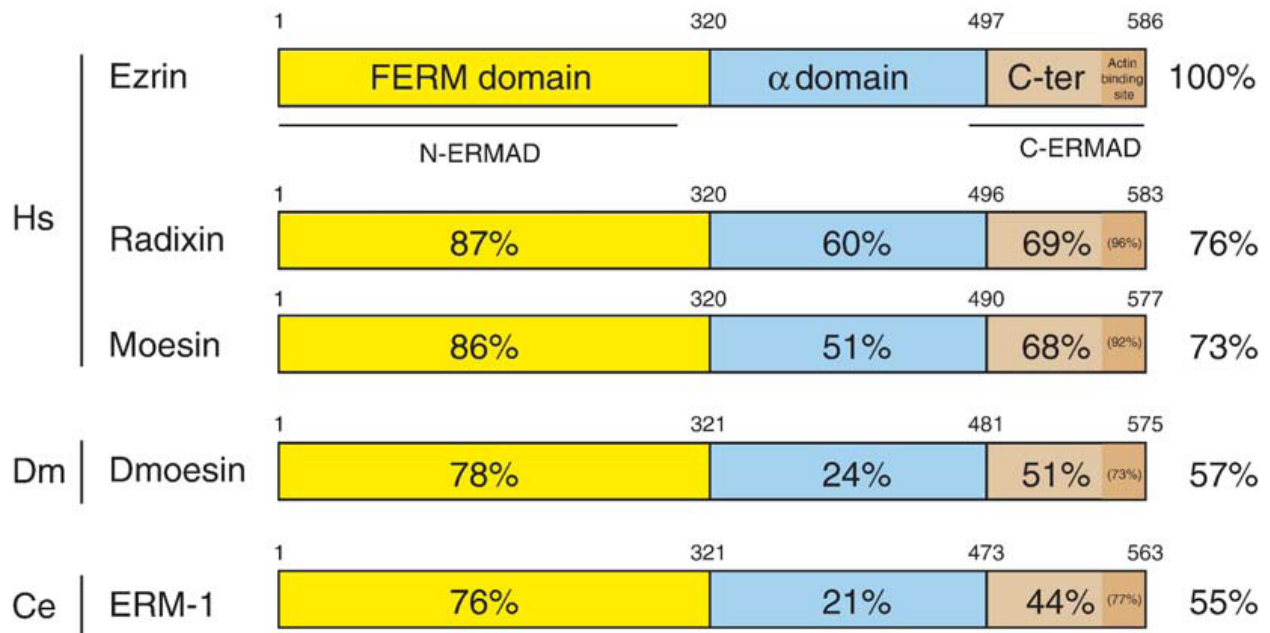


Figure 2. Homo sapiens (Hs), *Drosophila melanogaster* (Dm) and *Caenorhabditis elegans* (Ce) have a high conserved FERM Domain and C-terminal end. Dmoesin has 57% identity to human ezrin and Ce ERM-1 has 55% conserved identity. The FERM domain has a high sequence conservation than does the C-terminal end and both have a higher conservation than the alpha domain. (Fievet et al 2004).

There have been many linkages showing that ERMs of vertebrates and *C. elegans* behave similarly both functionally and structurally (Fievet et al 2004). Structurally there is a conserved FERM domain in which *C. elegans* has a 76% conserved sequence identity to human ezrin (Fievet et al 2004). For *D. melanogaster* and *C. elegans*, there exists one gene that codes for the ERM proteins (Fievet 2004). In *D. melanogaster*, Homo sapiens, and *C. elegans* there is a 75% observed identity between the N-ERMAD and C-ERMAD indicating a high conservation through evolution (Figure 3) (Fievet et. al 2004). Merlin's threonine residue that is phosphorylated is seen in both *D. melanogaster* and humans showing

conservation among species (McCartney and Fehon 1996). A high sequence conservation between merlin and the ERMs is also seen with a substitution of serine 251 with asparagine (Takai et al 2008).

D. melanogaster has one ERM homolog (Dmoesin) and merlin (van Furden et al 2004) and is required for actin filled microvilli during development (Chorna-Ornan et al 2005). In *C. elegans*, when the ERM-1 gene is suppressed, it interferes with the connection of the proteins to the F-actin cytoskeleton (van Furden et al 2004). Both of these findings suggest that the ERM homologs of *D. melanogaster* and *C. elegans* have important roles in regulating F-actin organization and function.

In vertebrates, specifically mice, the ERMs moesin and radixin can substitute for each other not producing a noticeable phenotype, indicating not redundancy, but a high sequence conservation (Doi et al 1999). *C. elegans* has two ERM genes that reveal 99% protein identity to each other (Bretscher et al 2000). Deletion of ERM-1 leads to constrictions and obstructions of the lumen in *C. elegans* by disturbing the connection between the cytoskeleton and the membrane of the intestine (van Furden et al 2003) and can cause a lethal phenotype in *C. elegans* (van Furden et al 2003).

Currently, a proposed merlin has been identified by sequence in *C. elegans*. In this study we aim to understand the intramolecular interactions of *C. elegans* merlin as it compares and contrasts to *C. elegans* moesin. Understanding the proteins in an earlier phylogenetic organism can augment the field of knowledge of these proteins in general, in particular to their function, sequence homology, and structure. This project will aim to (1) clone and purify *C. elegans* moesin-1b and (2) to establish a detailed phylogeny of merlin, ezrin, radixin, and moesin in reference to *Caenorhabditis elegans*, *Drosophila melanogaster*, and *Homo sapiens*.

Materials and Methods

(PCR) PCR products of the N-terminal of moesin-1b were generated from *Caenorhabditis elegans* using primers with terminal restriction sites of Hind III and Bam HI. A 1:80 dilution of the full length forward (5' CCGGATCCATGGTTGCGGCCGGCG 3') and the N-terminal reverse (5'

CCAAGCTTAGGCTTGTTGCTTCATTTG 3') primers were used to generate the N-terminal domain PCR product. The products were run on a 1% agarose gel at 120 volts for approximately 45 minutes. PCR products were purified from the gel using Gel and PCR Clean-up Kit (*Promega*).

(Digestion) The N-terminal PCR product and the pQE30-Xa expression vector with a 6-His tag (*Qiagen*) were digested using a 1:20 concentration of each restriction enzyme, Bam HI and Hind III, placed on a dry block at 37°C for approximately 4 hours. A 1% agarose gel was used to visualize the digested products at 100volts for about 45 minutes. Digested products were purified using Gel and PCR Clean-up Kit (*Promega*)

(Ligation) The PCR product was ligated using a 5:1 ratio of PCR product to plasmid. The plasmid revealed previously an upper and a lower band, thus both bands were considered viable products and the PCR product was ligated into each.

(Transformation) The ligated products and one sample of undigested plasmid were transformed into NEB5 α -IQ bacteria for 30 seconds at 42°C, placed on ice for 2 minutes, and allowed to recover in SOC Outgrowth Medium for 45 minutes. The bacteria were then plated on LB agar plates and colonies were picked that showed good growth to produce overnight cultures. Overnights were run at 240 RPM at 36.6°C. The overnights were then pelleted and the DNA purified using SV Minipreps: DNA Purification System (*Promega*).

(Single Digestion) A single digest of purified ligated DNA was done using 1:20 concentration of Hind III restriction enzyme, then placed on a heat block at 37°C. A 0.8% agarose gel was run at 120 volts for approximately 1 hour.

(Transformation) The entirety of the ligated DNA product was transformed into NEB-Iq and NEB 5- α bacteria by heatshock at 37°C for 30 seconds. The NEB-Iq bacteria were used for expression while the NEB-5 α bacteria were used for storage. Overnight cultures of the uninduced bacteria were created

shaking at 36.6 °C. A 10µL sample was placed into 18 mL of new LB ampicillin for a second overnight culture. Some samples remained uninduced while some were induced using 1000x solution of 3 mM IPTG for 3 hours at an OD₆₀₀ of 0.911. Induced and uninduced samples were then pelleted and frozen.

(Nickel beads) Bacteria samples were lysed using the lysis buffer - a wash buffer (0.02M sodium phosphate, 0.5M NaCl, 1mM imidazole at a pH of 8), 1%TX-100, and PI. Pellets were put into solution and lysozyme at 1000µg/mL was added and samples placed on ice for 15 minutes. Samples were then pelleted at 4500RPM for 15 minutes at 4°C. The lysate was then poured over 200µL nickel beads and rotated for 30 minutes, centrifuged, and the supernatant discarded. Three separate times the beads were washed with 1mL wash buffer, vortexed until beads were in suspension, centrifuged for 2 minutes, and the supernatant discarded. The protein was eluted using 100µL of elution buffer (0.02M sodium phosphate, 0.5M NaCl, 0.5M imidazole, pH 8.0), vortexed, centrifuged for 5 minutes, and the supernatant was frozen. 20µL samples from the lysate, post-lysate, washes 1,2,&3, and the elution were added to 5µL of 1X SDS sample buffer to be used in the spot blot test.

(Spot Blot) To visualize the presence of absence of the protein throughout the nickel bead purification, a spot blot test was conducted by first placing 2µL of samples on a nitrocellulose membrane. The membrane was blocked with 10% low-fat milk in TBST. The membrane was washed three separate times at 3 minutes each with TBST and the membrane rinsed with dH₂O after each wash. The membrane was incubated with 1:15000 B64 1° antibody, 1% low-fat milk, and 13.5ml TBST for one hour. The membrane was washed three separate times at 3 minutes each with TBST and the membrane rinsed with dH₂O after each wash. The membrane was incubated with goat anti-rabbit with horse radish peroxidase 2° antibody, 1% low-fat milk, and 13.5 mL TBST for 1 hour. The membrane was washed three separate times at 3 minutes each with TBST and the membrane rinsed with dH₂O after each wash. Finally, three mL of TMB was added.

(Sequence Analysis) FASTA protein sequences were acquired from

<http://www.ncbi.nlm.nih.gov/pubmed/>. The sequences were pasted into the sequencing program ClustalW2 (<http://www.ebi.ac.uk/Tools/msa/clustalw2/>). The parameters were slow pairwise alignment and default multiple sequence alignment. The output rendered percent identity which was the primary data used for analysis.

Results

PCR

PCR was used to amplify the N-ERMAD of *C. elegans* moesin-1b with Bam HI and Hind III cut sites for future cloning. Agarose gel-electrophoresis was used to visualize the PCR products. A 1% agarose gel was used, ran for 120 volts for approximately 45 minutes, and reveals several DNA products. The hopeful N-ERMAD PCR product was expected to be around 900 base pairs and its band was shown to be between the 1000 bp and 800 bp molecular weight marker of Hyperladder I. This suggested successful amplification and production of the N-ERMAD, however, no conclusions could yet be drawn about the correct restriction cut sites being placed on the PCR products (Figure 3.)

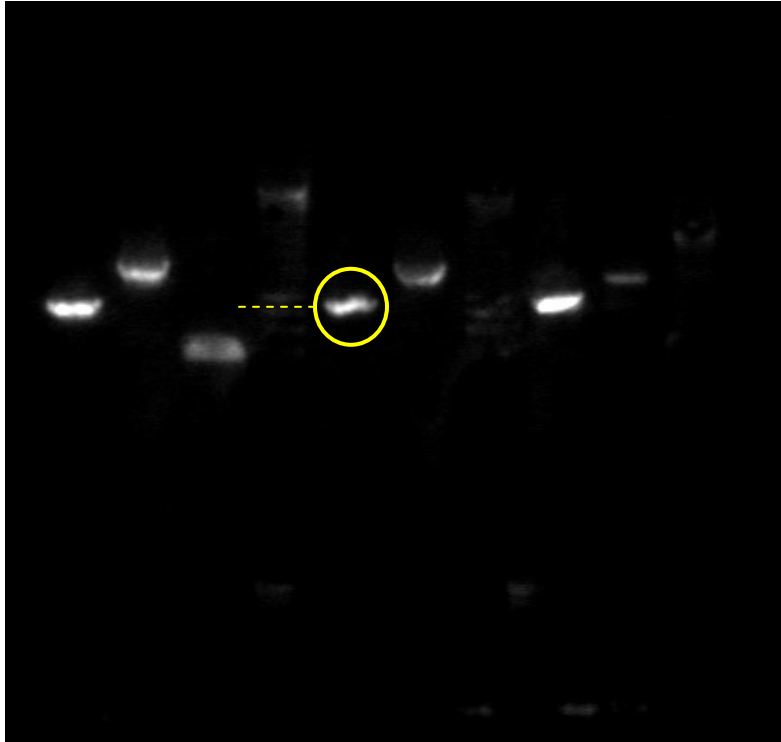


Figure 3. The PCR products were run on a 1% agarose gel at 120 volts for approximately 45 minutes. The band N-ERMAD of moesin-1b (encircled) falls in between the 1000 bp and 800 bp molecular weight marker, as expected because the N-ERMAD is approximately 900 bp. This suggests successful PCR amplification of the N-ERMAD of moesin-1b.

Digestion

To purify the digested product they were run on a 1% agarose gel at 100 volts for about 45 minutes. The expected length of the digested PCR product should be about the same as it was on the PCR gel. The N-ERMAD of the moesin-1b digested product fell between 1000bp and 800 bp of Hyperladder I molecular weight standards, indicating it was about 900 bp, as expected. This also served to visualize the digested pQE-30Xa expression vector. One band was expected; however, two bands were observed for the digested vector. The cause of this is uncertain. The upperband on the gel was thought to have been the digested vector due to its size. It ran around 3500 bp, as expected. Both the upper and lower bands were used and later ligated with the N-ERMAD of the moesin-1b (Figure 4).

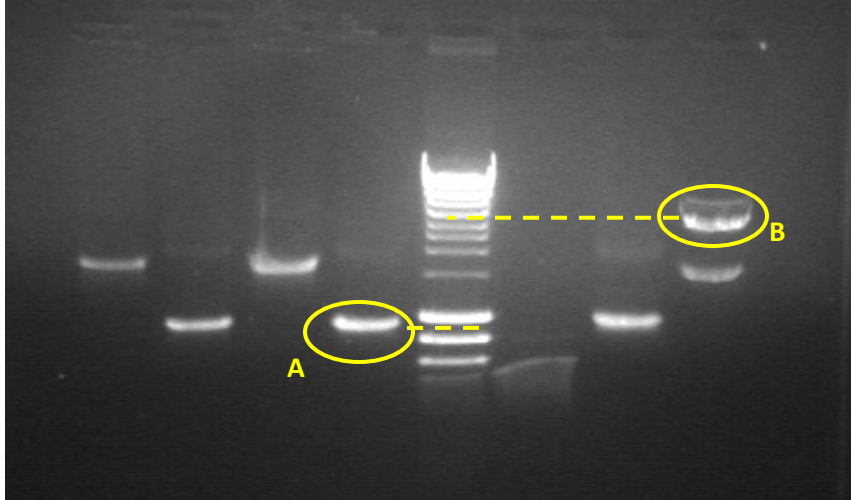


Figure 4. The digested PCR products at cut sites Bam HI and Hind III. A 1% agarose gel was used to visualize the digested products at 100 volts for about 45 minutes. The N-ERMAD of moesin-1b was between the 1000bp and 800 bp indicating it is about 900 bp as expected (**A**). The upper band of the digested pQE-30Xa expression vector at cut sites Bam HI and Hind III was somewhere between 4000bp and 3000bp, whereas it was expected to be about 35000bp (**B**). This suggests successful digestion of both the PCR N-ERMAD product and the expression vector. There was an unexplained lower band in the pQE-30Xa vector lane. Both the upper and lower bands were used for ligation.

Ligation and Transformation

The PCR product was ligated with plasmid pQE-30Xa and transformed into NEB-5 α bacteria. The product plasmid was verified by Hind III digestion. Samples were run on an 0.8% agarose gel at 100 volts for one hour. The ligated product was observed at 4400 bp, as expected, between the 4000 and 5000 bp molecular weight markers of Hyperladder I (Figure 5).

Lysate Post-Lysate Wash I Wash II Wash III Elution

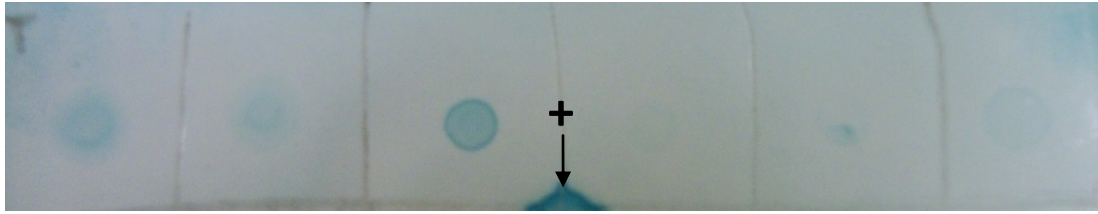


Figure 6. The (+) indicates the positive anti-ezrin control. Spots were observed in the lysate, post-lysate, Wash I, Wash III, and elution. The presence of a spot after the first wash, indicated the removal of the protein from the beads prematurely. Ideally, the majority of the protein would have been removed during elution.

Sequence Analysis

To examine if the sequence supported *C. elegans* merlin's identity, we examined the ERM and merlin conservation. The percent identities gathered from the output file from ClustalW2 were compared across various proteins and three well-studied species, *Homo sapiens*, *Caenorhabditis elegans*, and *Drosophila melanogaster*. The assumption was made that the higher the percent identity, the less time the organisms or the proteins had been separated evolutionarily because less time suggests less time for mutations to occur. Contrastly, the lower the percent identity, the more time the organisms or proteins had been separated evolutionarily because more time separated suggests more mutations.

The comparison of the ERMs and merlin of *Homo sapiens* revealed a high percent identity among ezrin, radixin, and moesin (**Table 1**). This suggests that ezrin, radixin, and moesin were once a single precursor that duplicated two individual times and then evolved. IT is suggested that this duplication of the gene occurred after the split of *D. melanogaster* from *H. sapiens* because there are not three ERM proteins in *D. melanogaster* homologous to the three ERMs in humans. The merlin of humans when compared to the ERM proteins of humans revealed about half of the percent identity that the ERMs proteins did when compared to each other. This indicates that merlin had been separated

from the ERM gene much earlier than the split of the ERM gene to produce three different ERM proteins.

Table 1. Comparison of ERM and merlin in <i>Homo sapiens</i> ERM homologs showed high percent identity indicating their recent separation or duplication from a single ancestor ERM gene. Merlin had about half the percent identity than the ERM homologs and showed consistent percent identity to all three ERMs indicating merlin had spent the same amount of time separated evolutionarily.	
	Percent identity
Ezrin vs. Moesin	73
Ezrin vs. Radixin	76
Moesin vs. Radixin	81
Ezrin vs. Merlin	44
Radixin vs. Merlin	45
Moesin vs. Merlin	45

When comparing the ERM homologs across the three species, that is the ERM of *C. elegans* and *D. melanogaster* and the moesin of *H. sapiens*, the percent identities were very similar. This could suggest that the ERM gene did not split to form merlin until just prior to the speciation event of *C. elegans*. The ERM duplication to form the *C. elegans* ERM could itself have been part of the actual speciation event. The small differences in the percent identities between the three species can reinforce the concept that humans are more evolutionarily separated from *C. elegans* (percent identity 53) than they are from *D. melanogaster* (percent identity 59) (**Table 2**).

Table 2. Comparison of ERM homologs ERM homologs across the three species showed similar percent identities suggesting that the ERM gene split just prior to or perhaps was part of the speciation event of <i>C. elegans</i> .	
	Percent Identity
<i>C. elegans</i> vs. <i>H. sapiens</i>	53
<i>D. melanogaster</i> vs. <i>H. sapiens</i>	59
<i>C. elegans</i> vs. <i>D. melanogaster</i>	60

When comparing the ERM of one species to the merlin of another species it revealed more evidence regarding the evolution of merlin and ERM homologs. The merlin between humans and *C. elegans* showed almost identical percent identity to the merlin and ERM homolog of *C. elegans*. This suggests that they are the same distance apart evolutionarily. More importantly it suggests that the divergence of a single ancestral gene into an ERM and merlin happened just prior or as part of the speciation event of *C. elegans*.

Table 3. Comparison of Merlin and ERM homolog of <i>C. elegans</i> suggests that merlin is the same distance apart from both humans an <i>C. elegans</i> and that the development of merlin happened just prior to the <i>C. elegans</i> speciation event.	
	Percent Identity
Merlin <i>H. sapiens</i> vs. <i>C. elegans</i>	35
<i>C. elegans</i> Merlin vs. ERM homolog	34

The comparison of the merlin protein in humans and *D. melanogaster* has a higher percent identity than the percent identity of merlin and ERM homolog of *D. melanogaster*. This suggests that the split of the merlin and ERM gene from a single ancestral gene occurred much early than the speciation

gene of *D. melanogaster* (Table 4). Figure 7 reveals an overview of the relationship of the various genes across evolutionary time for *C. elegans*, *D. melanogaster*, and *H. sapiens*.

Table 4. The comparison of merlin between *H. sapiens* and *D. melanogaster* reveals a higher percent identity than proteins of *D. melanogaster*. This suggests that the divergence of merlin from the ERM ancestral gene happened earlier than the deviation of *D. melanogaster* from *H. sapiens* as organisms.

	Percent Identity
Merlin <i>H. sapiens</i> vs. <i>D. melanogaster</i>	48
<i>D. melanogaster</i> Merlin vs. ERM homolog	40

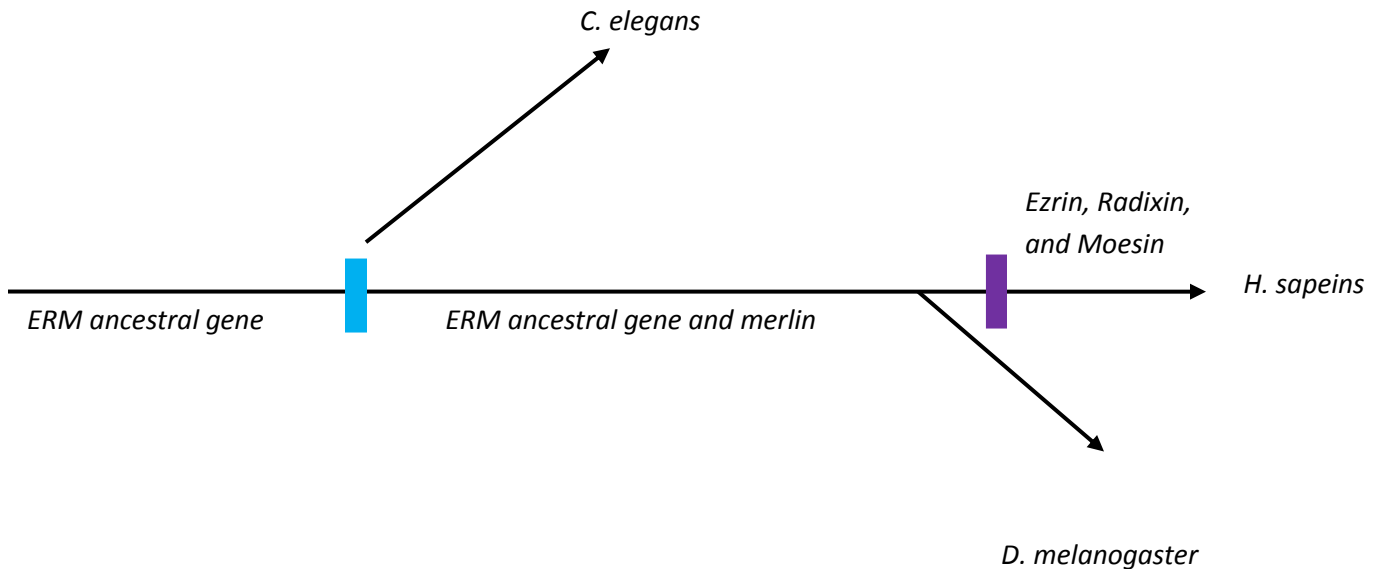


Figure 7. The blue bar represents the deviation of merlin from the ERM ancestral gene just prior to the *C. elegans* speciation event. This deviation could have yeiled the speciation event. The purple bar represents the duplication of the three distinct ERMs, ezrin, radixin, and moesin, found in humans but not in *C. elegans* or in *D. melanogaster*.

Conclusions

Successful recombinant production of the N-terminal of *C. elegans* moesin was achieved. However, it is unclear if the 6-histidine tag was incorporated properly because of the premature disassociation of the protein from the nickel beads. The protein sequence analysis of *C. elegans*, *D. melanogaster* and *H. sapiens* provided a time line of evolution of the ERM and merlin proteins. The divergence of merlin from the ERM ancestral gene happened just prior to or was part of the speciation event of *C. elegans*. The three similar proteins, ezrin, radixin, and moesin had very similar percent identities revealing the most recent deviation from a single ancestral ERM gene.

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“Surface and Symbol”



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McNair Scholar's Program

Under The Guidance of Assistant Professor of Art James Biggs MFA

Introduction

“I have a tale to tell”

Merriam-Webster defines art as, “the conscious use of skill and creative imagination especially in the production of aesthetic objects”.

(“Merriam-Webster”) I have set out on a mission to make work that builds on that definition and on my own vision of what art should be. My work has become a means to confront conflict within my life and has helped resolve many internal conflicts. Art can be powerful if one allows it to be and it becomes most powerful when it is personal. The one concept an artist can come close to fully grasping is the notion of self. With each piece, I leave a visual record of my thought processes and in turn, it helps to release the negative aspects of my life. I cannot and will not separate myself from my work; it is all I have and it is who I am. I want to be copyrighted, branded, and trademarked, i.e., a product. I want to be part of the work and a piece of work in my own right, for that is what art is all about. Ultimately I cannot change the world with my work but I can change how I view it and challenge others to do the same. In a sense, my work serves as a conduit to expel negativity and transform it into something productive. Art allows me to share my experiences with others and hopefully offer some relief in the fact

that we are not wrong, and we are not alone in our struggles.

Keeping in mind my decision to make work that reflects my identity and confront the conflicts of my life, I decided to take my McNair research into personal realms. Through historical observations of religious symbolism and personal introspection, I have gathered an array symbols, some broad in their connotations, and others deeply personal with layers of meanings. I have created a body of work that intends to tell a story, the story about a boy and his struggles to accept the realities of the world. The boy is gay and is not accepted by his religious mother or his bigoted father, and he does not even accept himself. The story is mine and through telling the story, I learned the message of self-



acceptance.

Art often requires one to read between the lines to get at the content encoded in the plaster, brush strokes, or in my

case, glitter. Oscar Wilde once stated, "All art is at once surface and symbol.

Those who go beneath the surface do so at their peril." ("Oscar Wilde") Mr. Wilde speaks of the perils of going beneath the surface to interpret the work; at times, it

will reveal something about the artist but it may also reveal something about the viewer.

Prior to entering the McNair program, I had experimented with symbolism. The first project with an aim to express something deeper was my self-portrait entitled, *“Live to Tell”*. At the point of producing, *“Live to Tell”*, I had unresolved issues with being gay. I told no one in my family that I was gay nor did I reveal the painfully obvious fact to my peers. In my first sculpture class the final project was set to be a self-portrait. The final product could be figurative rather than a literal self-portrait. Already knowing the requirements, I began work on it weeks before being assigned the task. I had a vision of what I wanted in my mind; a buffalo skull encrusted with hand-cut mirror tiles and crushed black glass that would be displayed like a traditional mirrored ball. My intention was to utilize this hyper masculine object, I had acquired from my father, to express the fact that I was not a masculine object but rather an overtly flamboyant display.



I remember my initial trepidation when it came time to present the idea to my professor, James Biggs, or Biggs as I now refer to him. I had previously taken Biggs for several basic design classes and was terrified the entire time. He is a tall man whom wears flannel (sometimes plaid) on a daily basis and totes around a two-liter bottle of Mountain Dew. He appeared, to me, to be one of the most masculine teachers I had come across and from my experiences; his “type” never liked me. I assumed all men like him were not opened minded and the idea of having to talk to him about something so personal as my sexual identity weighed heavily on my mind. Therefore, in the grand tradition of my past I would just skirt around the issue and be as vague as possible. Nearing the final critique, I remember speaking with him in his office about the skull and what it meant. Being a bit frustrated at my sidestepping he told me he was alright with the gay thing and that it should not be an issue for me when talking about it. I remember still feeling very nervous and having the urge to act offended at the idea that I was gay! However, I decided to take (in my mind) a risk and actually admit the obvious and what a relief it was! I could now speak openly about my artistic endeavors without fear of the repercussions.

At the final critique, my hands were worn with blisters and tiny cuts produced from the process of cutting thousands of little mirrors. With a lot of

glue, a smidgen of glitter, and countless hours, I had achieved my goal. The blinds were closed, the lights were out, and the spot was focused; the skull spun at a steady pace emitting thousands of rays across the room. Like that buffalo skull, I was beaming, for those minutes when I was showing off what I had done, I was



free.

“Live to Tell” meant so many things to me. It represented a desire to be accepted for something that did not quite fit but was there nonetheless. Named after a Madonna song of the same title, *“Live to Tell”* was about hiding a secret and how that secret burns one up inside. Madonna laments to the listener, “A man can tell a thousand lies. I’ve learned my lesson well. I hope I live to tell the secret I have learned, till then it will burn inside of me”. While this is a bleak outlook Madonna continues, “I know where beauty lives. I’ve seen it once; I know the warmth she gives. The light that you could never see, it shines inside you can’t take that from me.” (Madonna, “True Blue”) Ultimately *“Live to Tell”* is a torn creature that is not what it should be, but regardless it shines brighter than anything around it and nothing can take that away.



After *“Live to Tell”*, it took me sometime to accomplish anything artistically worthwhile, it made me question the reasons why I was so torn between the worlds of masculinity and flamboyancy. I questioned why I was gay and why the people close to me held that fact to such disdain that it strained our relationships.

I continued with symbolism and adopted the symbol of the red apple, the symbol for sin. I made big apples, little apples, apple cores, and everything in between; when all was said and done, I know I had made well over a thousand apples. I became obsessive, I could not stop making them.

Eventually I was accepted into the Concord University McNair Scholars



Program. Choosing my research topic was quite tasking and many unnecessary topics cropped up. In my mind the project could go two ways; one way involving research into process and the other focusing on content. I came to the conclusion that content was my main intent. Since I was already experimenting with the apple symbolism, I

decided to study Christian iconography and symbolism. After my initial research I began applying the thematics of traditional Christian symbolism to my artistic sensibilities. The research combined with my vast knowledge of gay cultural iconography to create a body of work rich in variety but sustained continuity in its story.



Will You Bite The Hand That Feeds?

"The Hand That Feeds" would become my next major project and successful artistic endeavor. My research was complete and I decided to utilize the right and left hand references in the bible. The right is associated with being righteous in the eyes of the lord and symbolically being on God's right side. In the book of Peter this concept is described as, "Who is gone into heaven, and is on the right hand of God; angels and authorities and powers being made subject unto him". (King James Version, 1 Peter 3:22) This leaves the left side to be that of the sinner that lacks the light of god and is doomed to the fiery depths of hell. I began to create a dichotomy in my work between "light and dark", "war and peace", and "good and evil."



Each part of *"The Hand That Feeds"* contains seven plaster replications of my right and left arms respectively, emerging from a base that emits lights through broken chunks of clear glass. The hands on the left are bearing apples that progressively go from whole to core and on the right the hands are gasping onto grenades, while the

grenades never progress, each arm slowly progresses from pristine to a crumbling jumble.

I wanted the left hand to be a comment on the nature of sin and how we are all born pure but it is human nature to bite away at the apple till all that remains is its empty core. One may wonder why I would place a grenade in the right hand, the right hand of God to be exact. It seems as if the ones who are so quick to throw the righteous stones are hiding behind a thin veil of hypocrisies. It is ironic to me that the religious right emphasize the social mores of the bible but omit aspects that would diminish fanatic devotion to war and capitalism.



“The Hand That Feeds” is

named after a Nine Inch Nails’ song of the same title. The song inquires if the righteous

are all that righteous and if they will do the right thing and “bite the hand that feeds?” Trent Reznor amplifies this discontent in the third verse asking, “What if this whole crusade's a charade and behind it all there's a price to be paid for the blood which we dine, justified in the name of the Holy and the Divine”.(Reznor,

“With Teeth”) Growing up in a conservative West Virginian home, I have often



been conflicted with what I would read from the bible and what I was taught. The lessons taught to me by pastors, youth group leaders, and my parents did not always add up. The Bible would tell the story of Jesus as a selfless

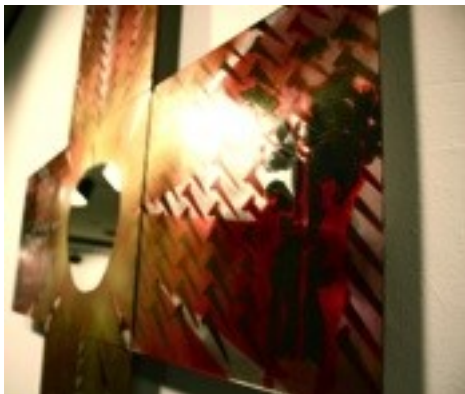
man who was accepting and tried to help others. In contradiction my mentors would judge and condemn me for my orientation. I was gay and scared to death of what these people would think of me, scared of being turned away, scared of having to make it on my own. In *The Hand That Feeds*, I wanted to express hypocrisy between the “sinners” and the “saints”. It has been my experience that no matter the “sin” or the person we are all going to “sin”. and from what I understand that is why god sent Jesus in the first place; to cover that sin. It is not attainable to live a “sinless” life for it is human nature to



fumble; it is how we handle those fumbles and how we treat others who fumble that matters. I think it is better for me to accept my sinful nature instead of casting stones at others to hide my faults. It is hard to condemn when you are welding a grenade.

Nailed

At this point in my artistic process, it became apparent that a dichotomy was starting to emerge in my work. I was presenting two worlds of opposites and it dictated the direction of my other pieces. For every dark element there had to be a light element to create a balance. I began a series of crosses that would be a set of three; one center main cross and two crosses representing the left and the right correspondingly. Each would be composed of 1'X 1' mirror tiles "floating" on a underlying structure. The cross on the left would bear the image of Tammy Faye Baker and is titled, "*Just as I am*". The cross on the right would become a "tribute" to beauty queens titled, "*At Seventeen*". The final and central cross, "*Personal Jesus*", was, as the title suggests, a representation of Christ. These



three pieces would dictate how the rest of my two dimensional works would follow suit, stylistically with the crosses being the focus.

"Just as I am, without one plea, but that thy blood was shed for me..." is how the standard invitational hymnal, "*Just as I am*", begins. (HymnSite) "*Just as I am*" describes the sinner imperfect but deserving of God's love. I utilized this

song as the title of the first cross I tackled in the series. It would serve as the lighter cross in the dichotomy I was creating. Like the others, *“Just as I am”*, consisted of mirror tiles with spray paint forming the imagery; the image of Tammy Faye was placed at the base of the cross and at each extension. The



background space was taken up by an interwoven pattern of lipsticks and mascara wands. At the center, intersection I placed the image of the bitten apple. I wanted this cross to again drive home my message of the imperfect Christian and the idea of a fall from grace. Tammy Faye serves as a symbol of one of a few religious “leaders” that openly accepts homosexuality and represents my

desire to be accepted by the Christian world.

“I learned the truth at seventeen, that love was meant for beauty queens and high school girls with clear skinned smiles”, sings Janis Ian on her 1970s track, *“At Seventeen”*. (Ian, *“Between The Lines”*) Janis sings of the difficulties of growing up an outcast in the un-accepting world of public schools. I took this song as a title for the second mirrored cross I produced for my show. *“At Seventeen”*,

would serve, as a negative symbol and I wanted it to reference the injustices of being denied normalcy from those with the “clear skinned smiles.” It bears the image of trucker flap girls at the base and at the two extensions of the



cross. The background pattern was formed with tiaras and hair spray cans. Like the Tammy Faye cross it has the bitten apple at the intersection. This cross would serve as the darker element in the series. I have been bullied for as long as I can remember and often times it was by the “pretty people”. I wanted to link the



connection of my experience with the likes of Anita Bryant and Carrie Prejean, both actual beauty queens, who were vocal critics of the gay rights movement. I liked the idea of playing with the image of beauty queens but depicting them as no better than a sexist symbol on a tire flap. These two women are the exact opposite of Tammy Faye in the fact that they used their faith as a basis of hate

rather than love. “*At Seventeen*”, represents “an eye roll” to the idea that I ever

wanted to be accepted by “the ones who serve”, it is like Janis Ian sings, “they only get what they deserve”.

“Someone to hear your prayers, someone who cares, your own personal Jesus, someone to hear your prayers, someone who's there” are a few of the sparse lyrics to Depeche Mode’s

80s dance track, “*Personal Jesus*”. (Depeche Mode, “*Personal Jesus*”) The song speaks of the

idea of a Jesus that is not responsible for everyone but, only

the problems of the listener. The song goes on to suggest that, perhaps, your own Jesus can be found. “*Personal Jesus*”, is the title of the central and final piece in my series of crosses. It is a piece of neutrality among a series of extremes.

On the base and two extensions, I decided to use the imagery of Adam and Eve partaking in the forbidden fruit. The background pattern is simplistic, using only the repetitive symbolism of nails. The center intersection of the cross is where things differ from the others; there is only an impression of where the apple, or sin, was on the other two. I wanted this to be a contemporary portrait of the Christian savior. I wanted to illustrate the concept of a Jesus rather than the



individual. I used the Adam and Eve symbolism along with the nails to place emphasis on the idea of redemption. To drive the idea of redemption home I wanted the apple to disappear in a radiating burst of light. "*Personal Jesus*", is my symbol of salvation. I understand now that I cannot expect salvation from anyone but myself. I had to become my own *Personal Jesus*, and accept that the only validation I need is my own.

The series of mirrored crosses offered a variety of content and implications but I think their overall purpose is the same; to illustrate different approaches to faith. Some people are gaudy and overt in their faith and let greed get in way of their original purpose. Others use religion as a means to exclude and validate their fear and hate. Ultimately I must remember that my faith must remain with my own "*Personal Jesus*".



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Mother and Father

One of the greatest struggles in my life has been my battle for acceptance by my parents. I believe that struggle is evident in a good deal of my work. I've spent a great portion of my life worried. That worry

carried through the period of time I was producing work for my McNair research. The dichotomy emerged because of this struggle between the light of acceptance and the darkness surrounding a world of un-acceptance. Both of my parent's social views are conservative in nature. I incorporated symbols from them to illustrate this struggle in my life.

My Mother is a highly religious woman who is devout in her faith. I have always clung to my mother's side and I have wanted nothing more than her approval and love. For the most part, I have felt loved but it felt as if I was deceiving her. For a majority of my life I thought that if I ever let my mother know I was gay I would not exist to her anymore. To depict this in my work I decided to use symbols from my Mother's faith. I painted evangelical and televangelist icons that propagate the same bigoted beliefs on homosexuality as my Mother's. These symbols were separated and utilized with the other dark symbols and added to the growing dichotomy of my work. The symbols attained from my mother are not all negative because we also had many good times. The good times are reflected in my other works of a more escapist nature.

My Father is a disabled coal miner with many opposing convictions; he is not religious in any form yet he is radically conservative. I doubt that I will ever

fully understand where his views of the world were formed. His views seem at odds with what I know of his life. He subscribes to the ideologies of Adolph Hitler, the full set of ideologies, everything from the Arian Race being superior to those, “greedy Jews controlling the media and money”. My sexuality would turn my relationship with my father into a mostly uncomfortable one. His views of

homosexuality are consentient with his other bigotry-laden views. From an early age I thought I was a degenerate who had no place in the world. I have never said



anything regarding my sexual preference to my father and I do not suppose that I ever will. I think the strain my father put on my life became a pressure point that has manifested in my work. He has inspired many of my pieces and I can see his influence in everything I do.

The buffalo skull originated with him

and I have utilized symbols that represent him. Some

are negative such as the mining pick and shovel, the spinal cord x-ray, and the grenades. However, not all are negative, I utilized the handicap



symbol along with my other positive imagery. Even though I don't agree with his views I do admire his strength. No matter how unfortunate his being in a wheelchair is, I feel a resolve with the situation. I believe my relationship with him taught me the valuable lesson of strength against all odds.

No matter my Mother and Father's views of the world, I still like to think of their positive attributes. Deep down I think they know they are wrong but they



are too stubborn to admit it. Conversely, that same stubborn nature has made them strong enough to get through the pitfalls of their life. They have had no advantages in their lives and everything that could go wrong has. They have not let their afflictions take them down; they continue to press

on with the best of their abilities. I am a person who idolizes many frivolous entities but they are two of the few tangible people that I look up to and I can only hope to have one ounce of their perseverance. I love my Mother and Father and I am thankful to still have them, for without their influence, I would not be who I am today.



There's No People Like show people

I noticed that my work was slowly being dragged into a void of darkness. I did not want to portray a world of nothing but despair, so I intergraded some non-Christian pop cultural symbolism. Pop culture has played such a large and constant role in my life that my devotion has slowly become akin to religious fanaticism. Movies and music became a way for me to escape the self-doubt and loathing created by the constant bullying of my everyday world. I grew up in a decade that lacked great escapist entertainment. I am the youngest child of older parents and I have always had a great interest in the eras of entertainment that came before me. When the need for escape came, I turned to the decades of the past to create my "Hollywood perfect" world.

My work has been influenced by this overtly stylistic world and that has added a sense of drama. When watching old films or listening to music, I am transported to a world of opulence. That opulence is a quality I wanted to integrate into my work. The golden age of Hollywood is defined by its overtly saturated colors and personalities. In utilizing Hollywood figures, I wanted to strike a balance between the more cumbersome religious symbols to give my work that spark of hope. Many "stars" fascinate me but there have always been

constant themes of female strength in those I devote my admiration to. I have used many obscure references to “stars” in my work but the direct use of their imagery was reserved for the three that I admired the most; Judy Garland, Joan Crawford, and Madonna.

“The Wizard of Oz” is an undeniable American film classic that is engrained in the public’s mind. Judy Garland was introduced to world as Dorothy in the film and it was her most iconic role. I choose Judy because I felt she was the first and best known gay icon to emerge from the entertainment industry. Her characters serve as a beacon of hope and joy to many. As many have, I watched *“The Wizard of Oz”* over and over and those 103 minutes of technicolor magic provided such a wonderful escape. Painting Judy Garland in a glowing aura similar to the rays traditionally surrounding religious iconography, contextualizes her as the definitive icon.

I have used other symbolism related to “The Wizard of Oz” in my sculptural endeavors. *“The Fembots of Dorothy”* were 12 pairs of shoes that I borrowed from inspirational women who have affected my life. I used crushed glass on each pair and chose colors to best fit each woman. As a person who hid so much of myself from my family I have relied on my friends to help me through. The nature

of my relationships with these women cannot be categorized as normal friendships. They have to developed into a surrogate family who accepts me. I have always been drawn to strong women and I wanted to devote these pieces to each of them for they are my “Dorothys” leading me down that winding yellow brick road.

Joan Crawford is the epitome of a strong woman and the title “Power Bitch”, comes to mind. Feeling drawn to her image from an early age, I decided to use just her strong recognizable features in my portrait of her. I also have an oddly fanatical connection to the biopic “*Mommie Dearest*” that follows her relationship with her daughter. I relate to the strained relationship between Joan and her daughter Christina. It is an odd adoration that gay men have for this movie, I look up to Joan Crawford at some points and conversely think she was horrible. It is almost like I simultaneously see myself in Joan and in Christina. I felt like Christina at times in my life when I was constantly looking for my mother’s approval and desperately trying to not upset her with my flaws. However, Joan was who I really wanted to be; a powerful person who could do what ever she wanted and defy anyone in her way. Joan Crawford is a symbol of perseverance, she was a woman who grew up in devastating poverty and against all odds, became one of Hollywood’s reigning queens. She serves as a reminder that with

hard work and determination one can ascend above their current circumstances to heights undreamed of.



Madonna Louise Veronica Ciccone, also known as Madonna, is undeniably one of the most successful recording artists of all time. Madonna, for many years, has served as one of my many fanatical obsessions. I have written previously about my obsession

with pop culture being akin to religious fanaticism. Madonna ranks as the holy grail of my adoration within that line of thought. You name it, this lady has done it, while simultaneously breaking the records and pushing the boundaries, no other mainstream artist could get away with. She once said, "I know I'm not the greatest singer or dancer, but that doesn't interest me, I'm interested in being provocative and pushing people's buttons."(Truth or Dare) I love her



because she is unafraid of what people may think of her and I think that's a trait everyone could use a little more of. I can see the "Madonna connection" through



out my work. It can be seen in the dramatic lighting, colors, music, and overall disco style I have crafted with every piece.

Ultimately by adding the escapist iconography to my work, I think I gave it a sense of purpose. If the dark pieces are the

starting point, the lighter more glorified work of disco flare is the light that can ease the pain and guide one out of the darkness. Escaping my world is not always an option but it is most defiantly a necessity and therefore it is necessary in my work. While one must not forget reality, society would never go anywhere if there were no dreamers who wanted to improve their world. As these strong personas have inspired me to dream, I want to do my part in encouraging others to do the same.

“The Beast Within”

Film, as I have mentioned before, has played a large role in my life. Along with film, music videos have served as an escape. Back when MTV played music videos, I would spend countless hours watching videos from the 80s and early 90s. Madonna, The Eurythmics, and the Pet Shop Boys were among my favorite

artists who dominated the artistic side of the medium. Creating a video meant I could relate a message and bring all my ideas in a short six minute format. Having no experience in film I decided to create the video from photography in a stop-motion fashion. I used a variety of effects and sound effects to alter songs that went along with my artistic message. The Video was created to be projected onto a television that I had mirrored the screen surface similarly to the surface of Buffalo skulls.

I started the film out with a heartbeat that slowly merges into the Pet Shop Boys' song, "*It's a sin*". I intertwined portions of the Madonna's song "*Live to Tell*". The music is set to rapid fire images of apples going from whole to core, me tossing about in an uneasy sleep, and me praying frantically at my bedside. As the pace of the music increases, so does the imagery and at it's most frantic height it changes to images of me at my bedside with a gun going



back and forth between praying and placing it at my head. The song eventually peaks and it is ambiguous as to what happens in the gun scene as it fades into images of me in a child like position watching television. During the final scene,

the music is a score from Kylie Minogue's "*White Diamond*" tour where Miss Minogue reads lines from classic films. The imagery goes from black and white to a "*Wizard of Oz*" style of Technicolor that eventually fades out to a white glow of



light.

"The Beast Within" is the accumulation of the themes of my other works. It illustrates the need for escape and the emotional damage of intolerance. I remember feeling

worthless everyday of my life and constantly praying to God to fix me, to take away my sin, and to take away my pain. I felt hopeless and the only relief I had found was in the fantasy world of Hollywood. I projected these images on to that mirrored surface to dissipate my message out, to expel the negative but scatter the positive through the disco mirror beams. I obviously never committed suicide but the thought often emerged in my head. I am



thankful I had an escape and I hope the viewer took that message away from this

piece. My world may have been miserable in those moments and it may turn that



way again but I must have hope that through hard work I can rise above and truly escape to a better world.

Missionary Man

“I was born an original sinner, I was borne

from original sin and if I had a dollar bill for all the things I've done there'd be a mountain of money piled up to my chin,” are the words echoed by Annie Lennox in the 1986 Eurythmics' hit “*Missionary Man*”. (Eurythmics, “Missionary Man”)

The lyrics of this song fit the intentions for my show so I entitled it, “*Missionary Man*”. The show became a manifestation of years of dreams. Everyday I would walk by the gates of the gallery and visions would come to my mind of what I could do in that space. I placed getting a solo show as my top priority my first semester and I sought that goal with such a fury it was all I could think of. It was a long hard road with many stumbles along the way but at the end



of the day, I attained that goal and it supplied the validation I had been seeking.

Through the process of doing my research for McNair I realized I wanted to submerge the viewer in my world; I wanted the viewer to walk through my distraught mind. The only way to do this was to create an installation where I would present the viewer with two-dimensional and three-dimensional elements that surrounded them with light, motion, video, and sound. Mirror is used in almost every piece I created and I choose this as my primary canvas so the viewer would have to look at themselves through my work. Forcing the viewer to face their own image through a variety of subject matter, no two people could ever see it quite the same. I set up the work with a religious theme in mind; everything



was arranged in a way to give an almost alter like feel to the display.

Symmetry was utilized in every aspect.

Each large wall would consist of one of the mirror crosses displayed in the center with

every other element radiating out from that focal point. The main wall was the central focus with the "*Personal Jesus*" mirrored cross in the very center. The two parts of "*The Hand That Feeds*" were placed to the left and right sides of the

cross. The other two larger walls consisted of mirror tile symbols and crosses

alone. The right wall

contained *“At Seventeen”*

and the accompanying

negative mirror tile pieces.

Conversely, the left wall was

composed with *“Just as I am”* and the corresponding positive mirror tile pieces.

On the smaller walls, I set up two varying installations of my personal belongings



and collections that reflected the vast amount of

material my inspiration was fed by. I displayed

the *“Fembots of Dorothy”* on the remaining two

walls. I hung my three mirrored skulls from the

ceiling closer to the lower part of the gallery but



separating each into the realms of the larger main walls. Finally, the mirrored

television was placed on the lower level close to

the main focal wall.

Lighting played a large roll in my show for

almost every piece reflected light. The buffalo

skulls were lit individually and were installed to spin by a motor. Along with the



mirrored television set, they provided a motion of lights that radiated through out the space. The mirror crosses and corresponding mirror tiles were lit from varying sources resulting in the imagery of each reflecting in varying patterns on the surrounds surfaces. This was intended to drive home the atmospheric feel of stain glass windows and create a church like feel for the show.

I created a play list of music that would reflect the dichotomy of the show. Some songs were celebratory in nature while others held darker religious meanings. I arched the opening of my show to begin with a darker mood musically while slowly sprinkling in songs of hope and inspiration. Three times during the night the title song, "*Missionary Man*", would play, signaling the start of my video and with each viewing the music would get lighter and lighter until an atmosphere of hope and celebration was achieved.

When all the varying aspects of my work came together in one unified space, it functioned as I intended. Calling it a “show” seems a bit



inaccurate at this point; it was an experience.

Taking the viewer from the darkest recesses of

my world to the

light hearted

fantasies of my

escape; I took the

viewer on the

emotionally frantic journey of my life up until that point.



The Mission Continues

I started my journey into the world of

Christian symbolism with the seemingly simple

symbol of the apple; perhaps it is best to end there.

The apple, as discussed previously, is typically

utilized as a symbol for sin in Christian art and that

is how I handled the subject matter. When I first started making apples, I thought I was wrong; that I was sinning because I was gay, but I now feel that was a disservice to me and to my viewer. My thoughts on the symbolism of the apple have evolved; it is no longer a symbol of sin but rather a symbol of continued knowledge.

Bette Davis once said, "I am doomed to an eternity of compulsive work. No set goal achieved satisfies. Success only breeds a new goal. The golden apple devoured has seeds. It is endless." (Bette Davis) Through the artistic process, I have evolved my way of thinking and have resolved my views of sin. I did partake in the "apple" but, as it turned out, the "apple" was not sin; it was knowledge. The knowledge that no one can fully express nor explain but that grows inside. I have succeeded in my mission but as Miss Davis said, I have devoured the seeds and they will forever grow. The mission continues to grow as I gain knowledge and it is constantly changing to fulfill my goals. My art serves as a record of this evolution of knowledge and change; it will continue to grow until my end. The mission, as with the show must go on, sometimes it will be successful, maybe other times it will fail, but it will go on...

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RETENTION RATES AT HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

Terasina Neely

McNair Mentor: Professor Dave Brock

Major: Communications

Abstract

My project examines Retention rate issues that are faced by Historically Black Colleges and Universities (HBCU). The documentary for my project will show the difference in the way students, faculty, and administrators view the issues that HBCUs are challenged with daily. West Virginia State University is the HBCU that will be used to examine these issues. Faculty, staff, and students will be interviewed in brief segments and will provide answers to the same series of questions that are posed to each, and the local and national impact of retention rates for HBCUs and students will be revealed.

Retention Rates at Historically Black Colleges and Universities

My mother is sick and there is no one else to care for her. The full time job I have had for six years changed my schedule so I can't go to class. I am the sole bread winner for my family. I can come back to school when the economy gets better. These are just a few of the reasons that students use to leave school.

Retention Rates are defined as first time full time freshman who attend and remain in the university in which they enroll.

West Virginia State University is the institution that I used to evaluate retention rates specific to the institution, and to apply my research regarding retention rates for Historically Black Colleges and Universities (HBCUs). West Virginia State University is one of two HBCUs that are located in West Virginia, neither of which ranks nationally. One of the many reasons for this is due to the retention rates for both institutions.

I interviewed students as well as faculty and staff from WVSU regarding factors that affect retention rates. The questions were as follows:

1. *Define retention rates.*
2. *What is the current retention rate for WVSU?*
3. *What factors – both academic and non-academic - contribute to this rate, both at the local and state level?*
4. *What are the retention initiatives and programs currently in place for students at WVSU?*
5. *Have these initiatives been successful? Why or why not?*

In addition to these questions I asked one additional question to a staff member who I interviewed from the University's Collegiate Support and Counseling Center:

How many teachers turn in forms that are handed out from your department regarding struggling students?

The faculty I interviewed were from various departments on my campus. The faculty members are Mr. Coston Davis, Ms. Sheilah Payne, S. Bryce Casto, Dr. Barbara Ladner, Dr. John Teeuwissen, Mrs. Sally Burger, Mr. Joseph Oden Jr., Mr. Chris Jackson, Mrs. Kelly Toledo, and Danny Cantrell.

Mr. Coston Davis, Director of Leadership Mentoring and Judicial Affairs, believes that the University is responsible for whether or not a student chooses to stay at the institution. He believes that a student should consider the area in which they plan to go to college for more than college. Job marketing needs to be considered. Davis also believes that if more companies came out to West Virginia the institution would have a better qualified students due to the fact that most students look at the area they go to school for the job market. He believes that the new Director of Recruiting in the office of Admissions plays a key role in improving the overall quality of the institution's quality regarding students.

Mr. Joseph Oden Jr., Assistant Vice President for the Office of Student Affairs, believes that there are many factors that play a key role in retention. The main issues are support academically and external reasons that the students carry with them daily. He feels that institutions are not prepared for the things that students need addressed. He states that there are different venues on campus that can help students to deal with issues that includes Student Support Services, Student Affairs, and tutoring throughout campus. He thinks that the institution's programs are successful for those who use them, but students that need help are not being reached.

Dr. Barbara Ladner, Dean of the Department of Communications & Media Studies, shared that she believes that economic situations, unprepared students, frustration with requirements, and not being focused are key factors in why West Virginia State University's retention rates are low. She took part in a Retention Initiative on campus with an English class. The class was for students that were not prepared for a 100 level class. The students were given the same material as students who were prepared for the class but were required to get help in the writing lab once a week. All the students that did what they were required to do passed. She feels that the reason the program was so successful was because all students got their needs met through one on one attention from the tutors along with their class lessons.

Mr. S. Bryce Casto, Vice President of the Office of Student Affairs, believes that retention is a measure of persistence. The factors that play a key role in retention are money, family, life, and academics; he believes that students need somewhere to go to get answers to their questions without being judged. The initiative that he feels is most important to improving retention is the Freshman Experience class. This class is an extension of orientation and gives students more information on where to go for help and how to get involved on campus. He stated that West Virginia State University's retention is on the rise because once they split from Kanawha Valley Community and Technical College they closed Admissions.

Ms. Sheliah Payne, Administrative Secretary Senior for the Office of Student Affairs, believes that the factors that are important regarding our retention rate are non-traditionally students not being able to take courses they need in a timely manner, ill prepared students, and the University not offering courses for development. West Virginia State University does however offer testing. She believes that the students who need help just need to come forward and let someone know that they are struggling. Payne states that WVSU has help in place for

students. Freshman Experience class, tutoring, on-line tutoring and developmental counseling are set up strategically all over campus to ensure they get what they need. Also, when a student received a D or F the counseling center sends them a letter informing them of where they can go to get help with the course they are struggling with. Payne believes the retention rate has been reduced because of these programs.

Dr. John Teeuwissen, Assistant Vice President for the office of Academic Affairs, believes the factor that are involves with WVSU's retention rate are students who are not prepared, limited finances, student being first generation, and students having jobs or responsibilities. Students think that they are the only person going through whatever they are going through and feel that they cannot make it. The thing is that it's usually typical. Teeuwissen also mentions that the campus has its own Ameri-Corp program through the Collegiate and Counseling Program. They send a report to teachers to find out what students are struggling and follow up with them.

Mrs. Sally Burger, Interim Director for Student Financial Assistance, believes that money is the biggest issue that students face. Tuition has gone up and financial aid stays the same. The campus for the first time has opened up an opportunity scholarship to help with this student need, but due to funding there are not many scholarships available. Students that are having difficulty should take advantage of the things that they can control such as the hours have per semester. Twelve hours per semester cost the same as twenty-one hours semester yet students take the bare minimum and that keeps them in school longer. Burger feels that the programs throughout campus are working but students need to speak up and let the faculty and staff help to help them by expressing their need and using the programs.

Mr. Chris Jackson, Interim Director of Admissions, believes that there are a million factors that play into the retention rate at WVSU, but assess ability, non-traditional needs, academic structure, faculty, and offering on-line courses are the biggest issues. He believes that once WVSU provides on-line degrees that things will dramatically change. There are many things that the university can do to improve retention starting with counseling services.

Mrs. Kelly Toledo, Director of Collegiate Support and Counseling, believes being prepared for English and math is the most important factor when it comes to retention. It is not about being able to pass but being able to comprehend the work. Poor planning also plays a part. Students have jobs and classes and typically do not plan well for either. The counseling center has started an Early Commitment Initiative where they call freshman students to see whether or not they have books or need help with classes during the semester. They have a faculty referral program for faculty to have Collegiate Support help them with personal issues and with tutoring. Academic coaching is another program set up for students that are going through the appeal process for Financial Aid. Collegiate support sits down with students and help them determine what their issues are and help set up a plan to work on them. Toledo believes that the students who get help will improve the retention rate at West Virginia State University.

Mr. Danny Cantrell, Director of Enrollment and Retention, believes that money management, finances, and jobs are the issue with retention. Students who need to work generally place more focus on working and not enough on their work. Through the studies he has done he found that if WVSU had a slightly better student the overall retention rate would be much better.

The students that I interviewed were both in-state and out-of-state students with various majors and classifications. The students who I interviewed were Kinyatta Buford, Ko Ko

Johnson, William Palmer, Tawonna Flowers, Jeremy Fisher, Shannetta King, Casey Guet, Vanessa Bumpus, Tim Steele, Steve Kimba, Chris Jones, Jessica Huffaman, Sandra Coleman, Keith Creighton, and Janai Willis.

Keith Creighton, Freshman, Vanessa Bumpus, Freshman, Chris Jones, Freshman, Sandra Coleman, Senior, Tim Steele, Senior, Jeremy Fisher, Junior, Ko Ko Johnson, Freshman, were interviewed but had absolutely no idea what a retention rate was, but were all interested to find out what they were. Once they found out they were excited to learn more about the subject.

Kinyatta Buford, Senior in in the field of Education, believes that finances are the biggest factor that West Virginia State University. Either you can afford to go to college or not. She thinks that demographics, being a first generation college student and social economic status play a big part too. When asked about the campus initiatives she said that the Ameri-Corp D F List initiative seems to be very effective but not many people talk about it.

William Palmer, Junior in the field of Business Management, believes that professors, the local communities, business, and the activities available to students play a huge role in retention. He believes that programs need to be evaluated to provide better services and tutoring for students. He is not aware of any initiatives available on campus regarding retention.

Tawonna Flowers, Junior in the field of Communications & Media Studies, believes that professors caring, and students not being knowledgeable about financial aid are reasons that retention is low at West Virginia State University. She was not aware of any programs that the University was doing to improve the retention rate.

Shannetta King, Junior in the field of Communications & Media Studies, feels that funding, students not understanding their work, home training, and party life are major issues regarding retention. Student Support Services, Ferrell House, attending professors' office hours

and tutoring throughout campus are the initiatives that she is aware of on campus. She feels that many of the faculty and staff that are active within the programs have their favorite students that they consistently help. If you are not one of those students then you are not focused on.

Casey Guet, Junior in the field of English, believes that funding, bad experiences, and lack of preparation are reasons that WVSU's rate is high. Students Support Services, Student Government, Student Activities and Student Affairs do their part to lower the retention rate at WVSU daily by making students feel at home. If all students have a place to vent and get help they will do their best to stay at school.

Jessica Huffaman, sophomore in the field of English, feels that single parents are the issue when it comes to retention. She feels that they do not know how to balance work, school, and children. She believes that the campus daycare center is something the university has done to help with retention, but it is not helpful because no one knows about it.

Janai Willis, Senior in the field of Health Science, funding, competing colleges' scholarship, non-traditional, transfer students, and customer service from faculty and staff have an effect on WVSU's retention. Ameri-Corps Early Commitment Initiative is a program that helps freshman have a smooth transition from high school to college, and Faculty Referral is a program that helps teacher contact students that barely come to class and have low grades. Collegiate Support also takes Ameri-Corp members to high schools to recruit and speak to students. She can see the change in the campus and is excited for the university.

Students and faculty have some understanding of the things that West Virginia State University is doing to improve their retention. Retention is everyone's problem and only will be fixed when everyone is on the same page. The campus needs to take a look at what they have

started after four years and make the necessary changes to the programs that they have to improve the entire campus.

Comparison of static stretching and self-massage with a roller modality while static stretching
to increase range of motion of the hamstring

Katrina Ostermann, Biology major

Mentor: Dr. Dave Chambers

Abstract

Static stretching is commonly used in many athletic and rehabilitation settings to increase hamstring range of motion (ROM). Massage is increasingly being used for this same purpose though research for its effectiveness is limited. This study compared the effectiveness of the standing static hamstring stretch to static hamstring stretch self-massage using a roller modality over a seven week period. Eighteen participants age 19-22 were recruited and evenly divided into the two groups. During the first four weeks participants stretched and performed the massage for 4 thirty second increments per leg five days a week. Participants were then measured once a week using the knee extension test. To measure ROM, participants performed their exercises and were immediately measured, then measured again ten minutes later. During the last 3 weeks of the study stretching and massage was no longer performed but ROM was still measured once a week. ANOVA testing was then used to determine any significant variance in ROM during the study. None of the participants in the massage group experienced statistically significant increases in ROM. Significant variance was found for both the left and right legs of stretching group when ROM was measured immediately. Significant variance in hamstring ROM was also found for the left leg of the stretching group when ROM was measured 10 post stretching, though not in the right leg.

Introduction

Flexibility is important not only to the performance of athletes but also in maintaining good general health.¹ The hamstrings in particular have a tendency to be tight which can lead to injuries of the legs and back.² Whether a person is trying to increase hamstring range of motion (ROM) to get back to the game or work, finding an effective means of increasing hamstring length can play a valuable role in their recovery. The most effective means to gain flexibility are strongly debated.³ Previous research has determined that both static stretching and dynamic massage increase range of motion, however, a side by side comparison has not been done to determine which is most effective.^{2,4,5}

Many people receive massage because it is thought to have both physiological and psychological effects.^{6,7} While massage is commonly used in the sports and rehabilitation settings, limited research has been carried out to study its effects, especially in regard to its effects on flexibility.⁸ Various forms of massage exist including Swedish, underwater, connective tissue, shiatsu, and acupuncture.⁶ Swedish massage, most often cited in scientific literature, has several basic techniques. Each session is typically started and finished with a deep stroking motion in the direction of blood flow. Kneading and friction follow to work muscles and deeper tissues.⁶ Shaking of the extremity can also be used to loosen the muscles.⁴

Dynamic massage, has been found to be particularly effective in increasing hamstring ROM. Dynamic massage combines different forms of massage and stretching. Initially, Swedish massage techniques are used to identify a tight area of the muscle while the patient lays prone. The patient then switches to a supine position and deeper strokes are performed while static, concentric, and eccentric stretches are done.⁴ The session then finishes with more Swedish strokes while the patient lays prone.

Despite its effectiveness dynamic massage is seldom used because it requires a trained therapist. An alternative roller massage modality will allow a person to massage their own hamstring while maintaining a stretch and thereby possibly mimicking some aspects of dynamic massage

Static stretching involves moving the body into a position that gently pulls on the muscles and maintaining that position until the muscles relax.^{9,10} Static stretching can be done without assistance and is one of the safest ways to increase ROM. However, several articles state that the increased ROM diminished after six minutes and does not increase the muscle length.^{2,11,12} This temporary increase in flexibility simply increases the participants pain tolerance for a specific position.^{11,12} These studies were only 4-6 weeks in length and may not have allowed enough time for the muscles to lengthen.^{12,13} It was indicated that people involved in activities such as ballet or gymnastics had greater hamstring flexibility even though most of their stretching is static.^{2,5}

Methods

Subjects

The study was conducted at Concord University and cleared by the campus Human Subject Review Board. Students between the ages of 18 and 25 were recruited and informed about the specifics of the project and their right to withdraw at any point. Any students who had hamstring or back injuries were ineligible to participate. The subjects' hamstring ROM was then measured and only participants lacking at least 30° of hamstring ROM were allowed to participate. This lack of flexibility allowed progress to be more accurately measured as ROM increases would be limited in subjects who already experience close to full ROM.

Data Collection

Hamstring ROM measurements were found using the knee extension test and a goniometer. Participants were randomly divided into a static stretching or self-dynamic massage group and instructed on the procedure for properly performing their routine. Instructions were read and the stretching demonstrated. Participants were monitored as they went through the routine for the first time.

The static stretching group was instructed to perform the standing static hamstring stretch. To do this they stood facing a table and one leg was placed with the back of the heel resting on the table, as shown in Figure 1. The participant then leaned forward slightly toward their toes without allowing their pelvis to rotate. This position was held for 30 seconds with a 15 second rest in between repetitions. The stretch was performed 4 times per leg, alternating legs for each repetition.



Figure 1. In the standing static hamstring stretch the subject places one leg on a table and while keeping their hips parallel to the table leans forward slightly until a tightness is felt in the hamstring of their raised leg.

The dynamic massage group performed the standing static hamstring stretch while using the roller stick to self-massage the hamstrings as demonstrated in Figure 2. Once subjects were in the stretching position they began using the roller to apply gentle pressure over the entire hamstring. Participants maintained this level of pressure for 30 seconds. If any tight spots were felt the subjects focused the massaging in those regions. The leg was then lowered for 15 seconds and the procedure was repeated on the opposite leg. The stretch and massage was performed a total of 4 times per leg.



Figure 2. Participants of the self-massage group will use a roller modality to massage the hamstring while in the standing static hamstring stretch.

Subjects were informed that at no point should they experience any pain. If pain or extreme discomfort are experienced the subject was instructed to reduce the pressure of the massage. Subjects in both groups were instructed if they experienced pain, they should immediately cease stretching.

To measure ROM the participant lay supine while their hip was moved into a 90° angle with their body. While this angle was maintained the knee was extended by the participant. The angle was then measured using a goniometer. An initial ROM was taken for each leg and then participants began the stretching or massage routine. During the first 4 weeks of the study Hamstring ROM was measured weekly immediately after treatment and then again ten minutes post treatment. The last three weeks of the study participants were instructed to stop stretching and ROM readings were taken once a week to determine if ROM was sustained after stretching or stretching and massage ceased.

Data was analyzed using an ANOVA test to determine if variance existed across the length of the study.

Results

The mean values for the initial ROM readings, the measurement at the fourth week, and the final ROM measurements are displayed below in Table 1 and again in Figure 3.

Table 1. Mean Values for Hamstring ROM

Group	Initial (Degrees)		4 th Week (Degrees)		Final (Degrees)	
	Left	Right	Left	Right	Left	Right
Stretching-Immediate measurement	47.88	42.54	30.33	33.46	38.59	38.13
Stretching- 10 minutes post	47.88	42.54	35.96	34.93	49.0	38.93
Massage- Immediate Measurement	47.23	43.92	34.26	35.3	36.2	36.84
Massage- 10 minutes post	47.23	43.92	35.22	36.64	36.2	36.84

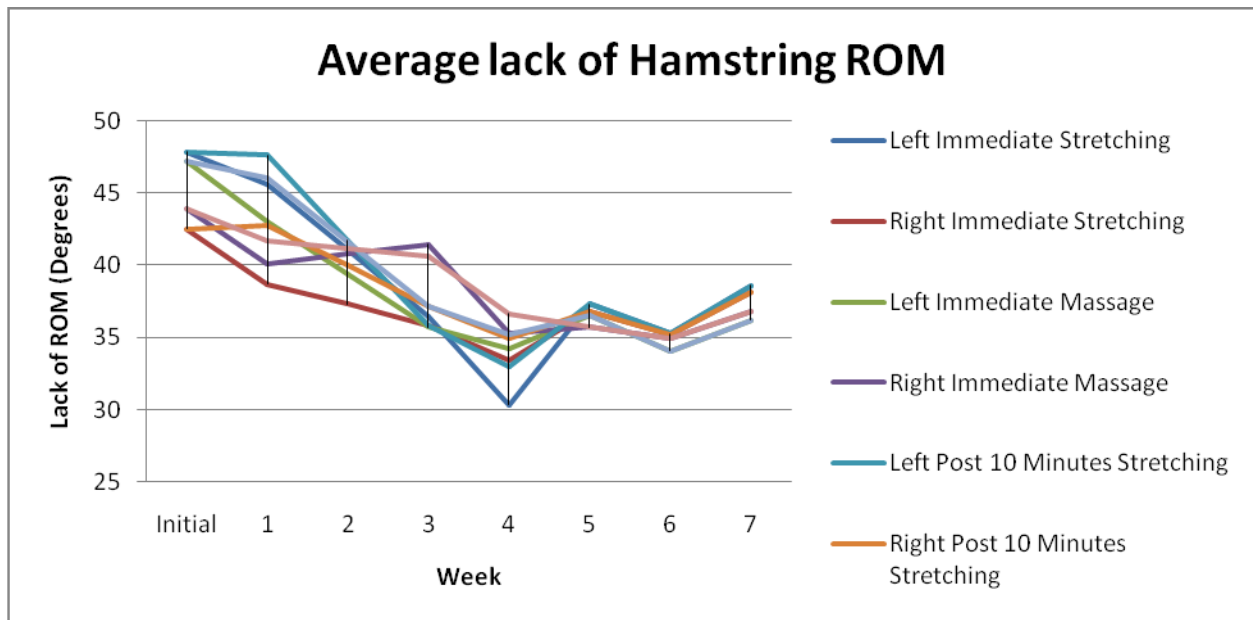


Figure 3. The average lack of hamstring ROM across the length of the study. Flexibility was determined by a lack of ROM so increases in flexibility correlate with a lower y value.

The ROM increases that were found to be statistically significant using ANOVA testing were the left and right legs of stretching group when ROM was measured immediately following stretching.

When ROM was measured ten minutes post stretching only the left leg of the stretching group was found to have improved a statistically significant amount. ANOVA testing found that the massage group did not experience significant variance when ROM was measured immediately after stretching or ten minutes after. The critical values and F values from the initial measurement to the fourth week for each group and measurement from are displayed in Table 2.

Table 2. Variance for Hamstring ROM from Initial Measurement to Fourth Week

Group	F Value Left Leg	Critical Value Left Leg	F Value Right Leg	Critical Value Right Leg
Stretching-Immediate measurement	8.04	2.61	3.62	2.61
Stretching- 10 minutes post	6.19	2.61	1.85	2.61
Massage- Immediate Measurement	2.37	2.61	1.02	2.61
Massage- 10 minutes post	2.38	2.61	0.65	2.61

Hamstring ROM increased in the left leg of the stretching group for both the immediate measurement and the measurement 10 minutes after stretching had ceased. ROM was also found to increase in the right leg of the stretching group, but only for the immediate measurement. ROM was not found to increase a statistically significant amount for the massage group.

Variance for the final three weeks of the study during which stretching and massage were not performed is shown in Table 3. None of the group showed a statistical change in hamstring ROM during this stage of the study.

Table 3. Variance for Hamstring ROM from Fourth Week to Seventh Week

Group	F Value Left Leg	Critical Value Left Leg	F Value Right Leg	Critical Value Right Leg
Stretching-Immediate measurement	1.78	2.90	0.67	2.90
Stretching- 10 minutes post	0.79	2.90	0.33	2.90
Massage- Immediate Measurement	0.20	2.90	0.10	2.90
Massage- 10 minutes post	0.12	2.90	0.10	2.90

Hamstring ROM was not found to vary significantly during the last three weeks of the study during which massage and stretching were no longer performed.

Discussion

Significant variance in hamstring ROM was only found between the initial measurements and those taken at the fourth week for the left and right leg of the stretching group when measurements were taken immediately following stretching. For that same time period, significant variance was also found for the left leg of the stretching group when measurements were taken ten minutes post stretching. This indicated that static stretching without massage was the most effective at increasing temporary ROM of the hamstring. The left leg of the stretching group maintained the ROM increases for the measurement ten minutes after stretching which indicates static stretching might also be effective at increasing long term ROM. The right leg of this group, did not have significant variance. The ROM differences between the legs could be influenced by leg dominance since variance was found within the group when the left side dominant individuals were removed.

The massage group did not experience significant ROM increases, even though the group was performing the static stretch, just with an added element. The addition of massage could have taken the participants focus off of performing the static stretch properly and thus preventing the stretch from fully increasing flexibility. The act of massaging the muscle during the stretch also could have affected stretching, by preventing the muscles from fully relaxing and lengthening.

The final three weeks of the study during which ROM was measured but stretching or massage was not performed was established to monitor the maintenance of any ROM gains. None of the groups experienced any statistical variance including the groups that had experienced an increase in ROM. This indicates that the groups that had gained significant ROM did not immediately lose the increase in flexibility.

While not statistically significant, ROM was found to increase for each group after four weeks of performing the stretching and/or massage. Had the study continued over a longer time period the increases in flexibility might have been found to be significant. Leg dominance as a factor should also be

further explored. Overall, the study confirmed that static stretching is an effective means for increasing hamstring ROM, while more research will have to be conducted to establish the effectiveness of massage.

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Contrarian Macroeconomics:

How Changes in the Federal Funds Rate Affect Long-Term Stock Market Performance

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B.S. in Business Administration: Areas of Emphases in Accounting & Finance

Abstract

All other interest rates are derived from the Federal Funds Rate, which effectively puts a price on money. Recent studies have shown that, in the short run, there is a direct correlation between the federal funds rate and subsequent stock market performance. However, other sources, such as value investors and Austrian business cycle theorists (ABCTs) argue that this should not be the case. By examining inflation-adjusted returns of the S&P 500 since 1955, this study discovered that the frequent intervention of the Federal Reserve may not only be ineffectual in the long run, but may also lead to the development of more severe economic bubbles in the market for stocks and other assets.

Contrarian Macroeconomics:

How Changes in the Federal Funds Rate Affect Long-Term Stock Market Performance

Introduction

“In the stock market, as with horse racing, money makes the mare go. Monetary conditions exert an enormous influence on stock prices.” ~ Martin Zweig, 1990

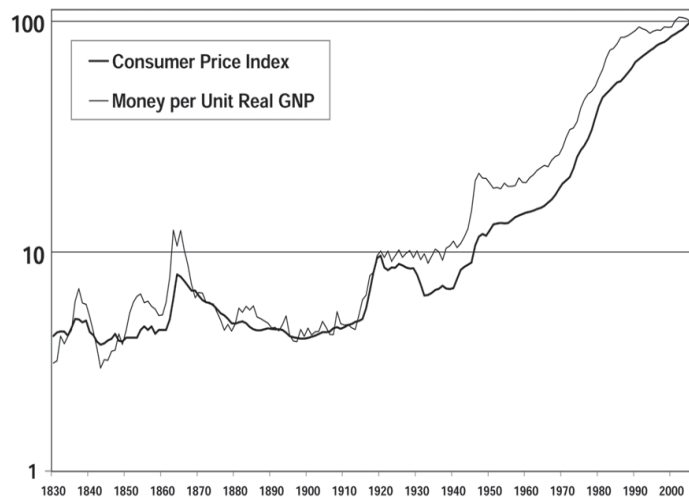
A substantial amount of time, money, and effort is spent by the financial and business community on predicating the Federal Reserve’s actions. Like the price of raw materials, the demand of a company’s products, and the outcome of the presidential election, the possible actions of the Federal Reserve represent the most dangerous element that investors and business professionals must deal with: uncertainty.

The Federal Reserve

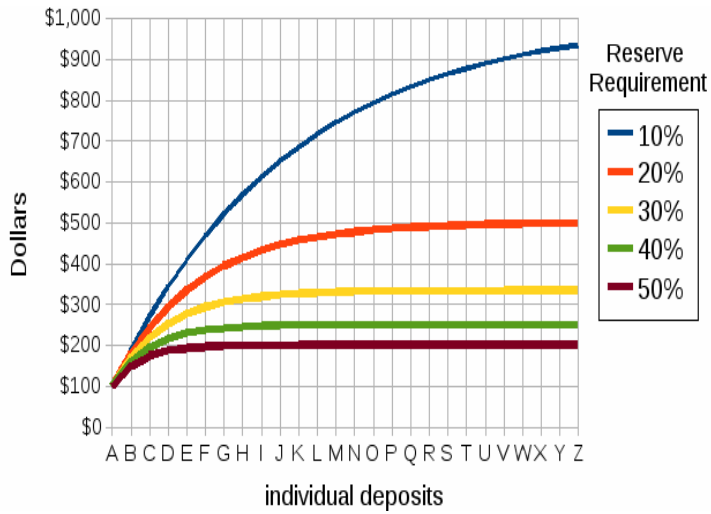
Founded in 1913, by an act of Congress the Federal Reserve is the central bank of the United States. In more colloquial terms, it is the “bankers’ banker” that provides the private depository institutions that individuals and corporations do business with on a daily basis with emergency funding and loans. As a result of the gold standard’s dismissal in 1933 and the astronomical, unprecedented period of inflation that followed, the Federal Reserve gained the additional responsibility of keeping inflation in check by controlling the supply of money.

Inflation

Inflation occurs when purchasing power is destroyed. In the past, inflation occurred as a result of both natural and manmade crises, such as crop failure or war. However, since going off the gold standard, economists have found a distinct positive correlation between the volume of money and the level of inflation.



Fractional Reserve Banking



The reason inflation is such a large problem under our fiat monetary system is because of our private depository institutions' fractional reserve banking. Through this, a substantial amount of money is created from even the smallest transactions, through a process of lending and depositing that leads to perpetual, exponential growth.

The Federal Funds Rate

The federal funds rate is the overnight rate at which private depository institutions, such as banks, lend money from their account at the Federal Reserve to other private depository institutions.

Although individuals and corporations are not eligible to receive loans from depository institutions at the federal funds rate, all other rates are derived from it since—through the countless exchanges between borrowers and lenders—it effectively prices interest.

Interest is the value an individual, business, or government entity places on foregoing present consumption to lend its money to another, in hopes of receiving more money back in the future.

Depository institution's most credit worthy customers—such as Fortune 500 companies or members of Forbes' Richest People in America list—see the effects of the federal funds rate in the prime rate, while the typical consumer is exposed to its fallout in the rate charged for their mortgages and credit cards.

The Federal Funds Rate & Short-Term Stock Market Performance

In Jeremy Siegel's *Stocks for the Long Term*, the author describes a negative correlation between the federal funds rate and the subsequent returns of the S&P 500. However, this study only examines the relation between the two variables in the time frame of 3-12 months.

Research Project Problem

Through either personal retirement accounts or their employers' pension plans, most individuals are not investing in the equities market over such a short time horizon. Instead, they are investing for the long haul, over decades. What is the long-term effect of changes in the federal funds rate to those investors?

1955-2006	3-month	6-month	9-month	12-month
Increases (116)	1.4%	3.3%	6.0%	7.4%
Decreases (108)	5.0%	9.5%	11.8%	15.3%
Benchmark*	2.9%	5.8%	8.8%	11.8%
1955-1959				
Increases (18)	5.0%	7.0%	10.1%	11.8%
Decreases (8)	6.4%	17.4%	27.8%	36.0%
Benchmark*	3.3%	6.4%	8.9%	11.4%
1960-1969				
Increases (22)	-1.2%	1.2%	1.4%	2.6%
Decreases (17)	3.5%	6.1%	7.4%	8.6%
Benchmark*	2.2%	4.1%	6.2%	8.4%
1970-1979				
Increases (29)	-1.9%	-1.2%	3.7%	4.8%
Decreases (26)	6.5%	11.1%	13.8%	17.7%
Benchmark*	1.9%	4.3%	6.7%	9.3%
1980-1989				
Increases (16)	3.9%	4.2%	9.1%	8.6%
Decreases (23)	6.5%	12.9%	14.9%	21.1%
Benchmark*	4.3%	8.8%	13.0%	16.9%
1990-1999				
Increases (11)	3.3%	8.8%	13.4%	20.2%
Decreases (22)	6.1%	10.6%	14.3%	17.6%
Benchmark*	4.5%	9.0%	13.9%	18.9%
2000-2006				
Increases (20)	2.7%	4.7%	4.1%	4.6%
Decreases (12)	-1.7%	-3.2%	-7.4%	-9.8%
Benchmark*	0.6%	1.0%	1.2%	1.9%

* Average of all time periods in selected sample

Reasons for Short-Term Performance

Reflecting on a little business sense leads to a conclusion that does not mesh with the published results. The vast majority of the financial and business world is only concerned with providing investors returns in the immediate future, as their compensation packages and bonuses are tied to short-term results. Arguably, this conflict of interest between investors and the agents selected their businesses creates a moral hazard that destroys shareholder value.

Therefore, lowering the federal funds rate, or—essentially—the interest rate and subsequently the value of money, causes businesses and financial institutions to expand their investment horizon to include opportunities that would not be considered at higher levels of interest. For example, as the current federal funds rate approaches essentially zero, even treasury bills—which have earned a paltry 2.8% annual real return for investors over the past 200+ years—are a viable investment opportunity since any return generated from them is essentially free money if a financial or business institutions only has to pay a negligible rate of interest.

Project Objectives

1. Develop a model to isolate the independent variable (the Federal Funds Rate) and the dependent variable (S&P 500 returns).
2. Readjust data for changes in the price level due to inflation.
3. Determine if there is a long-run correlation between the level of the Federal Funds Rate and stock market performance as determined by changes in the S&P 500 index.

Methodology

1. Utilized the following governmental and corporate data for this study:
 - a. Historical federal funds rates were provided by the Federal Reserve Bank of New York.
 - b. Historical consumer price indices provided by the United States Bureau of Labor Statistics.
 - c. Historical returns of the S&P 500 provided by Standard & Poor's.
2. Developed model in Excel to examine data from 1955-2004.
3. Isolated data into cumulative yearly data for the five years following each increase or decrease in the federal funds rate.

Hypothesis

Contrary to the short-term negative correlation between lowering the federal funds rate and the returns of the S&P 500, I believe that—*ceteris paribus*—there will be a positive long-term correlation between the federal funds rate and the returns of the S&P 500.

In other words, a high federal funds rate will result in higher returns for investors since financial and business institutions will have to be more prudent and exhaustive in their due diligence in researching and selecting how to allocate their scarce amounts of capital. The opposite scenario will result for situations with a low federal funds rate.

Data Analysis

Over the short run, Professor Siegel's hypothesis holds true. That is, there is an inverse relationship between the level of the federal funds rate and subsequent stock market performance.

However, the variability is less pronounced with adjustment based on the level of inflation. This may be due to short-term stock market performance being influenced by the inflationary environment created by low federal funds rates.

This is especially relevant since market makers rely on the accounting data provided by publicly-traded firms. However, accounting data is not adjusted for inflation, meaning that per share earnings data may be inflated.

However, post 1990, there is a direct correlation between the federal funds rate and subsequent stock market performance in both the long and short term. Therefore, investing in the future based solely on the actions of the Federal Reserve may not result in the same performance as the years prior to 1990.

01/1955-12/1959									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	10.77%	2.39%	3.67%	4.67%	4.52%	8.35%	14.28%	21.96%	31.19%
Decrease	-10.58%	1.50%	5.25%	6.72%	9.65%	17.32%	23.82%	33.22%	37.62%
Benchmark	3.65%	1.92%	3.63%	4.73%	5.66%	11.11%	16.92%	25.73%	32.50%
01/1960-12/1964									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	13.75%	1.34%	3.63%	5.26%	7.11%	14.12%	18.53%	22.27%	20.33%
Decrease	-7.42%	2.22%	4.44%	7.14%	9.88%	10.91%	19.98%	26.81%	29.27%
Benchmark	1.19%	2.06%	4.28%	6.43%	8.90%	12.78%	19.36%	24.44%	25.74%
01/1965-12/1969									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	3.75%	-1.24%	-2.50%	-2.91%	-4.34%	-5.74%	-5.89%	-10.78%	-16.72%
Decrease	-3.65%	0.54%	-0.75%	-4.01%	-4.85%	-5.74%	-9.52%	-9.22%	-19.15%
Benchmark	1.53%	-0.70%	-1.98%	-3.24%	-4.49%	-5.74%	-6.98%	-10.31%	-17.45%
01/1970-12/1974									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	6.57%	-5.62%	-9.12%	-9.82%	-12.37%	-22.78%	-25.50%	-29.34%	-34.65%
Decrease	-7.21%	3.27%	6.72%	6.04%	6.27%	10.19%	-7.38%	-22.27%	-20.29%
Benchmark	0.26%	-1.76%	-2.05%	-2.64%	-3.68%	-7.38%	-16.66%	-25.90%	-28.17%
01/1975-12/1979									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	3.92%	-1.58%	-2.12%	-2.57%	-2.57%	-5.82%	-9.54%	-8.46%	-3.98%
Decrease	-4.49%	2.37%	0.34%	0.18%	0.14%	-7.00%	-14.25%	-10.40%	-13.14%
Benchmark	0.98%	-0.20%	-1.26%	-1.61%	-1.62%	-6.23%	-11.19%	-9.14%	-7.19%

01/1980-12/1984									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	6.09%	-0.48%	0.24%	1.54%	1.71%	12.38%	33.03%	36.56%	49.21%
Decrease	-7.61%	3.14%	5.97%	7.24%	9.50%	17.58%	31.17%	47.83%	67.74%
Benchmark	-0.30%	1.21%	2.91%	4.20%	5.35%	14.81%	32.16%	41.82%	57.86%
01/1985-12/1989									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	3.03%	2.68%	6.22%	9.83%	9.69%	17.39%	18.74%	29.70%	32.53%
Decrease	-3.38%	2.58%	4.29%	5.03%	8.86%	12.02%	16.83%	22.27%	28.25%
Benchmark	0.09%	2.60%	5.22%	7.52%	9.24%	14.94%	17.92%	26.33%	30.69%
01/1990-12/1994									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	3.01%	0.30%	1.58%	4.19%	7.97%	22.52%	47.49%	78.12%	114.31%
Decrease	-3.80%	1.80%	3.17%	4.55%	6.22%	12.39%	21.10%	37.68%	67.72%
Benchmark	-0.62%	1.10%	2.42%	4.38%	7.04%	17.12%	33.41%	56.55%	89.46%
01/1995-12/1999									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	1.77%	5.13%	10.49%	14.91%	20.46%	32.81%	42.08%	42.83%	35.18%
Decrease	-1.69%	5.36%	9.61%	14.82%	18.52%	34.87%	39.85%	38.91%	29.03%
Benchmark	-0.02%	5.10%	9.99%	14.69%	18.99%	33.15%	39.90%	38.85%	30.18%
01/2000-12/2004									
	FFR % Total	3	6	9	12	24	36	48	60
Increase	4.76%	0.54%	-1.63%	-1.92%	-2.93%	-2.30%	-0.28%	-4.68%	-9.54%
Decrease	-6.84%	-2.19%	-3.90%	-6.48%	-7.97%	-8.06%	-0.18%	4.72%	-0.08%
Benchmark	-1.17%	-1.18%	-2.49%	-3.61%	-4.33%	-3.58%	1.94%	3.08%	-2.80%

Additional Considerations

1. To what level does the idea of self-fulfilling prophecies factor into the direct relation found in the years after 1990? Are investors, particularly market makers, factoring in the idea that the Federal Reserve will “do the right thing” before there is an official announcement?
2. To what degree does the fact that, historically, the stock market goes up about $\frac{3}{4}$ of the time influence the data in the study?

Future Considerations

1. Based on the nature of their business in regards to leverage, to what degree do banks influence the returns of the S&P 500?
2. What other asset classes are influenced by changes in interest rates, and could the performance in the S&P 500 be influenced by the possible alternative asset classes that could be invested in?
3. More broadly, do the relationships recognized in this study extend to the broad economy, such as private businesses or small and medium capitalization securities?

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Analysis of Zinc Metal Absorbance by Cobalt Prussian Blue Analogue

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Abstract:

Contamination of heavy metals in aqueous systems and in petroleum is a problem with many industrial and mining applications in the 21st century and methods to reduce this contamination has been investigated extensively. Cobalt Prussian blue analogue (CoPBA) was synthesized by the standard method in which $K_3Fe(CN)_6$ and $CoCl_2 \cdot 6H_2O$ of a 5.0×10^{-3} molar concentration were mixed in deionized water under varying salt concentrations and the excess nickel was complexed with ethylenediamine for determining concentration with UV-Vis spectroscopy.

Introduction:

Contamination of heavy metals in aqueous systems and in petroleum is a problem with many industrial and mining applications in the 21st century. Acid mine drainage is the resulting contamination of primarily iron cations mobilized during mining activities. Sites where acid mining occurs release toxic heavy metals other than iron including arsenic, lead, and manganese in drainage runoff. The metal iron cation contaminants serve as Lewis acids, which results in acidification of aqueous media into which the contaminants drain. The resulting alteration of pH affects the health of indigenous flora and fauna and poses threats to human health in the water supply and in many recreational activities. Burning of fossil fuels produce large volumes of heavy metal waste, and thallium is released as waste in cement creation^(1,2).

Prussian blue (PB), or iron III hexacyanoferrate ($\text{Fe}_4^{\text{III}}[\text{Fe}^{\text{II}}(\text{CN})_6]_3 \cdot 14 \text{H}_2\text{O}$) is a coordinate covalent compound composed of divalent and trivalent iron atoms bridged by cyanide in a face-centered cubic crystal lattice. Other names for PB include Turnbull's blue, Parisian blue, Chinese blue, Hamburg blue, mineral blue, iron blue, Brunswick blue, and Milori's blue. PB's face-centered cubic lattice is interspersed with holes where water is trapped, but it can be filled with other molecules and/or atoms (e.g. hydrogen or heavy metals)⁽³⁻⁷⁾. Chemical and physical properties of PB investigated include intramolecular storage, nanoparticle synthesis, and film formation.

Cobalt Prussian Blue (CoPBA) was utilized in place of standard iron PB due to its ability to be characterized by XRF in terms of structure determination. It was then exposed to Ni and UV-Vis analysis was used to determine absorbance in addition to fluorescence spectroscopy. This CoPBA powder was then exposed to Ni and Zn solutions respectively and allowed approximately 1 week of exposure time. The excess Ni and Zn were complexed to provide spectroscopically active species for determining concentration with Beer's Law and an established calibration curve ($A = Ebc$), where A is absorbance, E is molar absorptivity, b is pathlength, and c is concentration of analyte in molarity.

Experimental:

The CoPBA was synthesized by the standard method in which $K_3Fe(CN)_6$ and $CoCl_2 \cdot 6H_2O$ of a 5×10^{-3} molar concentration were mixed in deionized water under varying salt concentrations. The effect of CoPBA formation in various salt concentrations was analyzed by varying the amount of sodium chloride present in the solution. The varying molar concentrations that the CoPBA was synthesized under is 0M, 1M, 2M, 3M, and 5M of sodium chloride. Each molar concentration of CoPB was exposed to a Ni solution for the Ni tests and exposed to a 8-Hydroquinoline (8-HQ) solution for the Zn tests. These exposures were allowed to continue for 7 days before the supernate was centrifuged and isolated from the CoPBA powder and complexed for spectroscopic analysis.

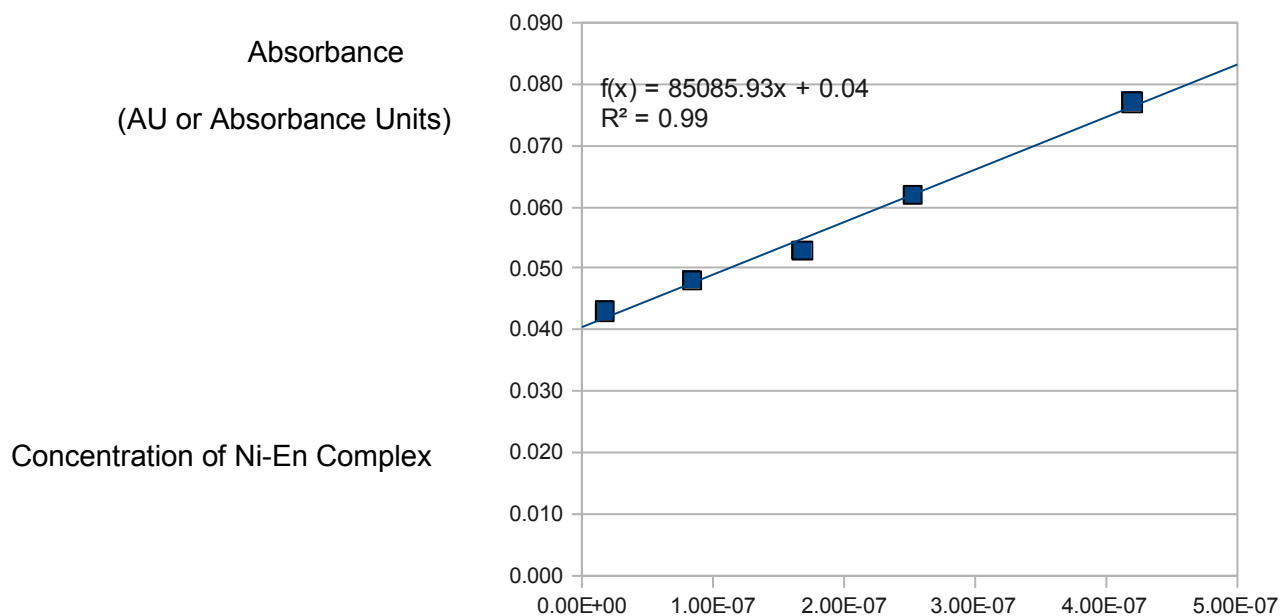
The amounts of the metals Ni and Zn absorbed by CoPB was characterized by a Beer's Law plot of absorbance from a UV-Vis spectrometer and a fluorescence spectrometer in comparison to a standardized calibration curve. The Ni trials were afterward examined by complexing the surplus, non-absorbed Ni with the bidentate ligand ethylenediamine in a 1:3 Ni to ethylenediamine ratio. Zn was similarly complexed with the bidentate 8-HQ molecule in a 1:2 Zn to 8-HQ ratio. The limitations of the instrument in terms of sensitivity affected the results of the Ni and the Zn. A calibration curve was constructed for each metal-ligand pair for experimental comparison.

Due to the $Zn-(8-HQ)_2$ complex having greater characterization potential with fluorescence, the investigation of Zn was performed with a fluorescence spectrometer. The resulting data from the fluorescence spectrometer was erratic and expressed characteristic signs of cuvette absorbance.

Results and Discussion:

The calibration curve established for the Ni-Zn complex met the predicted Beer's Law absorbance linear pattern. From this, the later Ni-En complexes of the Ni remaining from the interaction of the CoPBA was compared.

Fig 1. Ni-En Calibration Curve



The initial trial of Ni absorption yielded results that were bordering on the detection limit of the UV-Vis spectrometer. This was evaluated to be the effect of very small concentrations and the amount of CoPB utilized (approx. 0.05g) for the initial trial. The average absorption of the trials was 0.049 AU with standard deviation of 0.009 absorbance units (AU) compared to the ideal 0.5-2.0 AU. Considering the questionable results from the low detection limit, no remote assessment regarding the effect of the salt concentration formation's effect on absorption effect can be inferred. The 1M anomaly of a negative concentration clearly indicates that this low concentration provides data unusable for assessment. Nickel stock was 5.24 millimolar prior to exposure.

Table 1

Absorbance of molar type of CoPB of nickel in trial 1 at 551.7 nm

CoPB Molar Type	Concentration Ni After Exposure (Millimolar)	Absorbance (AU)
0M	3.23	0.062
1M	0.29	0.038
2M	1.17	0.048
3M	1.91	0.053
5M	0.44	0.043

The second trial of nickel utilized greater amounts of CoPB than the first trial (approx. 0.30g), granting greater detection of absorbances of the Ni-ethylenediamine complex. The results were comfortably within the detection limits of the UV-Vis spectrometer with the average absorbance being 0.195AU with a standard deviation of 0.026 AU. In Fig.1, the resulting absorbances of the various CoPBA concentrations are displayed, and they show the absorbances the spectrometer record are greater than the maximum amount that could have been provided by the Ni solution alone. This indicates that more Nickel was detected than present initially.

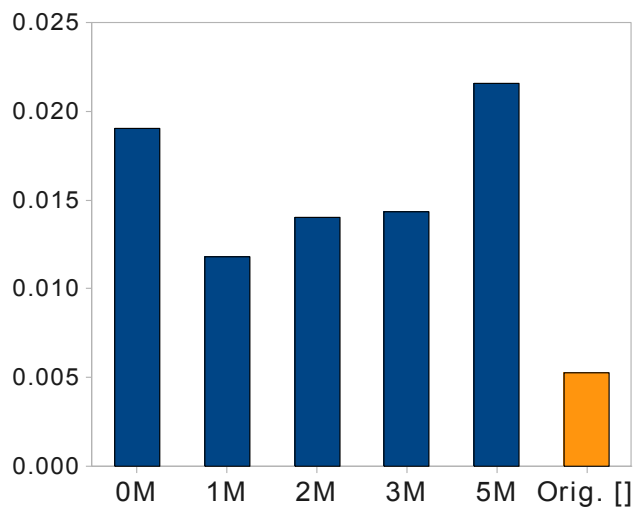
Table 2

Absorbance of molar type of CoPB of nickel in trial 2 at 545 nm.

CoPB Molar Type	Concentration Nickel After Exposure (M)	Absorbance(Au)
0M	0.019	0.213
1M	0.012	0.167
2M	0.014	0.181
3M	0.014	0.183
5M	0.022	0.229

Fig. 2

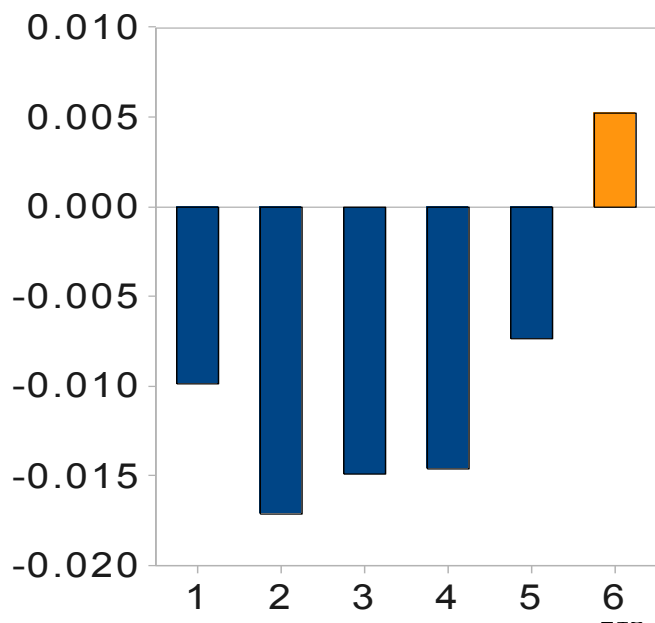
Absorbance of Ni in trial 2



This discrepancy was determined to be from the similar absorbances of the CoPB with that of the Ni-ethylenediamine complex. There existed the possibility that significant amounts of CoPB remained suspended in the supernate during the decanting process which interfered in the UV-Vis analysis of the sample supernates. The possibility and level of CoPB interference with analysis of the Ni(en)₂ supernate was determined by attempting to closely replicate the circumstance with which the supernate was removed (i.e., centrifuging CoPB and decanting) with the resulting supernate then tested for UV-Vis absorptivity. The simple test verified that CoPB does absorb at the ideal absorbance of Ni(en)₂ complex at 545 nm and that the methods utilized for removing supernate from the CoPB cause significant amounts of CoPB to transfer and interfere with UV-Vis analysis. To acquire an approximation of what the absorbances would be without the CoPB contamination of the supernate, matrix subtraction was used. The rough approximation of CoPB contaminant absorbance bases on the techniques employed was 0.92 AU. This was subtracted from each absorbance with the trial 2 Ni data (see Fig 2). With the matrix subtraction adjustment, the absorbances become negative, which is a physical impossibility.

Fig 3

Adjusted absorbance of Ni with maxtrix subtraction



Conclusions:

The physically impossible excess positive and negative absorbances detected for the concentrations of Ni-En complex with the UV-Vis indicates that the CoPB contamination of the supernate distorts the actual absorption of the Ni(en)₂. Possible changes in the experimental procedure to minimize interference of contaminant CoPBA powder in the Ni-En analyte would be additional centrifuge and settle time for the powder, so as to further minimize the possibility of it being transferred. Future research regarding the application of PB and PB analogs include utilization of an XRF to determine the structure of the powder post-exposure to metal analytes to determine the structure of the powder.

The detected interference of the contaminant CoPBA powder so greatly affected that determination of actual absorbance that investigation of CoPBA absorbance by this method is not ideal.

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How to Minimize Hacking: Understanding the Motives of Hackers to Plan a Counter Attack and Prevention Techniques

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Abstract

Human hacking is a nontechnical kind of intrusion that relies heavily on human manipulation. Its impact is continuously giving serious concern in the Information Security arena. This study presents results of a survey of self-proclaimed computer hackers about their perceptions in regards to illegal hacking. The survey was done completely online using surveymonkey. Five hacker forums were chosen randomly online to post the survey link. . Results show that hackers continue to engage in illegal hacking activities despite the perception of severe judicial punishment. A closer look shows that hackers perceive a high utility value from hacking, little informal sanctions, and a low likelihood of punishment which explain the hacker's illegal behavior. Strategies for developing and implementing a successful information security awareness program are presented as well as an introduction to the subject of human hacking while discussing the various counter-measures available to minimize the likelihood of such occurrences.

Introduction

The original use of the term hacker refers to innovative programmers at MIT who wanted to explore the limits of mainframe computing. However, the term “hacker” is now associated with a negative connotation describing computer intruders who carry out destructive acts. Over the past decade there is a growing global culture of self-proclaim computer hackers who believe that information should be free and that the pursuit of knowledge through hacking is an essential human right (Sinrod & Reilly, 2000). Illegal hacking causes serious damage to corporate and individual computer systems that can result in a public relations disaster and loss of consumer confidence (Sidel, 2007). Most self-proclaimed hackers claim to do creative things with technology and argue that knowing how to do something that might be harmful is not the same as causing harm. The general public often has difficulty drawing a line between self-proclaimed hackers who study computer security as a technical interest and criminals who break into computers and deliberately cause damage (Rogers, 2001).

However, compared to other crimes, illegal hacking sometimes enjoys its popularity and glamorization. The media and society view hackers as talented individuals with a strong interest in computers (Skurodomova, 2004). Since the introduction of the internet, the number of users, hosts, domains, and enterprise networks connected is growing explosively leading to a dependency on computer network for business transactions, information sharing among research, academic organizations, government agencies and individuals (Stone, 2002). Most organizations and individuals have their valuable information in the interconnected information highways creating a global information society. It is a great challenge to implement a good cyber defense to secure the valuable information on the interconnected information highways by minimize the likelihood of hackers getting access to the networks (Halbert, 1997). Given the cost of hacking to

the business community and the mixed messages that we see in the media, it is necessary to assess issues relevant to the hackers' perception of illegal hacking activities. In this study I focus on the perceptions of Self-proclaimed hackers and how these perceptions impact the hackers' decision to engage or not to engage in illegal hacking activities. Also various counter attack measures available to minimize the likelihood of illegal hacking and strategies for implementing a successful information security awareness program are presented.

Background

The link between perceptions and actual behavior has been proven in previous researches on this topic (Bargh, Chen, & Burrows, 1996; Epley & Gilovich, 1999). As a result, I explore the perceptions of self-proclaimed hackers with regards to illegal hacking. By looking at the perception of self-proclaimed hackers, issues relevant to the effectiveness of current social pressures, legislation and corporate policies aimed at protecting information and systems can be examined. The perception measures of interest include **moral disengagement, informal sanction, punishment severity, punishment certainty, and utility value.**

Moral disengagement refers to the cognitive processes that justify deviant conduct. People do not engage in deviant behaviors until they have justified the rightness of their conduct (Bandura, Barbaranelli, Gian, & Pastorelli, 1996). Once morally justified, these deviant behaviors are perceived as personally and socially acceptable. A difficulty with appraising moral disengagement is distinguishing whether moral disengagement arises due to selfish motives or due to competing principles influencing a situation (Smith & McVie, 2003). Self-proclaimed hackers often view themselves as modern-day "James Bond" (Rogers, 2001). They publicly state that they help corporations identify corporate security problems and do nothing harmful. Instead they claim that they simply learn how computer systems operate and search for

vulnerabilities. Other hackers declare a mission of keeping an eye out for unethical behaviors of vendors, corporations and governments. This “James Bond” mentality allows the hackers to deceive themselves and view their illegal activities as providing a service for the greater good. It also gives them cause to justify their activities should they be caught engaging in any illegal activities by blaming the victims.

Hackers live in a social world where contacts with various individuals, such as parents, teachers, and friends, often impact perceptions and behavior. However, hackers also inhabit a virtual world where government authority and the ownership of information are actively questioned. This virtual world described by (Halbert, 1997) was “an invisible community with a complex and interconnected lifestyle, an inchoate anti-authoritarian political consciousness, and dependent on norms of reciprocity, sophisticated socialization, rituals, networks of information sharing, and an explicit value system” (pp. 364). Living in their isolated virtual world makes it easy for them to justify their behaviors.

Informal sanctions are reactions by others to the deviant behavior of an individual (Kaplan, & Johnson, 1991). They are similar to subjective norms, which is a person’s belief about whether specific individuals approve or disapprove of the individual performing a behavior. In prior research, sanctions are often classified into either a formal or informal dimension. Formal sanctions are imposed by government legal systems while informal sanctions are tied to reciprocal relationships (i.e., family, friends, employers, etc.) provoking feelings of embarrassment and shame in the deviant individual as a result of engaging in deviant behavior. Although informal sanctions are not sufficient to deter crimes, they carry an implicit threat to punish certain actions. Capturing the social pressure on an individual, informal sanction can

strengthen or weaken the likelihood a person engaging in deviant behavior (Sinrod, & Reilly, 2000).

Punishment severity is the impact on an individual as a result of being publicly discovered engaging in an illegal or immoral act. There is a direct impact due to punishment severity such as prison time, fines, and community service. There are also indirect impacts such as increased difficulty securing employment and fostering relationships. The Computer Fraud and Abuse Act (CFAA) was amended several times and penalties for engaging in cybercrime have increased, which shows that the government is determined to punish any kind of cybercrime, including hacking. However, there is also evidence that CFAA has done little to slow the growth of computer crime (Skibell, 2003).

Punishment certainty measures an individuals' perception of the probability of being caught. Research has shown that severity of punishment has little or no effect when the likelihood of punishment is low (Von Hirsch, Bottoms, Burney, & Wickstrom, 1999). However, when individuals perceive that there is a large possibility that they will get caught committing a crime, they are less likely to engage in crime. Although punishment for hacking is severe, hackers may believe the chances of being caught are low (Von Hirsch, Bottoms, Burney, & Wickstrom, 1999).

Utility value of a course of action is an economic rationalization influencing an individual's decision making (Leatherwood & Spector, 1991). A utility value perspective proposes that given a choice between two or more courses of action a hacker will make a choice based on which provides the greatest level of gratification after consideration of the risks associated with the choices (Leatherwood & Spector, 1991). The action of interest, in this study, is the decision to engage or not engage in illegal hacking. A utility value perspective examines

the decision making process in terms of alternatives. A risk neutral hacker will engage in illegal hacking behavior if the expected payoff is positive and refrain from illegal hacking behavior if the expected payoff is negative.

The Study

The study was done online and data was collected from five randomly selected self-proclaimed hacker forums. Questions were created on survey monkey and the link to the survey was posted on the forums. During the two months that the survey was open, 157 people completed the survey. According to the profiles of the self-proclaimed hackers on the forums, it shows that different professions were represented which includes professors, security engineers, software developers and students. To ensure that we examine people who commit illegal hacking acts some research was done on the randomly chosen forums to verify that most people on the forums have committed illegal hacking. The responders were asked to rate the statements in the table below using a scale from 1 (strongly disagree) to 5 (strongly agree). These statements measure five dimensions of perception that are relevant to views on hacking: moral disengagement, informal sanction, punishment severity, punishment certainty and utility values of hacking.

Definitions, Items, and Descriptive Statistics

Moral disengagement: Cognitive processes to justify detrimental conducts.

- 1 Hacking into computer system is OK as long as no damage is done.
- 2 Hackers help companies improve their systems' security.
- 3 If people do not want me to hack into their system, they should put in place better system measures.

Informal sanction: Reactions by others to real or imagined deviant behavior.

- 1 My friends would think less of me if I were caught hacking illegally.
- 2 My family would think less of me if I were caught hacking illegally.
- 3 My friends think hacking illegally and not getting caught is cool

Punishment severity: Perceived magnitude of penalty if arrested.

- 1 The punishment for being caught illegally hacking is severe.
- 2 If you were caught hacking illegally, your life would be severely disrupted.

Punishment Certainty: Perceived likelihood of receiving a legal penalty.

- 1 If you were to hack illegally, the chance you would be caught is small.*
- 2 People who hack illegally will be caught eventually.
- 3 If other people were to hack illegally, on average, the chances they would be caught is small.

Utility Value: Perceived returns

- 1 I can gain from hacking illegally.
- 2 The potential gains from hacking illegally exceed the potential cost.
- 3 I can lose from hacking illegally.

Results

Scheffe's multiple comparison tests were performed to examine the results. The results of the study show that about 89% of the people who completed the survey have a high level of moral disengagement. Hackers perceive that hacking is acceptable as long as no damage is done. Hackers even believe the act of hacking helps companies improve their systems. Through such euphemistic language, hacking is made personally acceptable within the mind of a hacker and socially acceptable within the hacking community in general. As a consequence of moral

disengagement, hackers disregard any negative consequences of hacking by blaming the victims. For example, a hacker may accept responsibility for committing illegal activities but may insist any harmful consequences are not wrong in light of the circumstances. The harmful consequences become a form of punishment where the hacker is the good guy and the victim is the bad guy. Some hackers view the harmful consequences of their actions to be inconsequential to the benefits of aiding organizations in the identification of security holes and aggressively encouraging organizations to make changes.

This study also shows that self-proclaimed hackers perceive a significant lower level of informal sanctions against hacking because about 81% of people who completed the survey don't get negative feedback from their friends and families. Hackers tend to agree that their friends and families would not think less of them if they were caught hacking. The findings support the contention that hackers are not afraid of being socially excluded as a result of their behavior. Hackers perceive that the consequences of being caught engaging in illegal hacking activities will not result in criticism and disapproval or bring shame to their families. On the contrary, hackers believe they may receive recognition and respect from their peers. When confronted about illegal hacking activities, hackers blame the victim for the consequences of the illegal hacking activity and effectively shift the appropriate feelings of guilt and shame to the victim (McDevitt, Balboni, Garcia, & Gu, 2001).

The lack of social pressure on illegal hacking activities is a product of the type of crime and the environment associated with illegal hacking. The virtual hacker underground is a world few people in society are intimately familiar with and it is difficult for them to understand the impact of certain types of illegal hacking activities. While it is easy for people to understand the impact of stealing credit card information and using the information to purchase products, it is

difficult to understand the consequences of gaining illegal access to a company's mainframe or server. In general, society, especially the financial markets, is willing to blame the victimized organization by viewing an organization's management as irresponsible whenever a major security breach occurs.

Self-proclaimed hackers perceive the consequences of being caught engaging in illegal hacking activity are severe because about 95% of people who completed the survey acknowledge the high punishment severity. But on the contrary 97% of them have a low likelihood of getting caught. Hackers are keenly aware that if one were caught engaging in illegal hacking activities, his/her life would be seriously disrupted but if the chance of getting caught is low they will take the risk. This shows the success of the United States government in communicating the seriousness of engaging in illegal hacking activities to the hacker community but they also perceive a significant lower likelihood of getting caught. Some of the following reasons might be responsible for the hackers having the perception of getting away with illegal hacking. First, law enforcement agencies often fail to keep up with cybercrime technologies. They are also inexperienced with cybercrimes and lack the ability to solve cybercrimes. Secondly, companies are often reluctant to report cybercrimes either due to lack of confidence with law enforcement agencies or embarrassment for being the victims of cybercrimes. Thirdly, the skills, intelligence and experience some hackers possess enable them to avoid prosecution.

Consistent with the utility value perspective, hackers engage in hacking because 90% of people who completed the survey perceived gains exceed perceived costs. Hackers may perceive a utility value from hacking by creatively bypassing information security controls and/or they may seek monetary gains from stealing information. At the same time, hackers can also suffer losses from their actions if they are caught. Hackers may be ordered to pay fines, perform

community service, and/or serve prison terms. In this study, hackers tend to agree more with the statement “I can gain from hacking illegally” than with the statement “I can lose from hacking illegally”.

Conclusion

The study shows that hackers justify their behavior, perceive a low level of social sanction, a high level of severity punishment from the court but a low likelihood of getting caught and receiving the punishment. Hackers also perceive a relatively high utility value resulting from engaging in illegal hacking activities. One interesting result is punishment severity does not appear to deter illegal hacking behavior. The fact that hackers consider their behavior morally right and acceptable to their family and friends in combination with the fact that they believe there is a low likelihood of being arrested, allows them to take risks. The perception that the probability of being caught is low may explain the insignificance of punishment severity. Punishment severity is inconsequential when there is little or no chance of being punished. This result suggests that investments, tools and techniques that improve detection of security breaches and prosecution of hackers may be more effective than increasing punishment and enacting more laws. Therefore, investments in forensics specialists and the education of law enforcement personnel are needed to combat illegal hackers more effectively.

The study is significant for the IT community because it provides insights into the hacker’s psyche. While the U.S. legal system has prosecuted some illegal hacking severely, based on my findings, we cannot assume that severe punishment will deter illegal hacking behavior. Legislation alone cannot solve the hacking problems. The number of laws passed and the number of security measures installed will not result in a secure system. Instead, promoting an ethical approach to computing is necessary. Self-proclaimed hackers, need to be educated

about the importance of data privacy and security. Companies and organizations should also build an effective information security awareness program.

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Correlation of Poverty and Crime Testing the Anomie Theory

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Abstract

Crime is a problem in all societies. No society can exist without some deviation from the collective norms. I will be testing Merton's anomie theory which will indicate a gap between the cultural goals of society and the means in which we achieve those goals. Poverty is being looked at as playing a role in the everyday choices and opportunities that people have. My hypothesis is that there is a correlation between poverty and crime.

Correlations will be tested through SPSS (Statistical Package for Social Sciences) using data collections from the most current statistics. The United States Census bureau will provide poverty rates by state and the FBI's UCR (uniform crime rates) will provide crime rates by state for various crimes.

Correlation of Poverty and Crime Testing the Anomie Theory

Introduction

The purpose of this paper is to test the anomie theory and understand the effects it has on crime. Understanding the underlying causes of crime can help society understand that strategic planning and implementation of certain programs can be helpful in lowering crime rates.

Accessibility is very important to individuals who otherwise would not have opportunities for advancement. I will test the general hypothesis derived from Anomie Theory, that there is a positive correlation between poverty and crime, by comparing states in the United States.

Merton's Anomie Theory

Anomie theory, created by Robert Merton, is when cultural goals and the means by which to reach these goals are not in balance with one another. People want the American Dream but they do not have the means by which to acquire it. People may at this point become innovators and reject the acceptable means by using some other avenue of achievement. Culturally everyone wants certain things but in reality everyone cannot reach those goals legitimately. These goals are pushed onto society by the dominant institution, which is the marketing industry. This can produce a high amount of deviant activity.

Society is structured in such a way as to provide itself with long lasting sustainability and when, in fact, that structure is not in balance, problems do occur. One of the side effects of the structure of society is that some people are not well endowed with the material possessions that others have. Because of the economic atmosphere of the capitalistic gain for all, even the not so well endowed strive to get the material possessions the marketing industry pushes on society. When this class of persons cannot get these things they find ways to get them, which can lead to the quickness of illegal activity for monetary or material gain. Society has changed in the past

thirty years in a way that has created an institutional anomic state in society. The marketing and entertainment industries rule what society deems as important, meaning the purchase of “stuff” that one does not need for survival. Even though many of the purchases society makes are not necessary, even the people who cannot afford them feel they need to show that they too can have these items. So when it comes down to the line what we do as individuals is what we believe to be necessary, and sometimes we take risks to satisfy that necessity.

If we intend to make changes in society then we need to make changes in our neighborhoods and communities. We need to plan cities so that accessibility is a word that all can have in their vocabulary. People must have access to their basic needs of food, water, clothing, and shelter. If they can meet these needs then they should also have access to other opportunities such as an education. If they feel it is within their reach then they may grab hold and grow.

No society is completely without crime. No matter what, crime will persist but if we strive to keep people within reach of the things that can advance their personal worlds, then crime may decrease and help society as a whole.

The American Dream

The “American Dream” is something that people aspire to no matter what level they are on the social structure because it is a cultural goal. It is a way of life that people wish to live by. It may be difficult for some to acquire this without the funds that are necessary so they may do whatever they can to achieve the “American Dream. Institutional anomie theory examines a causal relationship between culture and social structure. Even though this explains why people reach for the “American Dream”, it has been found that it is not strictly American. It explains

the reach for better living in other nations where the market economy dominates (Messner & Rosenfeld).

Cultural Values and Goals

Values are the ways in which a person carries themselves in their speech and their actions. It is their beliefs about how people should act and react. People develop their values from the environment they are surrounded by. The way someone is raised inside of the home can be an intervening variable that may deter someone from choosing or cause someone to choose an illegal route to monetary gain.

As a whole, speaking on a national level, society holds a set of values that are beliefs about the way everyone should behave. These are the same beliefs that we use to carry us through each and every day. We make our decisions based on the beliefs that we hold dear to us as a culture. The way we present ourselves in everyday life is due to our cultural values, our proper dress to certain events, our actions at home as opposed to our jobs or church, and the means by which we achieve our goals. People act in the ways they do because of collective representation which is the knowledge of the cultural values that society expects each individual to adhere to in any given situation. Therefore when someone goes against these norms it is probably due to some sort of change in their environment (Goffman, 1959). If your environment is not supportive and of the value system that is considered the norm then this is where things start to change and being not of the norm it is also where deviant behavior may occur.

We do, however, rely on non socioeconomic institutions to instill these values in our society from birth to adulthood and beyond. So the smaller picture that helps us to adhere to the big picture is our families, churches, and schools. These are the places that we grow up in, therefore, these are the institutions that our culture relies on to raise our children according to the

norms and values that as a nation we hold dear. Non socioeconomic institutions do however have it hard because the socioeconomic institutions are calling the shots these days. They are setting the bar and they do not seem to adhere to a very strong moral code, so it seems society tends to follow suit because the socioeconomic institutions are where people seem to be looking for what's popular.

Social Structure and Institutionalized Means

Society is shaped by culture which creates the status someone holds and usually that denotes money, power, or prestige, they are the satisfiers of society. This structure is how we determine what poverty is by creating a line of poverty. If you are not above the poverty line then your status is low. Durkheim says that every status is important in order to keep society innovative and changing. This means that even criminal activity has its place in the structure of society, thereby causing society to strive for better things. Durkheim also states that if there is rapid socioeconomic change it can upset the status and roles in society, also causing a rise in criminal activity (Bernburg 2002). This type of change causes social instability. When these rapid changes occur our non socioeconomic institutions are broken down. This causes problems because these are the very institutions that we rely on to guide us to make the right decisions. Noneconomic institutions exist and provide an important function for the good of society as a whole. When these functions are shifted due to massive societal change, in the economy especially, then they fail to provide the functions that keep society at bay.

Poverty

Poverty affects people every day. It affects the way we live and the means by which we survive. It is defined by a margin that the U.S. Government uses to determine the lowest amount that families in a given demographic can earn before they are considered poor (Barnes 2005).

Poverty is caused by changes in society's structure on a macro level which creates an imbalance in the socioeconomic and non socioeconomic institutions. Some complete neighborhoods are broken down due to poverty conditions. In this instance workers may be dislocated, and these workers comprise whole neighborhoods causing stress in the regions they live in. With so many out of work in a single community it is difficult to find new jobs in areas for which these persons are not trained. When families endure this type of stress sometimes they do not make it, ending in divorce, hence one parent and one income (if any) households.

When someone is poverty stricken they may not have the same opportunities for advancement as someone who is not poverty stricken. This can be because they cannot afford transportation to get them back and forth to a job or school, or maybe they can't afford to clothe themselves properly to be marketable in the job market. Whatever the case may be, the opportunities that they do have may not be legal. Poverty stricken people may take advantage of the illegal opportunities simply in order to feed and clothe themselves or their families. When someone gets to a point that they do not know what to do in order to survive, then the risk of the illegal activity can be diminished or overshadowed, due to the will for survival.

People who live under these less than perfect conditions can have low self efficacy and therefore feel defeated. Due to the feelings of low self esteem these persons may feel like the best and quickest route to their goals would be to engage in the illegal activity that has presented itself to them. If, however, these same people have experienced for themselves, or witnessed someone else experience success, then they may be more optimistic about their future.

According to theories of utilitarianism when this happens people will make better decisions because they deem their futures to be bright (Barnes, 2005). When people have experienced these successes first hand they are more inclined or willing to achieve them the hard way

(meaning the longer, legal route) because they know the outcome to be worth it, and once they reach their goals they wish to stay at that level. These persons are not willing to risk the consequences of illegal activity because they would not be able to enjoy their future success because of the risk of incarceration.

Crime

Crime is a very broad subject. The crime that this discussion is primarily concerned with is crime that induces monetary gain. These crimes can range from burglary to homicide. Again this is a very broad subject. Some of the crimes are pick pockets, scalpers, petty larcenist, drug dealers and bank robbers. Because of the nature of the crime someone may go as far as killing anyone who stands in their way of the monetary success, hence the stretch to homicide.

According to the United States Department of Justice's statistical tables for the criminal victimization in the United States, in 2006 there were 18,915,740 property crimes and per 1000 households 446.1 of those had to do with some type of theft or burglary. People tend to take personal property from other people to either sell for monetary gain or to use for themselves.

Criminal activity is at a higher rate among those who are not above the poverty line. A lot of times these people are from broken families. These families, due to the probability of only one income or no income, are at higher risk for crime due to monetary gain because they are more willing to take the risk involved. Single parent homes may be more likely to fall in this category (Jensen, 1996).

Methods

To test Anomie Theory I researched a relational hypothesis between poverty and crime. People in poverty don't have access to the means to reach cultural goals but still desire them. These people are more likely to become innovators and engage in something deviant in order to

reach their goals. This leads to my hypothesis of a positive correlation between poverty and crime. I will use the quantitative research method. I wish to show that in the presence of high rates of poverty there may also be high rates of crime. I will use data from the United States Census Bureau to determine poverty rates as defined by the U.S. Government in all 50 states. Rates of violent crime, murder, robbery, property crime, burglary, and motor vehicle theft come from the FBI's Uniform Crime Reports. What I intend to find out is, if states with high poverty rates also have high rates of crime. These specific crimes were selected because they are crimes that may be involved when pursuing monetary or material gain. Correlations were calculated using SPSS (Statistical Package for Social Sciences). Using Table 687, Individuals and Families Below Poverty Level – Number and Rate by State: 2000 and 2005, and table 4, Crime in the United States by Region, Geographic Division, and State, 2006-2007. These are the most current statistics posted and they will show if there is a relational existence between poverty and crime.

The specific hypothesis is that states with high poverty rates will have high rates of violent crime, states with high poverty rates will have high rates of murder, states with high poverty rates will have high rates of property crime, states with high poverty rates will have high rates of robbery, states with high rates of poverty will have high rates of burglary, and states with high rates of poverty will have high rates of motor vehicle theft.

Results

The correlations between poverty and my six variables were as follows: violent crime ($r = .392$, $p = .0004$) low correlation, statistically significant, murder ($r = .504$, $p < .001$) moderate correlation, statistically significant, robbery ($r = .271$, $p = .055$) little correlation, not statistically significant, property ($r = .418$, $p = .002$) low correlation, statistically significant, burglary ($r =$

.570, $p < .001$) moderate correlation, statistically significant, and motor vehicle theft ($r = .231$, $p = .104$) little correlation, not statistically significant.

With these findings, even though we are not showing high correlations to the variables we are showing that the amount of the criminal activity in these areas is not by chance alone. All but robbery and motor vehicle theft were statistically significant. This gives support for my hypothesis that there is a positive correlation between poverty and the variables of crime tested. If the dark figure (unreported crimes) in the UCR were to be added, then my correlations would possibly be even stronger.

One may use these findings to investigate more extensively into a specific area and see if there is any action that may be taken to reduce the inequalities in opportunity.

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Autonomous Robot Software

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Abstract

Archon is an autonomous ground vehicle used by Bluefield State College (BSC) to compete in the annual Intelligent Ground Vehicle Contest (IGVC). The development and improvement of Archon's software is an ongoing research endeavor, involving many inter-related sub-systems. These sub-systems include laser-based radar (LMS), vision, compass, GPS, sensor fusion, goal selection, path planning, and control decisions. Path planning in particular has been a major area of focus. Path planning consists of three major systems: ripple, pathing, and a smoother. Software must operate in a real time environment, so speed of computation is crucial. Functionality of the software is determined through both simulation and real world testing. During real world testing, Archon is "turned loose" in an outdoor environment to find its own way towards a designated location. The test course can consist of boundaries defined by visual cues, barrels, trees, netting, flags, and other obstacles. Multiple goals may be defined within a single course. In the case of multiple goals, Archon must navigate to each goal in a predefined order. The integration and evolution of all these sub-systems into a functional and efficient autonomous vehicle has been an ongoing field of research at BSC for the past eleven years.

Autonomous Robot Software

The research and design of autonomous robots is an active field of research. The ultimate goal is the development of self-directed machines capable of efficiently navigating to a selected goal. All intervening obstacles encountered must be identified and avoided or overcome. Traps, dead-ends, and switchbacks must be avoided. Along the way, interim goals must be selected. The autonomous vehicle must maintain an awareness of its current location and heading, and it must make adjustments in real time due to a dynamically changing environment.

Problem definition

An autonomous robot has many software requirements that must be met simultaneously. Knowledge of current robot state, correct selection of goal, fusion of data from multiple sensors, map generation, obstacle detection, obstacle detection and avoidance, and real time operation pose many challenges. Solving individual problems in isolation of the others can be challenging enough - the autonomous robot must provide solutions to all these, in real-time, operating in a real-world environment.

Methodology

The Archon platform provides a real-world test base for algorithm development and integration. Algorithms generated are integrated into an overall software solution. Testing is performed both in the lab using a combination of simulated and real-world data. Further testing is then performed in the field. Course navigation includes lane detection, detection and avoidance of obstacles, detection of the robot's state utilizing GPS and Compass sensors, and goal section. Success is measured both by Archon's real-world performance and by a review of captured data.

Literature Review

Archon is the culmination of years of research and development. Autonomous ground vehicle development at BSC began with ENIAC (Riggins, 2001). Capable of basic vision and obstacle avoidance, ENIAC possessed few of the algorithms necessary for advanced goal setting and no capability to handle waypoints. Sensor fusion consisted of a single particle diffuser and a single sonar array.

The next year Centurion added GPS to the sensor fusion and the initial development of the slant algorithm, a program detecting the overall direction of the course. (Ground Robotic Vehicle Team, 2002). Centurian II (Ground Robotic Vehicle Team, 2003) added particle diffusers, sonar measurements, a camera, and proximity detectors to the sensor fusion algorithms. The robot performed long range goal computations once per second and short-range collision detection computations every $1/10^{\text{th}}$ of a second. While increasing in complexity, Centurion II still used inaccurate sensors. It also lacked an integrated solution to both course navigation and waypoint navigation.

Vasilius (Snider, 2004), was built in 2004. It employed a newly designed base, stereoscopic vision, and the replacement of the sonar sensors with a laser range-finder. Concentrating heavily on an attempted implementation of Kalman filters to track robot state, the process proved overly complicated and was abandoned for a less complicated solution with the next robot.

Anassa (Myers, 2004) introduced parameters for the calibration of goal selection criteria, clutter detection, and further refinements to slant. Anassa continued to serve as the platform for the BSC robotics design team for the next several years (Huntley, 2006), (Cardwell, 2008). Refinements to the obstacle detection and avoidance algorithms continued, and did refinements

to waypoint navigation and sensor availability. As sensor fusion using the digital camera become more efficient, usage of particle diffusers for color detection was discontinued. IGVC rules changes mandated that usage of proximity detectors be discontinued.

Scope

The testing and development of Archon's software is focused on the limitations and rules of the Intelligent Ground Vehicle Competition (IGVC, 2010). This includes an outdoor obstacle course defined by both solid and dashed lines. Obstacles - barrels, trees, sand, ramps, and netting - will be detected and avoided. A series of eight waypoints will be located on the course. Autonomous vehicles must navigate them in a predetermined order. Red and green flags will be placed near the end of the course. Robots are to navigate to the left of red flags and to the right of green flags. Robots must maintain a minimum average speed of 1 mph.

Proposed Solution

The software solution for Archon involves an object-orientated strategy using the C++ programming language. The change to C++ was accompanied with a reevaluation and redesign of many of the robot's core algorithms. Archon's autonomous navigation system consists of six steps: map generation, sensor fusion, map augmentation, goal selection, path-planning, and control decision. Each step is repeated every 60ms (milliseconds).

Map Generation

Archon's map consists of a series of 6400 nodes arranged in an 80x80 grid, each node representing approximately 4" (inches). The upper left node has a location designation of (0, 0) and the lower right node (79, 79). Archon always considers itself situated at node (40, 60). Archon's map encompasses a forward looking awareness of 20' (feet), a rear awareness of 7'8"

and awareness to each side of 13'4". During the map creation step, all nodes are assigned a starting weight of 1000. Node weights are discussed in the **Pathing** section below.

Sensor Fusion

Sensor fusion, the merging of multiple types of sensor data into a single coherent world view, is a primary system. Archon uses four primary forms of sensor data: LMS, camera, compass, and GPS. Each sensor provides data in a unique format. LMS, camera, and GPS data are converted to distance and vector information prior to integration and placement of the data on the map. Compass data are used solely for path planning and are not integrated until that time.

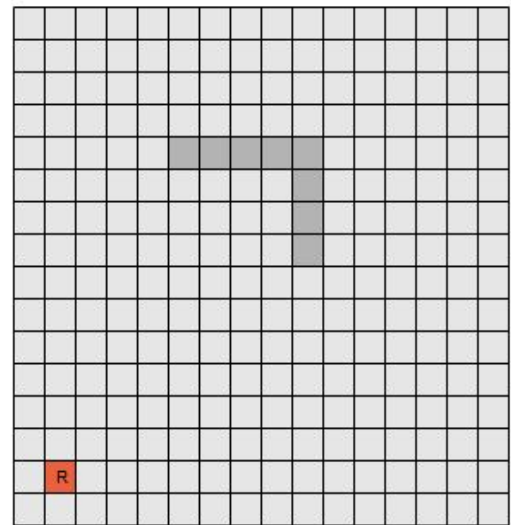


Figure 5.1: Map after LMS Data Added

LMS

LMS data consists of a 1080 element array representing a 270° field of view in ¼° (1/4 degree) increments. Due to hardware design limitations, 10° of data at each end are discarded,

leaving the robot with an effective arc of 250°.

Accuracy of the LMS is limited only by the resolution of the map grid. Obstacles detected by LMS are assigned a value of 3500, representing a high level of confidence due to the accuracy of hardware.

Camera

Camera data are returned as a wide-angle video feed, distorted both radially and geometrically. The

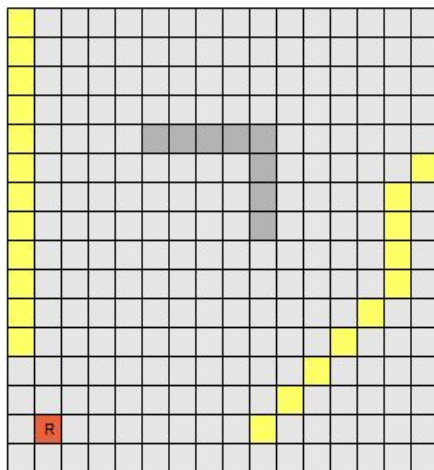


Figure 5.2: Map after Camera Data Added

image is processed to generate a 181-element array.

Obstacles are detected through an image analysis algorithm which detects a number of user defined values. Specifically, Archon looks for white boundary lines used to denote the course and for the flags introduced for this year's competition. Distance measurements to obstacles are recorded in the camera array index corresponding to the vector of the detected obstacle. While accurate, camera detected obstacles are deemed to be of lower confidence than LMS detected obstacles and are assigned a lower weight.

Map Augmentation

The third step is map augmentation. Archon views itself as occupying a single 4"x4" node. In order to prevent collisions Archon employs a "fat layer", a buffer zone imposed on all detected obstacles that helps Archon avoid the detected obstacles. This fat layer is adjustable, with a typical value of 4 and providing a minimum usable gap of 32 inches between the robot and detected obstacles. During path planning, map squares denoted as fat are treated as obstacles. Archon has a frame width of 26 inches, providing a minimum of 3" clearance on each side of a detected obstacle. Should additional clearance be desired, the fat layer can be increased in the field, pushing Archon further away from detected obstacles.

Goal Selection

Goal selection is the process by which Archon determines a destination. As Archon's map is only an 80x80 grid, an interim goal is chosen if the desired goal is beyond the range of the current map. This interim goal is selected via a dynamic weighting algorithm whereby the goal

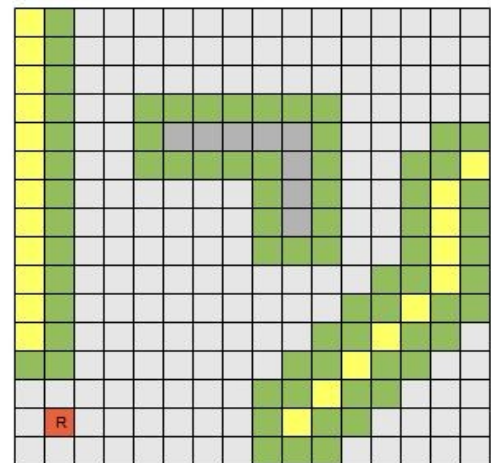


Figure 5.3: Map after Fat Layer Added

node is selected using a number of parameters: straight, distance, gap, slant, and final destination (user supplied waypoints). Any of these weights, including the waypoints, can be disabled without impeding the basic functionality of Archon. All parameters are user defined and can be adjusted in the field by a human controller. This allows for dynamic adjustment of Archon's goal selection preferences.

Characteristic	Definition
d	A measure in meters of the distance between the robot and the possible goal node
α	A measure in degrees of how in line a possible goal node is with the actual direction of the GPS waypoint with respect to the robot
β	A measure in degrees of how in line a possible goal node is with the straight ahead direction of the robot
S	A measure of how in line the node is with the slant of the map (Slant is discussed below)
G	A measure of the gap on either side of the possible goal node if obstacles are present. (Gap is discussed below.)

[Figure 5.4 Definition of goal node characteristics

$$Weight = (d \times P_d) + (\alpha \times P_\alpha) + (\beta \times P_\beta) + (S \times P_S) + (G \times P_G)$$

Equation 1: Weight Equation

Slant is the direction that objects on the map tend to follow. An example is path that tends to bear to the northwest. Archon will notice this tendency and tend to favor a path following the same bearing.

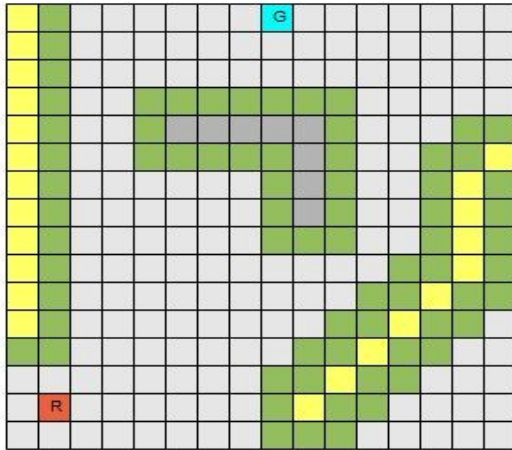


Figure 5.5: Map after goal node selection

Gap measures the amount of space on either side of a potential goal node. Archon will have the tendency to choose the widest gap that is less than or equal to a predefined width. Since the obstacle course at IGCV has a known maximum width, Archon can be instructed to prefer paths of less than this known width if available.

The goal selection process itself begins at the robot's node and iterates through all allowed nodes with a potential path. An allowed node is one which is not occupied by an obstacle or fat. As each row is iterated through all gaps in the row are identified and the center node of each gap is evaluated using the cost equation. If the evaluated node has a better cost than the current candidate goal node, it becomes the new candidate goal node. This process will continue until either all rows have been evaluated or there is no path to the next row. At this point, the candidate goal node is assigned a weight of zero.

Path Planning

Path selection consists of three sub-processes: the ripple algorithm, the waterfall algorithm, and the smoothing algorithm. This process creates an optimal path to the goal node. The goal selection algorithm assures that a valid path to the goal will always be available.

ripple.

The ripple algorithm assigns a weight to all map nodes not occupied by an obstacle (Snider, 2004). This process begins with the goal node and executes using a breadth first strategy. A recursive algorithm continues checking nodes adjacent to nodes already assigned a value by the ripple algorithm until no valid adjacent nodes remain.

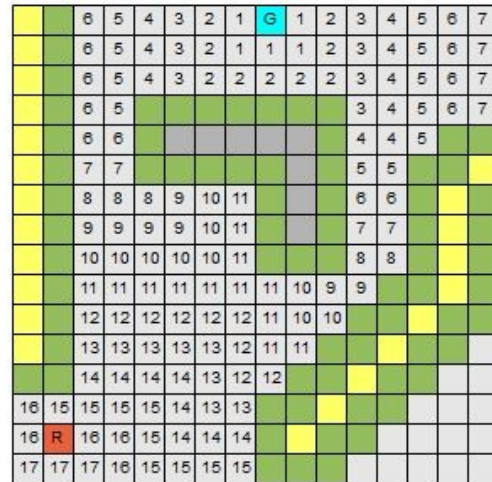


Figure 5.7: Map after ripple algorithm

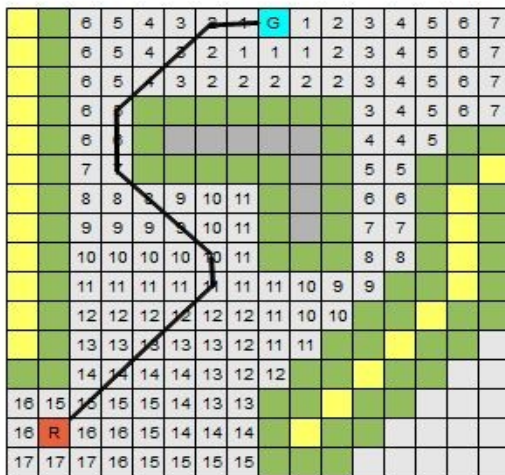


Figure 5.8: Map after path selection

path selection.

The waterfall algorithm, based on the well-known A* algorithm (Dechter, 1985), finds an optimal path from Archon to the goal node. Starting with Archon, all nodes surrounding the current step in the path selection process are evaluated and the node with the lowest value is chosen as the next node in the path. In case of a tie,

a cost equation decides which node to use. As with the A* algorithm, we are guaranteed that the selected path is optimal in terms of number of nodes in the selected path.

A special case algorithm has been implemented if a pair of flags has been detected on the map between Archon and its next designated waypoint. If this special case is detected, path selection always passes between the detected flags.

smoother.

The path selection of the Waterfall algorithm (Snider, 2004), is restricted to 45° and 90° turns. This limitation is overcome in Archon by usage of a smoothing algorithm to “cut corners.” Smoothed paths always avoid taking Archon across a node occupied by an obstacle. This allows Archon to take a straight-line path whenever available, resulting in an optimal path as measured in real-world distances.

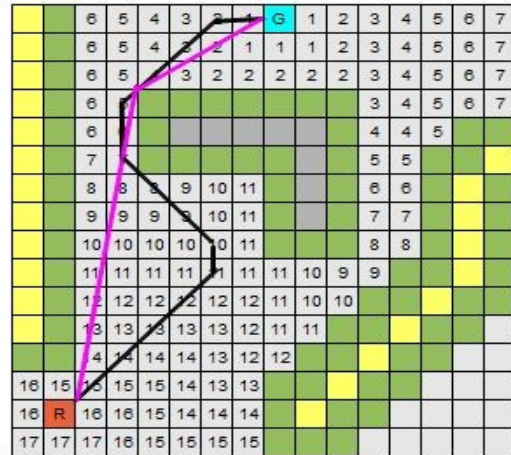


Figure 5.9: Map after smoother

Control Decisions

With path planning completed Archon implements its pathing decision. Robot speed is dynamically adjusted based upon the length of the first straight line segment of the planned path (Snider, 2004). Archon travels at minimal speed when faced with nearby obstacles, speeding up as longer segments of clear space become available. This strategy allows Archon sufficient time to react while in tight quarters.

Control decisions are output as serially separate speed commands for each servo. The serial speed commands are then processed by a separate micro-controller, which in turn provides an analog signal to Archon's servos.

Conclusion

Archon is performing reliably in both field testing and lab simulations. Reaction time in a dynamically changing environment has been trimmed to 60 milliseconds, with further time reductions possible. Obstacle course navigation and waypoint navigation are integrated into a single system - a long term goal of the robotics team finally being realized.

Efficiency improvements were primarily due to an order-of-magnitude improvement in Archon's ripple algorithm. Previously the computational cost of this algorithm was $O(N^3)$, the new algorithm has a computational cost of $O(N)$!

Further efficiency improvements have been realized in the analysis of captured video data. The computational cost of captured video frames has been reduced by 75%. Refinement of the video processing algorithm remains a focus for future efficiency improvements

Archon is an autonomous ground vehicle. It consistently demonstrates the ability to locate and navigate towards a series of defined goals using only onboard sensors and systems. It does so both in indoor environments and in field environments. It navigates using real-time information, without *á priori* maps. Archon has furthered, and continues to expand, the limits of what is possible in the field of autonomous ground vehicles.

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