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Contact in Belugas *(Delphinapterus leucas)*

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Abstract

Contact plays a significant role in regulating the physical development and behaviors of humans and their relationships with each other. Contact also influences the behavior and associations of delphinids and other cetaceans. Little is known about belugas (Delphinapterus leucas) and the role of contact in their social interactions. The purpose of the present study was to investigate the degree of physical contact displayed by a group of 8 adult and juvenile/infant belugas located at Sea World San Antonio. The frequency, duration, initiator, receiver, and body parts used or touched were recorded using 10-min focal-follows 3 days a week during park operating hours. A total of 27 contact events occurred across 128 observation sessions. Contact occurred at a rate of .02 events per minute. Most of the contact events were initiated by the three non-adult belugas, during affiliative play interactions and were short in duration, average. A third of the events occurred between a mother-calf pair while the calf was in infant position and lasted longer than most social interactions, on average. Contact is rare in beluga interactions but may be important in the development of young beluga relationships. In contrast, social interactions between adult belugas seem to be facilitated by something other than contact.

As the largest sense organ and one of the first sensory systems to develop for many animal species, the role of contact is critical to the survival and welfare of many animals (Field, 2010; Montague, 2001; Moszkowski & Stack, 2007). Contact is defined as the state or condition in which the external surfaces of two bodies touch one other (Oxford-English Dictionary, 2011). Touch is a type of contact in which an individual puts a body part on top of another part so as to create a tactile sensation (Merriam-Webster Dictionary, 2011).

In humans, touch is known to promote the physical and cognitive well-being of individuals. During prenatal development, fetuses receive and initiate frequent tactile stimulation while moving in utero and exploring their bodies, such as sucking their fingers or thumbs and grabbing their umbilical cord (Dieter, Field, Hernandez-Reif, Emory, & Redzepi, 2003, as cited in Field, 2010; Lagercrantz & Changeuz, 2009, as cited in Field, 2010). Following birth, studies on massage therapy have suggested that infants who receive moderate massages develop faster and gain more weight than infants receiving light massages (Field, Diego, Hernandez-Reif, Deeds, & Figuereido, 2006). Touch seems particularly important for infants born prematurely as premature infants who receive skin-to-skin contact develop faster than premature infants who were not touched (Feldman & Eidelman, 2003; Ferber, Feldman, & Makhoul, 2008, as cited in Field, 2010). Throughout infancy, touch occurs frequently as it is experienced through cuddling, breastfeeding, and thumb-sucking (Bellieni, 2007, as cited in Field, 2010; Field 2010). In fact, many studies have suggested that touch decreases blood pressure, heart rate, cortisol levels, and increases oxytocin levels, all of which are vital for infant development and growth (Field, 2010; Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003; Henricson, Berglund, Määttä, Ekman, & Segesten, 2008). Infants and children who have been deprived of contact also experience deficits in their cognitive welfare. Infants who were not touched while living in an institutional setting showed cognitive delays (MacLean, 2003) while children raised in a similar setting displayed cognitive skills that were below average as compared to children who grew up in families (Field, 2010).

Touch also helps infants communicate with their mothers and regulate their own emotions. Recent studies have demonstrated the effects of emotional availability of mothers on their infants' contact behavior (Moszkowski & Stack, 2007; Moszkowski, Stack, Girouard, Field, Hernandez-Reif, & Diego, 2009). Using experimental manipulations (i.e., a still-face procedure, SF, a mother presents a neutral face in which no emotional expression is provided) and naturalistic contexts (i.e., maternal depression vs no maternal depression), these studies found that infants directed more active touches (e.g., strokes, finger, pats, and pulls) toward themselves and spent more time touching themselves when mothers were emotionally unavailable during the still face condition (Moszkowski & Stack, 2007) or a depressed state (Moszkowski et al., 2009). These bouts of self-touch were hypothesized to soothe the infants and/or to help regulate their emotions. When typical mother-infant interactions were examined, the infants engaged in more passive touches toward themselves (e.g., unmoving, static contact such that a touch was maintained for some period of time) and spent more time touching their mothers. The authors suggested that these changes in touch was related to the fact that the mothers were emotionally available to help the infants regulate their internal states, and the infants did not have to perform their own tactile stimulation (Moszkowski & Stack, 2007).

During childhood, touch continues to play an important role such that studies involving children and adolescents have indicated that the lack of affectionate touch is

related to negative consequences (e.g., increased aggression). One cross-cultural study compared levels of physical affection by parents with pre-school-aged children living in either Miami, Florida or France. French parents were more physically affectionate than American parents, and French children were less aggressive than American children (Field, 1999b, as cited in Field, 2010). The results of this study suggest that the level of physical affection received by children at young ages may influence their level of aggression. An observational study conducted with French and American adolescents supported this interpretation as American adolescents displayed more verbal aggression than French adolescents (Field, 1999a). This observational study also suggested that American adolescents engaged in more self-touching than the French adolescents (Field, 1999a). As children grow touch continues to play an essential role, and when there is insufficient tactile stimulation, self-stimulation seems to increase.

Touch is also significant in the socioemotional regulation of adults. Adults often use touch to convey and communicate different emotions (Elfenbein & Ambady, 2002). One study demonstrated that a receiving participant correctly identified the touch of a sender who was attempting to portray a randomly selected emotion word via a touch on the forearm, 48%-84% of the trials (Hertenstein, Keltner, App, Bulleit, & Jaskolka, 2006). Thus, touch seems to be important medium by which humans communicate emotions.

Humans may also use touch to influence others such as when one wishes to increase compliance. People are more likely to give something if they are touched when a request is made (Guéguen & Fischer-Lokou, 2003). Interestingly, the frequency of touch also affects compliance. Participants were asked to complete a questionnaire while not being touched, touched once, or touched twice. The results showed that participants who were touched twice instead of once or not at all were more likely to complete the questionnaire (Vaidis & Halime-Falkowicz, 2008). Finally, physical touch is correlated with relationship and partner satisfaction. The more touch that occurs between partners the higher their satisfaction with their relationship and partner (Gulledge & Fischer-Lokou, 2003, as cited in Field, 2010). In fact, the absence of touch can prevent romantic relationships from forming (Gulledge & Fischer-Lokou, 2003, as cited in Field, 2010). In summary, it is clear that touch plays a significant role in many aspects of a human's life.

Although much of the extant literature on contact is centered on humans (Field, 2010; Montague, 2001; Moszkowski & Stack, 2007), research on contact between marine mammals has experienced significant growth (Brown, 2001; Connor, Mann, & Watson-Capps, 2006; Dudzinski, Gregg, Ribic, & Kuczaj, 2009; Mann & Smuts, 1999; Tamaki, Morisaka, & Taki, 2006). The human literature has indicated that touch plays a significant role in regulating the physical development and behaviors of an individual as well as the relationships between individuals. The research on contact in delphinids has also suggested that contact influences the behavior of individuals and the relationships between individuals.

From a developmental perspective, contact between mothers and their calves occurs in a variety of contexts and may serve several functions (Gubbins, McCowan, Lynn, Hooper, & Reiss, 1999; Mann & Smuts, 1999; Weihs, 2004). A longitudinal study on wild bottlenose dolphins (*Tursiops* sp.) in Shark Bay, Western Australia focused on the behavioral development and mother-calf relationship in nine newborn calves (Mann & Smuts, 1999). Contact occurred during a variety of activities, including infant position swimming, echelon swimming, and social interactions that were affiliative, such as petting, rubbing, or aggressive, such as raking or ramming.

As described in Table 1, calves often swim just below their mothers positioned near the mammary slits. This infant position has several functions including safety, nutrition, comfort, rest, and protection (Gubbins et al., 1999; Mann & Smuts, 1999; Weihs, 2004). Similarly, when the calves swim slightly above and to the side of the mother's dorsal fin (i.e., echelon swim), the calves are protected and able to rest when they are very young (Gubbins et al., 1999; Weihs, 2004). Contact occurring between the calves and their mothers or other dolphins during social interactions includes a broad range of behaviors (e.g., petting, rubbing, mounting, chases, genital inspections, gooses, pokes, play, and aggressive actions like raking and ramming) (Mann & Smuts, 1999). Definitions for each type of behavior of interest are presented in Table 1 and were adapted from Mann and Smuts (1999) and Dudzinski, Gregg, Ribic, and Kuczaj (2009).

Table 1

Operational Definitions for Specific Contact Behaviors

Target Behavior	Operational Definition
Contact	One individual touches with some body part another individual's body part (Dudzinski et al., 2009; Hill, 2009)
Touches	Physical contact between one individual and another individual (Dudzinski et al., 2009)
Aggressive	Interactions between two individuals that consist of threatening behaviors such as chasing, biting, hitting, body slamming, head butting, head jerking, and jaw clapping actions (Tamaki et al., 2006)
Affiliative	Gentle contact (Connor, Mann, & Watson-Capps, 2006); Friendly interactions that may consist of rubbing, petting, contact swimming, chases, and positive behaviors between two individuals (Hill, 2009)
Rubbing	An active movement of one body part of one individual to another body part of another individual (Dudzinski et al., 2009); gentle contact where one beluga rubs a body part on another individual's body part(Mann & Smuts, 1999)
Petting	An active movement of one individual's pectoral fin to another individual's pectoral fin (Dudzinski et al., 2009); resembles to 'grooming' in primates, one individual moves pectoral fins or flukes another individual's body (Mann & Smuts, 1999)

Contact swimming	One [animal](actor) rests its pectoral fin against the flank of another [individual] behind the other [animal's] pectoral fin and below or just posterior to the dorsal fin. Actor is positioned alongside and just above the other within 1/3 of a meter and 1/3-1/2 m behind the tip of the other's rostrum (Connor et al., 2006)
Echelon swimming	Swimming that involves contact where one individual, usually the calf, is at the side of another individual, usually the mother, and they swim parallel touching each other's body (Mann & Smuts, 1999)
Infant position	Calf swims underneath the mother touching the mother's body/abdomen area with its' head/melon; infant position breaks and contact ends when the calf comes out from under to surface (Mann & Smuts, 1999), this position resembles below the cow, *at* the cow's belly, and *at* the cow's tail(Krasnova et al., 2006)

Contact behaviors have been operationally defined and studies have indicated the importance of various contact events in relationship development and maintenance. Focal follows on male and female bottlenose dolphins in Shark Bay, Western Australia have indicated that touch is very important for both sexes but for different reasons (Connor, Mann, Watson-Capps, 2006). Affiliative behaviors or gentle contact behaviors, which are important for bonds, are demonstrated through petting, rubbing, or contact swimming (Aureli, Cords, & van Schaik, 2002; Connor, Mann, & Watson-Capps, 2006; DeVries, Glasper, & Detillion, 2003). Contact swimming is the most frequent form of touch observed in female dolphins in Shark Bay and appears to increase during stressful situations, decrease/prevent male harassment, increase female bonding, and provide locomotion in dolphin calves (Connor et al., 2006). Thus, the purpose of contact swimming is thought to be affiliative in nature as it seems to strengthen, maintain, and establish bonds between adult female dolphins and their offspring (Connor et al., 2006).

For male dolphins, contact swimming does not occur as frequently as in females. Rather, male dolphins contact each other most often through petting (Connor et al., 2006). This petting behavior may facilitate the bonds and alliances males form with one another to enhance their reproductive successes and prevent harassment from other male dolphins (Connor, Smolker, & Richards, 1992, as cited in Tamaki, Morisaka, & Taki, 2006)

In two other wild populations of dolphins, the functions and rates of contact behaviors (petting, rubbing, touching) have also been observed (Dudzinski et al., 2009). Using 12 years of data collected on Indo-Pacific bottlenose dolphins *(Tursiops aduncus)* from Mikura Island, Japan and Atlantic spotted dolphins *(Stenella frontalis)* from Little Bahama Bank, The Bahamas, the rates of contact were similar in both sites. Both species of dolphins engaged in rubbing more often than petting and both species preferred to engage in same sex rubbing and same age classes. The function of rubbing was interpreted as social and relationship maintenance and not for hygienic or self-stimulation purposes (Dudzinski et al., 2009).

Contact also contributes to relationship repairs in dolphins (Tamaki, Morisaka,

& Taki, 2006). Affiliative behaviors (e.g., flipper-rubbing) and aggressive behaviors (e.g., head jerking, jaw clapping, biting, hitting, head butting, chasing, and body slamming) were observed within the context of relationships in which aggression had occurred. Flipper-rubbing was associated with longer periods between aggressive events. When a bout of aggression occurred, flipper-rubbing increased following the aggressive event. Contact in this context functioned as a tool to repair and maintain relationships in dolphins.

Although, belugas (*Delphinapterus leucas*) belong to the same order and suborder as the Delphinidae family, belugas are considered a unique species (Krasnova, Bel'kovich, & Chernetsky, 2006). Unfortunately, the role of contact in beluga behavior and interactions has rarely been addressed and only within the mother-calf context (Krasnova, Bel'kovich, & Chernetsky, 2006). While beluga mother-calf relationships (Hill, 2009; Krasnova, Bel'kovich, & Chernetsky, 2006) seem to function like dolphin mother-calf relationships (Connor, Mann, & Watson-Capps, 2006; Mann & Smuts, 1999; Tamaki, Morisaka, & Taki, 2006), a limited amount of information is available. Like dolphins, beluga calves immediately swim and begin to follow their mothers at birth (Hill, 2009; Krasnova et al., 2006). Similarly the beluga calves increase their distance and duration away from the mother as they mature (Hill, 2009; Krasnova et al., 2006). Beluga calves also display different swim positions while swimming with their mothers (Krasnova et al., 2006). As with the dolphins, these different swim positions allow for different degrees of contact between the beluga mother and her calf.

In belugas, during the first days of life, the calf is usually *at* the cow's side or *at* the cow's tail because it facilitates movement through the water. These positions resemble the infant position displayed by dolphins (Gubbins et al., 1999; Krasnova et al., 2006; Mann & Smuts, 1999) and may or may not involve contact. Beluga calves spend longer and stable periods of time *at* the mother's side as they mature. Again, contact may be intermittent while in this swim position. On the other hand, positions that require high coordination, strength, and extended contact (e.g., *on* the mother's back or *on* the mother's tail) are shorter in duration. These positions are often avoided early in development because of their physical difficulty. As calves mature, they become more independent, spend less time at their mother's side, and swim ahead of the mother or *at* the mother's head more often. The increase in distance that occurs between calves and their mothers during this period decreases contact due to close proximity and increases the opportunity for intentional contact interactions.

Existing research with humans suggested that touch has many therapeutic benefits on the immune system, growth, breathing, heart rate, and levels of stress and anxiety (Field, 2001). Previous research with dolphins indicated that touch may decrease aggressive behaviors, increase female bonding, mend relationships, and provide positive developmental and social effects on infants (Connor et al., 2006; Dudzinski et al., 2009; Mann & Smuts, 1999; Tamaki et al., 2006). As little is known about belugas and the role of contact in their interactions, the purpose of the present study was to investigate the degree of physical contact displayed by a group of adult and juvenile/infant belugas in the care of humans. The frequency, duration, initiator, receiver and body parts used or touched were recorded. Thus, the following questions guided the current study:

1. How often and with what body parts does contact occur between belugas during different interactions?
2. If contact occurs, what role does contact play in the social interactions and relationships of belugas?

Method

Subjects

The subjects included eight belugas (*Delphinapterus leucas*) housed at Sea World San Antonio (SWSA): ATL, BEL, CRI, IMA, LUN, MAR, NAT, and OLI. Each beluga was identified using a variety of physical characteristics, including size, coloration, and the presence of unique markings. Given the scope of the study, genetic lineage and age are provided as they may be important factors in the study.

LUN, an 11 year-old captive-born female, was the older sister of OLI, a 4 year-old male, and the mother of ATL, a 1 year-old female. CRI, a wild-born female approximately 25 years old is the mother of BEL, a 2 year-old female. The remaining belugas do not share a genetic lineage with any of the population and are the following ages and sex: IMA, wild-born male approximately 25 years, MAR, wild-born female approximately 28 years, and NAT, wild-born female approximately 25 years. The belugas were classified into three age groups: infant, juvenile, or adult. Among the eight belugas, there were two infants, ATL and BEL, one juvenile, OLI, and five adults, CRI, IMA, LUN, MAR, and NAT.

Facility

The data were collected at the White Whale and Dolphin Stadium at SWSA, which consisted of seven interconnected pools. See Figure 1 for a diagram of the facility. Pool A is the main front pool where shows are held, and consists of a glass display that allowed underwater viewing. Pools B1, B2, C, D1, and D2 were located in the backstage of the facility and accommodated only above water observations. The last pool was the MED pool where observations were limited. See Figure 1.
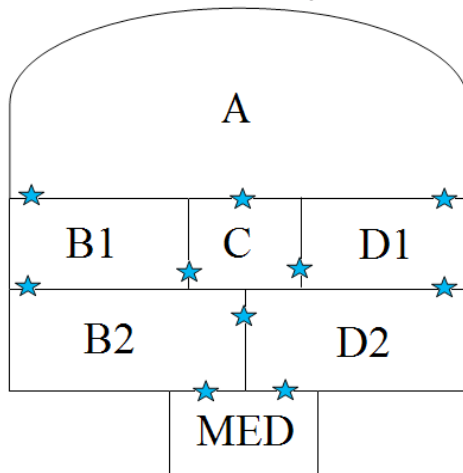

Figure 1. Schematic diagram of the facility, White Whale and Dolphin Stadium at SWSA. Stars represent location of the gates that connect pools. Diagram is not drawn to scale.

Measures

An ethogram used in previous research (Finn, Hill, & Kuczaj, 2007) was modified for the current study to record the contact behaviors of interest. Using a stopwatch and the ethogram for each beluga, the following information was recorded: the beluga to be

observed, the beluga that initiated or received contact, the pool in which the belugas were located during the observation, time of observations, companions in pool, and the type of contact and body part used to contact another animal (e.g., touch with body, touch with head, touch with pectoral fin, and touch with fluke). The frequency and duration of all observed contact behaviors were recorded. To allow consistency in recording of what body parts were used to initiate or receive contact the beluga was divided into four areas: head, body, pectoral fins, and flukes. See Figure 2. Table 2 lists all the operational definitions of the variables of interest for this study.
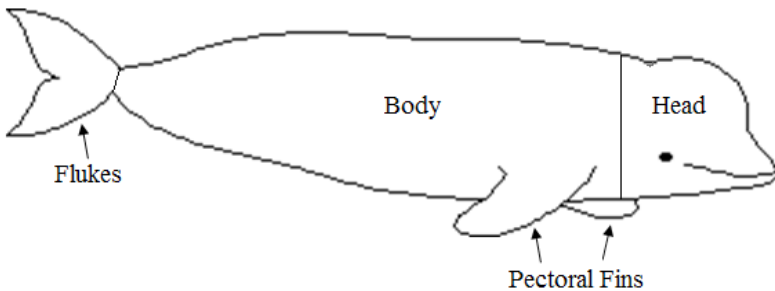

Figure 2. Schematic diagram of the body parts on Beluga whale. Beluga whale is divided into four body parts where contact behaviors were observed. (Diagram adapted from Col, 1998.)

Procedure

The data were collected three days a week during park operating hours between 8:00 am and 12:00 pm. A 10-min, focal-follow of individual belugas was used to collect the data. Several parameters were set to help control for potential biases including dependence of observations, unequal observation time, and the influence of people. The order of beluga observations was randomly determined each day. If belugas were housed in separate social groupings, observations were alternated between each social grouping to control for potential behavioral influences, when possible. If belugas were housed in the same social grouping every effort was made to alternate among the different belugas. Specifically, after observing beluga "A" for 10 min a one-min interval of no observation time was conducted. This procedure attempted to control for carryover effects such that contact behavior or social interaction between two belugas continuing from the first 10-min observation period could end. Contact events occurring between non-focal belugas during the observation session were not recorded. All observations were conducted outside of training sessions and at times when a minimal number of people were present. Contact events occurring between non-focal belugas during the observation session were not recorded. All observations were conducted outside of training sessions and at times when a minimal number of people were present.

Table 2 *Operational Definitions for Variables of Interest*

Target Behavior	Operational Definition
Initiator of Contact	Beluga that makes the first move or starts of the interaction of contact; beluga that made the contact on another beluga
Recipient of Contact	Beluga that receives contact from another beluga; beluga that gets touched by another beluga
Body Parts	A beluga can either initiate contact with four different body areas or receive contact in four different body areas:
Body	Beluga made contact with the use of its body or received contact on its body, which includes dorsal ridge, stomach, any body area from its neck down to the deeply notched centre that connect the body to the flukes
Head	Beluga made contact with the use of its head or received contact on its head, which includes any body area from the neck up (e.g. eyes, melon, mouth/beak)
Pectoral fins	Beluga made contact with the use of its pectoral fin or received contact on its pectoral fin, which are the two rounded flippers on the sides of the body
Flukes	Beluga made contact with the use of its flukes or received contact on its flukes, which is from the broad tail to the deeply notched centre

Observations were started once a beluga was identified. The companions, starting and ending times and beluga location were recorded on the ethogram. When a gate was opened between two pools, both pool names were recorded. The stopwatch was started when body-to-body contact was observed between the observed beluga and another beluga. The stopwatch was stopped once there was no body-to-body contact and the time was recorded on the ethogram. Contact behaviors were recorded in seconds. This procedure was repeated for each contact event that occurred during the 10-min observation. During observations it was assumed that the observed beluga initiated all the observed behaviors, and contact behaviors were recorded under the beluga's name that received the contact. However, whenever an observed beluga received contact from another beluga, the event was recorded in the notes section of the ethogram indicating that the focal animal received a contact event on a specific body part from another animal who initiated the event with an identified body part.

Data Analyses

All the data were transferred to a database so that analyses with SPSS© 17 could be performed. The data were entered as individual events for every observation session conducted for each animal. The data were then collapsed across each session for each animal so that if multiple contact events occurred within the same data session, they were summarized into one line of data. Using the summarized data, descriptive statistics were conducted. Two Chi square tests of independence were conducted to examine the frequency of events that were initiated by individual animals and received by individual animals.

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Results

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Observation Sessions

Each beluga was observed 16 times for a total of 128 sessions. The total observation time was 21 hours and 20 minutes. Individual belugas were observed for a total of 2 hours and 40 minutes each.

Contact Events

A total of 27 contact events occurred across the 128 observation sessions. Contact occurred at a rate of .02 events per minute. All, but two, contact events were initiated by the three non-adult belugas. Nine of the events occurred between BEL and her mother, CRI, while swimming together in the infant position. The remaining 18 contact events occurred during affiliative play interaction and were initiated by BEL, OLI, CRI or received by BEL, ATL, or CRI during their individual sessions. Out of the 27 contact events, without taking into account whose observations session it was, BEL initiated 18, OLI initiated 7, and CRI initiated 2 events. BEL initiated 2 events with ATL, and 16 events with CRI. OLI initiated 6 events with LUN, and 1 event with BEL. CRI initiated 2 events with BEL.

Two chi square tests-of-independence were conducted to assess the relationship between the frequency of contact events and the animal initiating or receiving the contact. The results indicated that several individuals initiated and received significantly more contact than the remaining animals, χ^2 (7, $N = 143$) = 43.40, p < .001, $V = .55$ and χ^2 (7, $N = 143$) = 29.99, p < .001, $V = .46$, respectively. BEL and OLI initiated significantly more contact with others than expected by chance alone. CRI received significantly more contact from others than expected by chance alone.

As summarized in Table 3, contact events occurring during mother-calf infant swims lasted longer than contact events occurring during social interactions. As the demonstrated by the range and standard deviation, infant swims varied greatly in their durations. Contact events during social interactions were much briefer and did not range as dramatically.

Table 3

Contact Events in Belugas

Type of Contact Events	N	Mean	SD	Range
Mother-Calf Contact Events	9	36.86	44.80	8-133.37
Social Contact Events	18	2.39	1.97	1-20.36

BEL. Out of the 27 contact events 11 contact events were observed during BEL's observation sessions, and BEL initiated 10 of the events (91%) for a total duration of 334.78 sec. Nine of the contact events occurred during the infant position and accounted for 3.45% (331.78 sec) of BEL's total observation time. Her remaining two events were during a social interaction with ATL for 3 sec, in which BEL initiated head-to-head contact with ATL, and during a social interaction with CRI for 1 sec, in which BEL received body-to-body contact with CRI. These events accounted for less than 1% of BEL's total observation time. Out of the 27 contact events BEL initiated 37% of the events and received 3.7% of the events during her observation sessions ($N = 10$).

OLI. Out of the 27 contact events, seven contact events were observed during OLI's observation sessions, and OLI initiated all of the events (100%) for a total duration of 15 sec. OLI directed six out if his seven events towards his older sister, LUN, and directed the remaining contact event towards BEL. These social contact events accounted for 0.16% of his total observation time. Five out of the seven contact behaviors involved OLI using his head to touch LUN's peduncle/fluke area (71% of OLI contact events) for a total duration of 13 sec. The remaining contact events initiated by OLI involved OLI using his pectoral fin to touch BEL's body for 1 sec ($N = 1$) and using his body to touch LUN's body for one sec ($N = 1$). Out of the 27 contact events OLI initiated 26% of the events during his observation sessions ($N = 7$).

ATL. Out of the 27 observed contact events ATL received one contact event from BEL during ATL's observation sessions. This contact event consisted of ATL receiving body-to-body contact initiated by BEL and lasted 2 sec, which accounts for 0.02% of ATL's total observation time. Out of the 27 contact events ATL received 3.7% of the events during her observation sessions ($N = 1$).

CRI. Finally, out of the 27 contact events, eight contact events were observed during CRI's observation sessions. CRI initiated one of the events (12.5%) for a total duration of 1.60 sec, and received seven of the events (87.5%) for a total duration of 20.36 sec. These contact events occurred during mother-calf social interactions between CRI and BEL, accounting for 0.23% of her total observation time. All eight social contact events involved body-to-body contact between mother and calf. Out of the 27 contact events, CRI initiated 3.7% of the events and received 26% of the events during her observation sessions ($N = 8$) for a grand total of 21.96 sec.

Adults. No contact events were observed for any of the adults, with the exception of the mother-calf infant swim and social interactions between CRI and BEL captured during BEL's and CRI's observation periods. Thus, out of a total 48,000 sec (i.e., 800 min) of observation for all adult belugas, no contact occurred between adults.

Discussion

The purpose of this study was to investigate the degree and nature of physical contact between belugas. Specifically, how often and with what body part did contact occur between belugas during different interactions? What role did contact play in the social interactions and relationships of belugas?

Frequency of Contact

Out of 76,800 sec of total observation time in eight belugas, contact was observed 0.49% of the time and no contact was observed 99.51% of the time. Contact events were observed to occur between mother-calf ($N = 18$), siblings ($N = 6$), and calves ($N = 3$). A lower rate of contact was found in belugas (0.02 events per minute) than was observed in a previous study with two different population of dolphins (Dudzinski et al., 2009). Contact occurred at equal rates between the two dolphin populations (Mikura Island =

0.37 events per minute and The Bahamas = 0.27 events per minute) and were 13 to 19 times more frequent than what was observed for the belugas. Clearly contact behaviors occurred infrequently for the belugas. These differences in contact rate may be due to a species difference, the living conditions, or insufficient data. The first two options seem more likely as this first empirical study of contact in a captive beluga population confirmed previous anecdotal reports of the lack of contact in adult belugas.

Contexts and Nature of Contact

A third of the observed contact events occurred during mother-infant interactions, while two-thirds of the observed contact events occurred during social interactions. However, more time was spent making contact during mother-calf interactions (0.43%) than during social interactions (0.06%). Depending on the context of contact, different body parts were used to make contact, such that contact events during social interactions allowed more flexibility on what body parts were used and touched when compared to the mother-calf interactions. Contact events ($N = 9$) only involved head-to-body contact during one mother-calf pair interactions. That is, when BEL swam with her mother for comfort, nutrition, or fatigue and contact occurred, contact occurred while BEL was in the infant position, a behavior that precludes the use of body parts other than initiator's head and the recipient's body. As observed by many other researchers, animals swimming in the infant position are not always in contact with their swim companion (Gubbins et al., 1999; Mann & Smuts, 1999; Weihs, 2004). Additional research should focus on how often animals swim in the infant position with and without contact to determine the role of contact while in this position.

In contrast, contact events during social interactions ($N = 18$) involved more body part combinations, including body-to-body (61%), head–to-flukes (28%), head–to-head (6%), and pectoral fins-to-body (6%). This difference in body parts used and touched depending on the context may be related to the nature of social interactions. All of the contact events observed during social interactions occurred during affiliative play and games involving younger belugas. Young belugas initiate social interactions from many different angles. They may chase each another, head butt, swim over or under, or circle around one another. All of these different types of interactions require a degree of flexibility in the body part to be used or contacted. The play bouts may also provide opportunities for younger animals to build their strength and test the skills and strength of each other, all important characteristics for a developing young. Unlike the young belugas, adult belugas were never observed touching one another. Considering the gregarious and social nature reported for belugas and their behavioral similarities to dolphins (Hill, 2009; Krasnova et al., 2006), one would expect some degree of contact between adult belugas. Thus, it is currently unclear why adult belugas did not engage in physical contact with one another during social interactions. Additional research with belugas located in different facilities and in their natural habitat is needed to better understand this lack of contact.

Initiation and Reception of Contact

Out of the 27 observed contact events 93% of them were initiated by non-adult belugas, a behavior pattern observed previously with dolphins in which calves initiated social interactions 99.9% of the observed time (Dudzinski et al., 2009; Mann & Smuts, 1999). Of the contact events that occurred while the bonded beluga calf swam with her mother, the calf initiated all of the events. This initiation of contact by the calf may be related to the observation that beluga calves appear to be the keeper of proximity with their mothers at very early ages (Hill, 2009) and corresponds to previous findings with dolphin calves (Dudzinski et al., 2009; Mann & Smuts, 1999). The type of contact

observed between this mother-calf pair was similar to previously observed beluga mother-calf positions, including *below* the cow, *at* the cow's belly, and *at* the cow's tail, all of which require little coordination and strength (Krasnova et al., 2006). Although the calf was two-years-old and was expected to be able to engage in positions requiring higher levels of coordination, strength, and extended contact, such as *on* the mother's back or *on* the mother's tail (Krasnova et al., 2006), she did not display these positions during observations. Additional research should be conducted to continue to examine the influence of age on the nature of mother-calf contact.

As expected from previous research with dolphins (Mann & Smuts, 1999), the contact events that occurred during social contexts were generally initiated by the younger belugas and directed toward older belugas, although a slightly older beluga did contact a younger beluga on occasion. One interpretation of this discrepancy in initiation and age may relate to the position of dominance held by the individuals involved in the social interaction. For example, social interactions with contact may allow younger animals to establish a submissive yet conciliatory relationship with older, more dominant peers. This example is reminiscent of the flipper-rubbing observed in dolphins following aggressive interactions or the initiation of social interactions by young dolphins with their older conspecifics (Aureli et al., 2002; Connor et al., 2006; DeVries et al., 2003). Future research should continue to explore the roles of the initiator and recipients and the contexts in which contact occurs, including dominance hierarchies.

Functions of Contact in Cetaceans

The current study provided some insight into the possible functions of contact for belugas. Unlike dolphins (Connor et al., 2006; Dudzinski et al., 2009; Mann & Smuts, 1999; Tamaki et al., 2006), contact between belugas in the current study was rare. When it did occur, it primarily occurred between young animals involved in playful social interactions followed by contact between a mother-calf pair during an infant position swim. No contact was observed occurring between adults. The nature of contact between the young animals was very similar to previous research conducted with dolphins in which dolphin calves frequently contacted one another or their mothers during play bouts (Dudzinski et al., 2009; Mann & Smuts, 1999). Interpretations of the function of contact in bottlenose dolphin calves include relationship development and maintenance of relationships and identification of physical ability (Tamaki et al., 2006). The nature of the contact events observed between young belugas provides some support for the interpretation of relationship development. Their contact events were brief and flexible regarding body parts used and contacted. The variability and brief durations may allow young belugas to test the strength of their peers. This interpretation seems to be supported by the fact that the contact events were often initiated by younger, less dominant animals and directed towards older, more dominant animals.

Additional support that contact may enhance the development of a relationship is provided by the contact events between mothers and their calves. Specifically, the beluga population in the current study consisted of two mother-calf pairs: CRI-BEL and LUN-ATL. CRI and BEL, who would be characterized as having a bond between each other, engaged in all of the contact events observed involving mothers and their calves. Their contact events contrasted dramatically to the lack of contact and mother-calf swims with the other mother-calf pair, LUN-ATL, who had not bonded. As the current study only incorporated two mother-calf pairs, additional research should be conducted with more mother-calf pairs of varying ages.

Unfortunately, no contact was observed between adult belugas, neither males nor females unlike previous research with dolphins (Connor et al., 2006; Dudzinski et al., 2009; Mann & Smuts; 1999; Tamaki et al., 2006). Although contact is expected during sexual interactions between males and females, none of these events occurred during this study. Additional studies are needed to characterize the nature of contact between male and female adult belugas during breeding or mating attempts. In the meantime, it does not appear that belugas males and females contact one another for any other reason. A similar conclusion may be drawn for female-to-female beluga contact. Once again, the female adult belugas never contacted one another during this study. This lack of contact may be explained by the lack of social interactions between female adult belugas. With the exception of one mother-calf pair, the adult females engaged in solitary swimming throughout the sessions. It may be possible that adult belugas receive their contact through auto-stimulation as they are frequently observed rubbing objects and walls within their pool. Calves also engage in solitary swimming and wall/floor rubbing or auto-stimulation, but their involvement in affiliative social interactions with contact provides other another function for contact (e.g. games, playful chases). Auto-stimulation was not recorded in the current study but should be considered in future studies.

Researchers should continue to examine the frequency and nature of contact in belugas housed at other facilities as well as in their natural habitat. Anecdotal observations indicate that few social interactions, affiliative or aggressive, occur between belugas in the care of humans. It is unclear how contact plays a role in wild beluga social interactions. Thus, until social interactions between belugas of all ages are empirically documented, the function of contact for belugas will remain unclear. Finally, the influence of current environmental stimulation should be considered in future research involving belugas in the care of humans. A qualitative analysis indicated that the belugas seemed to interact with each other more frequently and were generally more active following a show or human-beluga interaction program. For example, during an observation session of an adult female following a show, her companion animals, a mother-calf pair, were observed engaging in mutual play with an environmental enrichment device, which involved contact initiated by both the mother and calf towards one another. Whether it was the presence of people around the pools, human-beluga interaction, the presence of an environmental enrichment device, or some other factor, the spontaneous behavior of belugas was affected by external activities. While this potential confound was controlled as much as possible during the current study, the results must remain tentative until additional research is conducted on contact in belugas of all ages and facilities.

Although most of the contact events were easily observed, underwater observations would have greatly facilitated the ability to more accurately measure contact events. Above-water observations were the only perspective available for the current study. Depending on the lighting, visibility, and animal swim depth, contact events were difficult to observe at times. Ultimately, to truly understand the role contact plays in the beluga world, additional research is necessary.

Conclusion

Contact events occurred during mother-calf interactions and social interactions. Overall, contact was not observed between adult belugas and does not seem to play a significant role in social interactions for adult belugas. In contrast, the role of contact may be more important for calves as it provides opportunities for social and physical development. However, due to some of the limitations in the current study additional research is necessary to fully understand the role of contact in belugas in the care of humans.

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The Influence of Gender and Ethnicity on Depression Among College Students and Faculty

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Abstract

The current study explored the effects of gender and ethnicity on depression in a sample of college students and faculty seeking help from the university's counseling center. Participants completed a survey before the first appointment with a therapist at the center. Depression was operationalized as responses indicating feeling Unhappy Much of the Time or Sadness. The study found higher levels of depression among women, as well as Hispanics when compared with Caucasians.

The Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision (DSM-IV-TR; American Psychiatric Association [APA], 2000) lists criteria that a patient must meet in order to be considered as having Major Depressive Disorder. Major Depressive Disorder is defined as having "markedly diminished interest in pleasure in all, or almost all, activities most of the day, nearly every day." Fairly often, however, investigators use variations of the definition or rely on different measures and scales. For example, depressive disorders may be defines as "heterogeneous conditions that are likely to eventuate through a variety of developmental pathways" (Cicchetti & Toth, 1998, p. 221); one study (Furr, Westefeld, McConnell, & Jenkins, 2001) left participants to define depression during the survey. Expanding on the definition, many studies include possible causes of depression in order to provide a more detailed understanding of the disorder. Furr et al. (2001) identified a list of possible causes of depression and asked participants to identify which items better describe the reasons for depression. An average of 3.6 out of 9 items were selected per participant. As a student group, most responses predictably involved grade problems (53%), closely followed by loneliness (51%), money problems (50%), and relationship problems (48%).

Levels of reported psychological distress among college students seem to have steadily increased in the past two decades (Rosenthal & Schreiner, 2000). Articles dating back to the 1990's identify university students as the age group with the least psychological distress, regarding mental health (Horesh, Gothelf, Ofek, Weizma, & Apter, 1990). More recent articles show quite the opposite: college populations are second only to adolescents on depressive symptomology (Furr, Westefeld, McConnell, & Jenkins, 2001). Depression appears to begin to seriously affect individuals after the onset of puberty during early adolescence, at about age 11 (Fergusson, Woodward, & Horwood, 2000), steadily and grows to peak at age 16 for females and early 20's for males. After this, depression begins to decrease as the individual reaches early adulthood and emotional regulation becomes more prominent around age 25 (Costello, Swendsen, Rose, & Dierker, 2008).

In addition to chronological age, school attendance has been found to be related top depression. Gutierrez et al. (2000) found students are at a lower risk of depression while in school. The results conflict with other studies, such Furr, et al, 2001, which found that over half (53%) of students that reported having symptoms of depression, also reported that symptoms started after beginning college. Among students asked on how much of a problem depression was on campus, only 47% believed that depression was a serious problem and 17% of participants with depression reported seeking. Lack of knowledge of available resources, lack of accessibility to such resources, and desire for immediate relief or medication rather than slow-progressing therapy may explain failure to seek services. In addition, attempting to find a relationship between depression and type of institution in which the participant is enrolled, led researchers to note several differences. Students from larger institutions were more likely to report depressive symptoms beginning at college and more likely to select grades as a cause for depression. Schools with a large commuter population reported money problems most often, and community college students were less likely than other students to select loneliness as a cause.

Among college students and general population, depressive symptomology tends to be more frequently attributed to women than men (Gonzalez, Reynolds, & Skewes, 2011; Javdani, Sadeh, & Verona, 2011; Nordentoft & Branner, 2008; Beautrais, 2006; Rosenthal & Schreiner, 2000). One of the more popular opinions explaining the gender differences simply states that men are less emotional than women, and tend to

possess more callous-unemotional traits (Javdani, Sadeh, & Verona, 2011). Among 184 adolescents aged 11 to 17, the relationship between depression and callous-unemotional traits was assessed using the Antisocial Process Screening Devise (APSD; Frick & Hare, 2001) and the DSM-IV-TR definition of MDD. Females reported higher levels of MDD and males reported higher levels on the APSD. Higher Callous/Unemotional traits were related to lower negative affective states within both genders. These gender differences are usually first seen at puberty (Fergusson, Woodward, & Horwood, 2000) with women reporting depression twice as often as men (Beautris, 2006) throughout the lifespan until late adulthood when depression rates decrease.

Some controversy exists regarding ethnicity's effects on depression, with studies demonstrating different results. Some researchers argue that ethnicity does not play a role in depression (Rosenthal & Schreiner, 2000). In comparison of Hispanics and Non-Hispanics, little to no significant difference in depression was found between the groups (Del Pilar, 2009; Rosenthal & Schreiner, 2000). In comparison of European American and Minority groups, or separate clusters with homogeneous ethnicity, some differences begin to emerge, with European Americans reporting less depression (Costello, Swendsen, Rose, & Dierker, 2008). Only the Native American group showed similar results to the European American group, with no significant difference in depression (Gonzalez, Reynolds, & Skewes, 2011). Nevertheless, limited literature on the nature of the relationship exists due to the relatively small number of Native Americans across studies.

Another way of looking at the association between depression and ethnicity is by looking at causes of, and reactions to, MDD. Del Pilar (2009) reported 17% of Hispanics take or have taken antidepressants, compared to 3% of non-Hispanics. A slightly smaller difference was found in participants reporting having stopped taking medication without professional assistance (10% Hispanics, 3% non-Hispanics). The two groups had almost the same percentage of hospitalization for psychiatric reasons. No significant difference appeared between Hispanics and non-Hispanics for MDD, although, more Hispanics had a history of past depression. The Hispanic group were also more likely to live at home, had more children, and were more likely to have been born abroad.

As for causes for depression, a study on Mexican Americans attending college in the United States (Iturbide & Raffaelli, 2009) identified 7 variables of ethnic identity (affirmation or motivation to maintain the one's identity, acculturative stress or stress drawn from one's adaptation to two cultures, self-esteem, ethnic identity achievement, orientation , and other group orientation or extent of interaction with other ethnic groups) related to psychological well-being, and assessed the variables' interaction. Females had higher levels of affirmation than males, while males had higher levels of other group orientation. Acculturative stress correlated positively with depression in both genders, and was a good predictor of depression, but a negative predictor of self-esteem. Self-esteem in males was positively correlated to other group orientation. The Iturbide & Raffaelli (2009) study attempts to unmask some of the variables present in the lives of people put in the center of two conflicting cultures and how individuals become at risk of depression. Mexican Americans (as well as other minorities) are torn between following traditional lifestyles and those of the country of residence. Doubts about embracing the culture outside or remaining within the family traditions trigger negative feelings such as stress and anxiety, which eventually lead to depression and other psychological symptoms.

Costello et al. (2008) conducted research on a sample of 11,556 students in grades 7 to 12, to observe the relationship between depressed mood and risk and protective

factors. The study included three data-collecting periods (Wave 1, Wave 2, and Wave 3), with four-group model covariates (no depressed mood group, stable low depressed mood group, early high declining depressed mood group, late escalating depressed mood group) and seven risk and protective factors (socioeconomic status, delinquent behavior, alcohol, tobacco, and other drugs, family structure, connection to parents, peers, and school, and self-esteem), as well as general demographics. Results showed girls were more likely to follow any of the three groups concerned with elevated depressed mood trajectory. In other words, girls were more likely to become depressed than boys. The greatest gap between males and females was in mid-adolescence. Simply being African American, Hispanic, Asian American, female, having low self-esteem, and reporting weekly use of alcohol, tobacco, and other drugs meant a higher probability of depression. Significant protective factors were two-parent households, good self-esteem, and feelings of connectedness to parents, peers, and school.

The current study looked into the relationship between depression, gender, and ethnicity in a college population. The study hypothesized that there would be a higher number of women reporting symptoms of depression, as well as a higher number of Hispanics, as seen in the majority of the literature. A second hypothesis stated that women and Hispanics would report higher levels of depression than men and Non-Hispanics.

Method

Participants

The sample included 1,286 students from a private, Catholic university in Texas. All students voluntarily sought services from the university's counseling center. The participants filled out a survey before the first appointment with a therapist at the center. The participants were told that the survey would provide data for future research and that names and any other identifying information would be removed, and randomly generated subject numbers would be assigned, in order to ensure confidentiality. Informed Consent was provided by students agreeing to participate.

Of the participants, 413 (32.1%) were male and 873 (67.9%) were female. The study included undergraduate, graduate, and Law school students, as well as faculty. Five-hundred and four were Caucasian (39.2%), 587 were Hispanic (45.6%), and 195 were other ethnicities (15.2%). Ages ranged from 17 to 74 (M_{age} = 24.3; sd= 6.72).

Procedure

The study utilized data collected at the university counseling center from August 2006 through May 2011. The data were drawn from an 83 item self-report survey utilizing an 11-point Likert-type scale where 0 = *no interference* and 10 = *serious interference*. The survey consisted of four subscales: Academic Problems (16 items), Physical Problems (20 items), Emotional Concerns (29 items), Relationship Issues (18 items), and standard demographic information. Participants were informed of the possibility of data being used in the future for research, were assured of confidentiality of responses by a random assigned ID number, and signed an informed consent. Completion of the survey was required in order to see a therapist, but students could choose to allow or not to allow the inclusion of their responses into the deindividuated database to be used for research purposes.

One non-demographic variable from the Emotional Concerns subscale was used for the current study. Respondents'' answers to the question, *Unhappy Much of the Time or Sadness,* provided the data. Values from the variable were re-coded for the study into four categories, no depression (raw value of 0), mild depression (raw value ranges from 1 to 3), moderate depression (raw value ranges from 4 to 7), and severe depression (raw value

ranges from 8 to 10). No other variables were used.

Results

Of the 1,286 participants, 75.7% (*n=* 974) indicated some level of depression with 21.6% (*n=* 278) indicating mild, 29.5% (*n=* 379) indicating moderate, and 24.7% (*n=* 317) indicating severe.

Two chi-square tests-of-independence (Tables 1 & 2) explored the relationship between depression and gender, and depression and ethnicity. The first analysis on depression and gender found a significant relationship, $\chi^2(3, n=1,286) = 11.98$, $p < .05$. More men and fewer women reported no depression. The second analysis found a significant relationship between severe depression and ethnicity, $\chi^2(3, n=1,286) = 9.82$, $p < .05$. More Hispanics and fewer Non-Hispanics reported suffering from severe depression. Results from the chi-square analyses suggested a possible gender-ethnicity interaction.

A 2 (male vs. female) x 2 (Hispanic vs. Non-Hispanic) between-participants factorial Analysis of Variance on depression (No depression, Mild, Moderate, Severe) was conducted. No significant effects were found. A subsequent 2 (male vs. female) x 2 (Hispanic vs. Caucasian) between-participants factorial Analysis of Variance revealed main effects for ethnicity, $F(3, 1,078) = 6.96$, $p < .05$, $R^2 = .006$. Hispanics reported feeling significantly more depression than Caucasians. Main effects were also found for gender, $F(3, 1,078) = 8.77$, $p < .05$, $R^2 = .008$. Females reported more depression than males.

Discussion

The present study found a relationship between depression, gender, and ethnicity. In accordance to the hypothesis, the results show a relationship between depression and gender that suggested that fewer men have symptoms of depression than women. A significant relationship between depression and ethnicity was also found. More Hispanics reported having experienced symptoms of depression than Non-Hispanics.

Interestingly, however, when looking at the interaction between gender and ethnicity in relation to depression, no significant effects where found when separating participants into Hispanics and Non-Hispanics, although, a significant relationship was found when clustering participants into Hispanics and Caucasians, while leaving other minorities out.

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Figure 1
Average Level of Depression by Gender and Ethnicity of the Sample
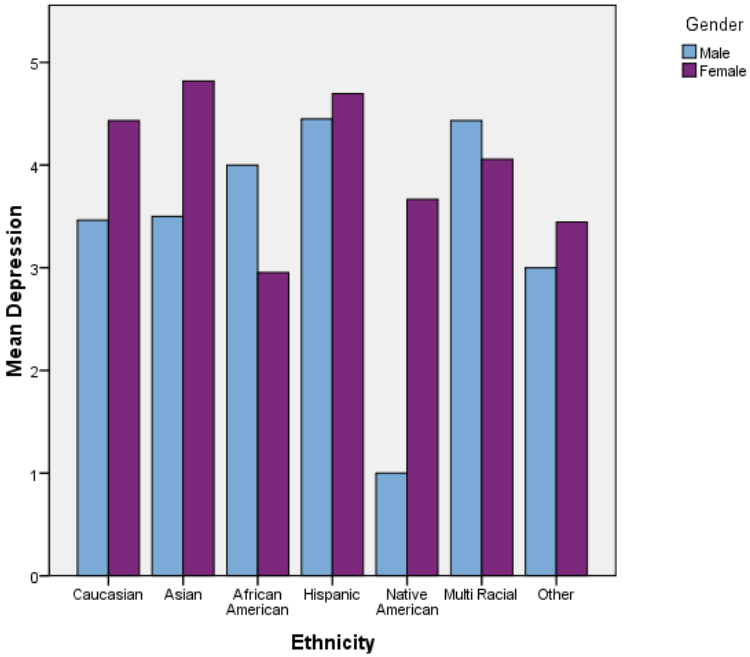
Note. Average depression reported by men and women from different ethnic groups on an 11-point Likert-type scale where 0 = *no interference* and 10 = *serious interference*.

Table 1
Chi-square Table Between Levels of Depression and Gender

			Gender		
			Male	Female	Total
Levels of Depression	No Depression	Count	124	188	312
		Expected Count	100.2	211.8	312.0
		% within Levels of Depression	39.7%	60.3%	100.0%
		% within Gender	30.0%	21.5%	24.3%
		% of Total	9.6%	14.6%	24.3%
		Adjusted Residual	3.3	-3.3	
	Mild	Count	89	189	278
		Expected Count	89.3	188.7	278.0
		% within Levels Of Depression	32.0%	68.0%	100.0%
		% within Gender	21.5%	21.6%	21.6%
		% of Total	6.9%	14.7%	21.6%
		Adjusted Residual	.0	.0	
	Moderate	Count	109	270	379
		Expected Count	121.7	257.3	379.0
		% within Levels of Depression	28.8%	71.2%	100.0%
		% within Gender	26.4%	30.9%	29.5%
		% of Total	8.5%	21.0%	29.5%
		Adjusted Residual	-1.7	1.7	
	Severe	Count	91	226	317
		Expected Count	101.8	215.2	317.0
		% within Levels of Depression	28.7%	71.3%	100.0%
		% within Gender	22.0%	25.9%	24.7%
		% of Total	7.1%	17.6%	24.7%
		Adjusted Residual	-1.5	1.5	

Table 2
Chi-square Table Between Levels of Depression and Ethnicity

			Ethnicity		
			Hispanic	Non-Hispanic	Total
Levels of Depression	No Depression	Count	129	183	312
		Expected Count	142.4	169.6	312.0
		% within Levels of Depression	41.3%	58.7%	100.0%
		% within Ethnicity	22.0%	26.2%	24.3%
		% of Total	10.0%	14.2%	24.3%
		Adjusted Residual	-1.8	1.8	
	Mild	Count	122	156	278
		Expected Count	126.9	151.1	278.0
		% within Levels Of Depression	43.9%	56.1%	100.0%
		% within Gender	20.8%	22.3%	21.6%
		% of Total	9.5%	12.1%	21.6%
		Adjusted Residual	-.7	.7	
	Moderate	Count	168	211	379
		Expected Count	173.0	206.0	379.0
		% within Levels of Depression	44.3%	55.7%	100.0%
		% within Gender	28.6%	30.2%	29.5%
		% of Total	13.1%	16.4%	29.5%
		Adjusted Residual	-.6	.6	
	Severe	Count	168	149	317
		Expected Count	144.7	172.3	317.0
		% within Levels of Depression	53.0%	47.0%	100.0%
		% within Gender	28.6%	21.3%	24.7%
		% of Total	13.1%	11.6%	24.7%
		Adjusted Residual	3.0	-3.0	

Nanomagnetism and Microfluidics for Cell Manipulation

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Abstract:

The use of magnetic particles within a magnetic field can help manipulate cell movement through a micro-channel. The channel contains magnetic disks that change polarization with the direction of an external magnetic field. This allows the cancerous cells that are labeled with magnetic particles to be separated from a population of cells. It is necessary to know the local magnetic field strength and resulting force that are needed to direct the cells in the presence of fluid flow. The electromagnets used to create the external magnetic field dissipate heat, which when high enough can cause cell death. We tested varying magnetic field strengths on magnetic particles to determine the minimum field strength required for manipulation. An in-plane field of 30 Oe and out-of-plane field of 0 Oe, creating a magnetic force of 0.89 pN, was the minimum needed to manipulate the bead. With the knowledge gained on these topics, the channels will become more reliable for cell manipulation and sorting.

Introduction:

Current methods of cell manipulation include optical tweezers, fluorescence or magnetic activated cell sorting, centrifugation, filtration and electric field-based manipulation and separations.[1] Another method is using a microfluidic device. Gijs et al. states three important advantages of microfluidic devices are (1) possibility of using minute sample size; (2) Fast reaction times, molecular diffusion lengths ~ microchannel dimensions; (3) large surface-to-volume ratio, compatibility between microfluidics and surface-based assays.[2]

Henighan et al. demonstrated how using an array of disks in the microfluidic device could assist in the manipulation and sorting of cells[3]. A permalloy disk's polarization changes with an external magnetic field; which is the in-plane field ($H_{x,y}$). A tethered cell moves along the rim of the disk with the magnetic field. When the direction of the out-of-plane field, H_z, the trap is strengthen keeping the particle at that position. As Hz direction goes down, the poles of the particle and disk repel each other, sending the particle to the adjacent disk[3], Figure 1.
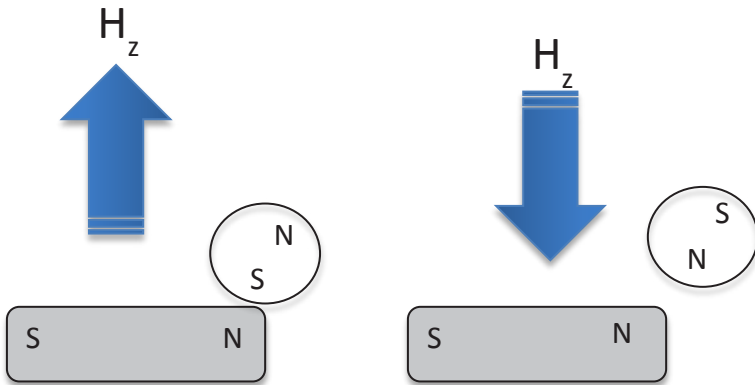

Figure 1: Out-of-plane field effects on disk and bead

Using these principles, we tested for the minimum force needed to manipulate the beads and measured the magnetic force the disk exerts on the bead; which equals the drag force at the critical frequency.

Methods:

This study used a 0.05% concentrated solution of 2.8μm Dynabeads (M-280, Intvitrogen, Carlsbad, CA) in water + surfactant on a disk array. The disk array consisted of permalloy disk (4.5μm in radius and 40nm thick) lithographically patterned on a gold-coated silicon substrate.[3] 5μL of the solution was dropped cast onto the disk array and placed in a joystick-controlled magnetic field (Fig. 1). The in-plane field, H_x and H_y, was controlled by four remotely controlled electromagnets. A circular solenoid coil controlled the out-of-plane field.
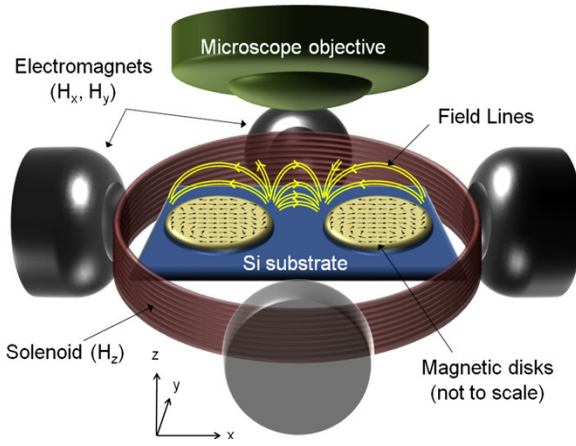
Figure 2: Schematic of Experimental Setup

The change of frequency of the in-plane field controlled the frequency the bead rotated around the bead. Video was taken of the bead's rotation at $H_{x,y}$ = 150 Oe and H_z varied from 0 to 20 Oe at 10 Oe increments. Bead movements were observed by an optical microscope (Leica Microsystems, Wetlzar, Germany) with a 50x objective and high-speed camera. Next, the frequency of the field was increased until the bead escaped from the disk, Figure 3, or was immobile, Figures 4. At this point (critical frequency), the drag force equaled the magnetic force exerted on the bead.
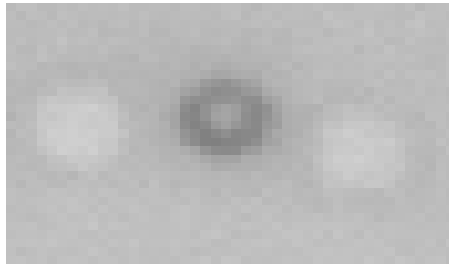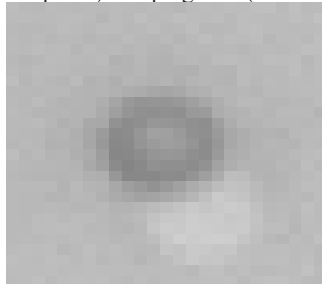

Figure 3: Bead (black sphere) escaping disk (white circle) to another disk

applied Bead immobile on disk

Videos were analyzed to measure the frequency the beads rotated around the disks. The drag force was calculated using Stokes' Law[4], Equation 1.
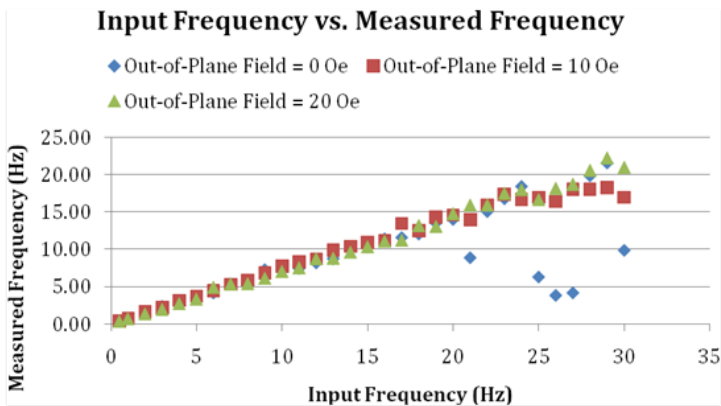
$$F_D = 6 \pi \eta \, r_{bead} \, v$$

$$where \; v = 2 \pi f_{critical} \, r_{disk}$$

$$at \; f_{critical} : F_D = F_M$$

**Equation 1:** Stokes's Law to measure drag force

Results and Discussion:

The correlation between the input and measured frequency was linear, with the measured frequency ~72% of the input frequency, Graph 1. This factor was applied when the magnetic force on the bead was calculated, Graph 2.

Graph 1: Graph of Input Frequency vs. Measured Frequency. Measured frequency was ~0.72 of the input frequency.
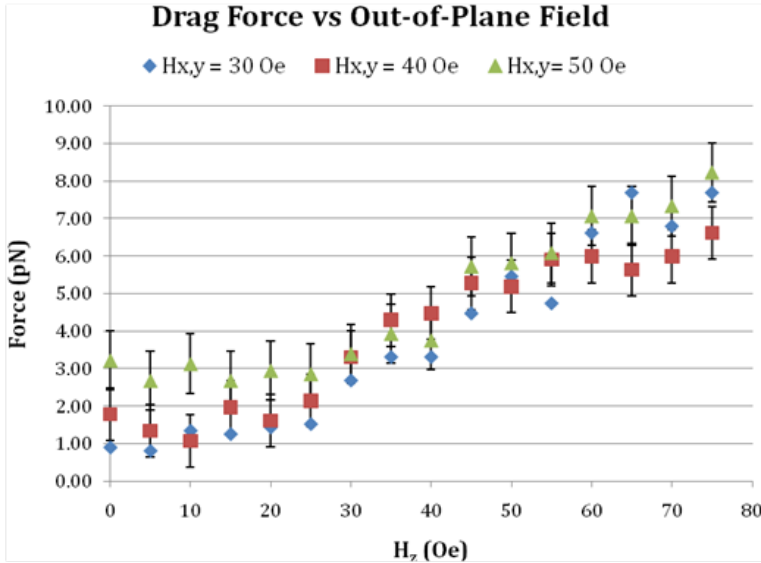
Graph 2: Calculated drag force for varying field strengths. Force increased with the out-of-plane field growth.

The minimum force needed to manipulate a bead was 0.89pN. This force occurred when the in-plane field was 30 Oe and the out-of-plane field was 0 Oe. When Hx,y is less than 30 Oe, beads are not trapped and therefore can not be manipulated. The maximum force calculated was 8.23pN, which was a product of $H_{x,y}$ = 50 Oe and H_z = 75 Oe.

The preliminary results also show a linear relationship when H_z < 70 Oe. As the out-of-plane field increases, the force on the bead follows suit. The increase may result from the larger attractive potential energy profile created by the out-of-plane field, resulting in a stronger trap at higher H_z.

Conclusion:

The objective of this project was to determine the magnetic force exerted on the bead at different field strengths. This study showed the minimum field strengths to manipulate a bead is $H_{x,y}$ = 30 Oe and H_z = 0 Oe; which exerts a 0.89pN force on the bead. As the out-of-plane grew stronger, the magnetic force increased until the bead is at equilibrium. The data shows the lower and upper limits of the disks, allowing us to make the microfluidic channels more efficient. Running the tests at $H_{x,y}$ = 30 Oe and H_z = 0 Oe allows for cell manipulation and keeps the dissipated heat low, allowing time for longer tests. The upper limit allows a higher infuse rate for quick tests but at higher field strengths.

Future Work:

One aspect that needs to be investigated more thoroughly is the effect of different size disks and particles on the magnetic force. A larger particle may need a stronger force to manipulate its movements due to its increased radius. This leads to studying beads with a cell as cargo. Again, the increase weight and size should require a stronger force for manipulation. The final study will include these aspects within a microfluidic device with a controlled flow.

Acknowledgements:

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"Can Transwomen be Feminists too?" Debate between Pro and Anti-transwomen Feminists.

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Abstract

This article examines the feminist debate on the legitimacy of transwomen feminists. Prior research has incorporated males with feminist studies but not with transwomen. Data was collected from literature, websites, blogs, and interviews by feminists. Findings show that anti-transwomen feminists have a narrower definition of feminism than pro-transwomen.

Introduction

What does a feminist look like? Some feminists argue one has to be sex born as a female and remain a female in order to be considered a feminist (Bridle 1999 & Jeffreys 2003). Specifically, sex born males cannot be feminists. Others interpret that being a feminist deals more about identification as a woman and oppression (Serrano 2007, Scott-Dixon 2006, Stone 2006, & Stryker 2008). This article assesses the validity of transwomen feminists. Feminists can be divided into two camps pro-transwomen and anti-transwomen. This paper will analyze the different arguments made by pro-transwomen and anti-transwomen feminists about whether or not transwomen can be feminists.

Feminism's first wave gave women the right to vote, property rights, educational rights, and better working conditions in the 19th and early 20th century. Suffrage was the main goal of the first wave of feminism. The second wave of feminism grew out of widespread social movement activism in the 1960's. During this time, women were given social, legal, economic, and reproductive rights. The central focus of the second wave was on total gender equality for women. The third wave started in the 1980's because views presented previously were overwhelmingly homogenous and exclusionary. The third wave of feminism deals with gender equality for all (Baumgarder & Richards, 2000). It attempts to accommodate diversity and change. Third wave feminism is overall more supportive of transwomen's identification as women and feminists, whereas second wave feminism is overall less supportive. Daughters of feminism are more trans positive than the mothers of feminism.

Women are easily divided by the issue of transwomen's inclusion. Currently, body and identity issues are being debated at Michigan Women's Music Festival (MWMF) and Camp Trans. According to the MWMF website, "It's a space to mix and mingle with thousands of women in a village inspired by feminist values and built through a unique collective ingenuity." To gain entry one must be sex-born female, raised as one, and identifies as female. Specifically sex born males, who have a penis or not, are not allowed entry. However, transmen are allowed entry based on MWMF "don't ask don't tell" policy. These supporters claim being raised as a female qualifies them to attend the festival. On the contrary, Camp Trans states one must identify themselves as a female as the only condition to gain admission into the festival. According to the Camp Trans website, "Camp Trans is an annual gathering of transgender people and their allies…" One thing activists at both camps agree on is that women need space from men. Michigan Women's Musical Festival and Camp Trans have two different definitions of feminism and who classifies as a female. These two festivals bring up the importance of examining the definition of a female and how it is related to feminism.

The importance of our study is that there have not been many studies conducted where transgender concerns feminism. This is also known as Transfeminism. We have found many books written in the perspective of activists and/or feminists, but not much empirical research has been done in this field. Transfeminism needs to be researched because of diversity now in feminism. Overall, feminists should all share a common goal. Previous research has shown feminists have a particular view on what feminism is. I am going to illustrate how feminism is related to transwomen and their common goal of gender equality. By doing this, I am going to critique serious debate issues within feminism. Particularly, how feminists define feminism and who classifies as a female.

What is Feminism?

Feminism has been defined different ways in society. Hooks (2000) defines feminism as a movement to end sexism, sexist exploitation and oppression. To some, it could mean a liberation movement for women or from men and marriage. It helps identify and fight sexism. It could be seen as promoting the rights of women or for the rights of men and women. According to Lorber (2005), "feminism is a social movement whose basic goal is equality between women and men." Research has shown that feminists self-label themselves differently (Liss, Hoffner, & Crawford, 2000). Feminists may have different definitions of feminism, however, they can still call themselves one. Yet these definitions are contested amongst feminists. For example, blogger Catkisser from radicalbitch.com wrote the following statement.

> Yes, after a lifetime of feminist consciousness (well since I was nine years old anyway) I was told the other day I am no longer a feminist because I reject the victimhood hierarchy that passes for feminism among so many younger feminists today. I was told this in no uncertain terms by a young lady on her blog who then proceeded to lecture me, apparently in total absence of any knowledge of my body of writing or my actual life, about the evils of the second wave feminists, gender as having any meaning and, as has become strangely common among some like her, my own relationship with Goddess Consciousness… What happened to Feminism? I will freely grant I am not a Feminist by her definition but not a Feminist? Hardly.

For Catkisser, she was surprised that a disagreement about an approach to gender inequality would lead to her identity as a feminist being challenged. Feminists often disagree on who should be a feminist. However, it is important to realize that all feminists are interconnected due to the goal of gender equality. Liss and Urchell (2010) found out that women believed they should work together towards change collectively.

Hyde (1998) has shown there are many different types of feminist attitudes. Liberal feminism focuses on working within institutions to gain equality for women but does not focus on changing the entire institution, which places it at odds with radical feminism. Equality feminism is about gaining equality between men and women in all domains such as work, home, sexuality, law. It argues that women should receive all privileges given to men and that biological differences between men and women do not justify inequality. Radical feminism focused on sweeping social reforms, social change, and revolution. It is against institutions like patriarchy, heterosexism, and racism and instead emphasizes gender as a social construction, denouncing biological roots of gender difference. Within radical feminism are some anti-transwomen belief systems. Radical feminists were very active during the Second wave of feminism. Some well-known radical feminists are Gloria Steinem and Mary Daly. The importance of radical feminism is that it often paved the way for others branches of feminism. Lorber (2005) has also described other types. Essentialist feminism focuses on "true biological" differences between men and women, arguing that women are essentially different from men but equal. Second wave of feminism is fundamentally derived from this definition. It focused on individual autonomy, rights, liberty, and independence. Lesbian feminism is feminism based on the rejection of institutionalized heterosexism, particularly the primacy of the nuclear family, and the lack of legal recognition afforded to lesbians. It argues that lesbian identity is

both personal and political, and actively works against homophobia. Postmodern feminism critiques the male/female binary and argues against this binary as the organizing force of society. It advocates deconstructionist techniques of blurring boundaries, eliminating dichotomies, and accepting multiple realities rather than searching for a singular "truth." Kate Borestein is an advocate on this type of feminism. She is a transwomen, however, she doesn't associate herself with either sex. Separatist feminism advocates separation from men, physically, emotionally, psychologically, and spiritually. Separatist feminists argue for women-only spaces, large and small, including lesbian separatist living communities, women-only music festivals, and consciousness-raising groups. An example of this is the MWMF. It emphasizes healing and connection between women that male-patriarchal spaces prohibit. Sometimes promotes spelling "women" as "womyn" in order to remove "men" from the word "women."

Background in Transfeminism

How are transgender rights related to feminism? Susan Stryker (2008) and Julia Serrano (2007), who are both transwomen, define transgender as people who do not feel they were born the correct gender assigned at birth. Anti-trans feminists argue is that one must be sex born as a female and remain a female in order to be called a feminist. According to this, transwomen cannot be considered a feminist. Pro-trans feminists argue that one does not need to be sex born as a female. Many transwomen see themselves as women since they dress and live the life of one. Not only that, feminism's goal is for gender equality. Serrano (2007) discusses the importance of discussing transgender issues to eliminate discrimination. Serrano debates that past research on transgender people have been mostly written by non-transgender people. She feels that non-transgender people need to hear the personal experiences from trans people in order to better understand the struggles and hardships they must live with without any preconceived misconceptions. This illustrates the importance of how transgender and non-transgender people can learn from each other.

Methods

I examined in this article feminist attitudes and social artifacts from the 1960's to present. I looked at this time period because feminist issues from the 1960's are currently still being debated today. I particularly wanted to assess feminists from the Second and Third Wave. These feminists have experience as an activist, researcher, or blogger. I looked at 13 literature books, 2 empirical articles, 5 websites, 8 blogs, and 2 interviews written by feminists. All sources were chosen randomly.

I examined feminist literature from the 1960's to present because of the evolving changes in feminism. Feminist literature in this article expresses the views of Second and Third Wave feminists. Feminist writing has been insistence on expressing and valuing women's point of view about their own lives. While earlier in history, it was primarily men who wrote, from their own point of view, about women, the concern of feminist writing is to place women in the position of authority about their own lives and experiences, to hear and believe women's voices.

I studied 3 empirical articles because it was important to understand the past and current research conducted that is related to this field. Being able to relate past research to current findings relevant to this article was crucial. These articles correlated feminist attitudes and self-labeling to past and current feminists. Research in feminist attitudes were important because it showed a relationship between different types of attitudes to beliefs. Feminist beliefs were also linked to how feminists self-label themselves.

I looked at 5 feminist websites since the internet is a very popular tool in expressing ideas. In this new world of Internet connectivity, people can share their experiences, ideas, suggestions, and problems, try to exert influence, and to get fast responses and reactions. The most important thing that can be said about the internet is that it welcomes and encourages intellectual activity. People are welcome to express their views and the things on their minds, share information, and brainstorm and interact with each other.

By looking at 10 feminist bloggers, I was able to hear from modern feminists. Blogging is seen as a very powerful tool in our current world. By collecting their information from online, I was able to see current feminist views from today. According to feministblogs.org, the feminist blog, "…is a community of weblogs by self-identified feminists, women's liberationists, womanists, and pro-feminist men…in order to raise awareness, bring together feminist voices, and promote cross-linking and discussion between feminist bloggers."

It was also important to assess interviews by feminists. I looked at 2 past interviews by feminists. By doing this, it made collecting data a much easier process. Also, feminist Mary Daly is deceased and by looking at a past interview I was able to include her in my research. It was important that she was included since she is considered a pioneer in feminism.

Analyzing the Anti-transwomen femininist debate

Anti-trans feminists question the legitimacy of MtF trans feminists because they feel the fact that transwomen were born with a penis goes against the core of feminist issues. Feminists feel sexism and the need for separatism. Their belief is that sex born females were raised and lived life differently from sex born males. Being born as a male means society automatically gives them male privilege. Emphasis is put on having a penis. Penis can symbolize power. Because transwomen were born with a penis, it implies they were raised with male privilege throughout their life. Anti-trans feminists believe transwomen can only sympathize and not empathize. These men were not biologically born as female. In particular, a pre-operational (pre-op) transwomen's penis can make females uncomfortable when a space is shared (Namaste). Post-op trans are still considered dangerous according to Janice Raymond. Raymond (1979), who wrote the important radical feminist book The Transexual Empire, explained trans as, "All transsexuals rape women's bodies by reducing the real female form to an artifact, appropriating this body for themselves .... Transsexuals merely cut off the most obvious means of invading women, so that they seem non-invasive." Another feminist write Bev Jo wrote a blog on the website, The Magazine Project for Lesbians, stating, **"**transwomen" are merely castrated men. Bev Jo personally expresses her view as to why men are tyring to be females. She further writes, "…as expected in patriarchy, men are made more important than any women." Feminist pioneer Gloria Steinem also echoed this sentiment. Gloria Steinem (1995) wrote in her book.

> When I probed further, I discovered that male-to-female transsexuals were not only used as a handy testimony to the desirability of the traditional female role, but they were also the only sort of sex change many interviewers could accept or imagine. For a man to give up his superior role and become a woman was easy-frightening, but no challenge. For a woman to rise out of her inferiority and achieve

> manhood was unthinkable, impossible-just too big a job. Men were not
> about to accept a former female as an equal, but they expected women
> to accept and even be honored by a former man.

Gloria Steinem first sentence personally expresses her view on the power of a male's penis. Male-to-female transsexuals are sex born males, therefore, born with a penis. This view echoes the same sentiment that Namaste, Raymond, and Bev Jo share. A male's body and penis are detrimental to the presence of sex born females. Anti-trans feminists argue the fact that whether a penis is present or no longer, transwomen feminists are not legitimate feminists. This view assesses whether genitals play a factor on who can be called a feminist.

A male's penis can symbolize power. The penis can be seen as a powerful means as to oppress. A male grabbing his crotch can gesture power, not his actual penis. Fear of a penis and the assaults it has done to womankind elicit negative reactions from feminists. Gloria Steinem (1995) feared what transsexualism could do to feminism. This fear of a male's penis is crucial to the anti-trans feminnst debate. Anti-trans feminists argue the fact that whether a penis is present or no longer, the threat is still there. Importantly, transwomen feminists are not legitimate feminists because of this.

Another core issue would be women's reproductive organs. Because of this, anti-trans feminists argue that transwomen are unable to give birth. Gloria Steinem (1995) expressed this view.

> But many of women's body scars have a very different context, and
> thus an emotional power all their own. Stretch marks and Cesarean
> incisions from giving birth are very   different from accident, war,
> and fight scars. They evoke courage without violence, strength without
> cruelty…" Gloria noticed females giving birth as a powerful event.
> She further states, "Childbirth is more admirable than conquest, more
> amazing than self-defense, and as courageous as either one.

Gloria Steinem wanted females to celebrate these scars in pride. She felt it was nothing to be ashamed about but rather powerful. The fact that women have the ability to bring another life into this world is a difference between males and females. Her view is that scars can be seen as courageous on a female's body. Physical scars can symbolize a journey.

Many anti-trans feminists are separatists. A popular anti-trans feminist was Mary Daly, a lesbian separatist feminist who believed in women's space. Mary Daly expressed her view on women's space in an interview on Enlightennext.org.

> She stated, "And what's so precious about my space at Boston College
> is that it's women's space. When you get a teacher and students
> who really want to be with women, and we seize the space and read
> philosophical works and literature by women, they begin to think like
> themselves. They feel as if they've come home again. And that is the
> very groundwork of radical feminism. So if our space is taken away
> from us, which is what they're attempting to do at Boston College,
> then so is the possibility of that kind of, I won't call it dialogue, that
> kind of *spinning* conversation, of matching experiences."

Mary Daly, argues that that men present in her classrooms hindered class discussions in her feminist classes. Gloria Steinem (1995) demonstrated that males hinder female discussions because they are more likely to speak more than females. Steinem felt it was a stereotype to

say females speak more than males. She stated it was males demonstrating their dominance that hindered the women's voice. This could be seen as a man trying to claim a female's domain. Raymond (1979) argues that transwomen create confusion among women and these "males" are only looking to claim a woman's body. This exemplifies the point of do women need to have their own space.

Being born a woman is such an important component of being a feminist for anti-trans feminists that they argue that neither transwomen nor men can be feminists. Some feminists do not feel comfortable when men refer themselves as a feminist according to the feminist website, Jezebel.com. Byron Hurt, a heterosexual, human rights activist, says he is profeminist and expressed his view in an interview on Jezebel.com

> …he noted how he's been challenged by feminists to also identify himself as a *feminist* because, for them, the term "profeminist" makes it seem like the man is not really willing to stand up with feminists, but rather will find it sufficient to somewhat passively support feminists, applauding from the sidelines…Other feminists have challenged him to call himself *profeminist*, noting that men who call themselves "feminist" are far too often attempting to co-opt the various women's movements and struggles toward Women's Liberation.

For a sex born male to become a pro-feminist, he must step to the sidelines and cheer on and educate others for equal gender rights. Anti-sexist is another term anti-trans feminist feel comfortable males using since they want them to view females as human beings. Anti-patriarchal can be used because these feminists do want males to question and fight against male domination. Oppression is a theme in feminism. Anti-trans feminist Bev Jo, a writer from The Magazine Project for Lesbians, wrote "You can choose to accept them when they insist they are Lesbians and women – but know that your choice is seriously hurting and demeaning all Lesbians and women." Bev states that by letting transwomen call themselves lesbians and women is an insult to womanhood.

Anti-transwomen feminists argue that transwomen were sex born males. Because of this, they were not raised as a female and do not understand the experiences of one. Also, being born with a penis means they were shown male privilege. By them being shown male privilege, they were showing superiority. Lastly, by letting penis be included into a woman's space, men would be oppressing a woman. Anti-transwomen feminists feel that sex born males need to be excluded since they argue that women need their own space from men.

Analyzing the Pro-transwomen femininist debate

Pro-transwomen feminists' definition of feminism allows transwomen to call themselves feminists. Pro-trans feminists argue that feminism will make the world equal for all genders. One blogger argued for this definition of feminism.
Tekanji wrote,

> Feminism is about equality for all, not equality for some. It's not just about the middle-aged, upper class, white, straight, [fill-in-the-majority here] women. It's about the young and the old, the middle class and the poor, the black, the Asian, the Latino, the gay, bi, and trans. It's about us, and them, and so much more. How can you, or I, be a feminist and then stand up and say, "But I don't like *you* so you're

not allowed in the club!'"?

Tekanji expresses his definition of feminism that is current with Third Wave feminists. He sees diversity within feminism. Pro-trans feminists also do not agree with Anti-transwomen feminist Janice Raymond. Asher, a blogger from Transarchanism.com expressed his opinion on how transwomen are related to feminism.

> What's feminist about excluding an extremely vulnerable class of women who disproportionately suffer from violence, rape, body shaming, unemployment, homelessness, and poverty, who are routinely abused and manipulated by the medical establishment, and who are disproportionately involved in sex work and pornography?

Asher argues that transwomen should be included in feminism due to their hardships, isolation, and financial hardships they go through. Not only are transwomen women, but they are an "extremely vulnerable class of women."

Pro-trans feminists also argue that gender oppression does not just affect females. Feminine men of different orientations can be oppressed by other men. This view is expressed by Julia Serrano, a transwoman with a Ph.D. in Biochemistry and Molecular Biophysics from Columbia University. She described how this can happen in an interview for scavengernet.com. Julia stated, "The thing is though, biology itself is not essentialist. It's a source of profound diversity and variation. People fall all over the map with regards to gender expression: some people are feminine, some masculine, and many of us express some combination of both." Her opinion echoes the sentiment that power struggles do exist within a male group.

Pro-transwoman feminist, Kate Borstein (2010), wrote that there is nothing wrong with crossing many gender boundaries. As a feminist, it important to break norms that society gives us. Fear that anti-transwomen have is considered gender-based discrimination, or transphobia (Serrano, 2007). Because of this model, members of the transgendered community have many negative experiences in common. Transgendered people often live in fear for their safety, may or may not experience personal torment resulting from having internalized phobic messages, and are isolated from much of society because of feelings of "lack of place." Pro-trans feminists argue anti-trans feminists fear is not valid and is rather transphobic. Gender is a complex social phenomenon. Gender is a social creation taught to us from birth on the basis of our sex, however, gender is also about self-expression. Gender can be seen as something created by each and every one of us. Most people choose their means of gender expression from a predetermined set provided by society. Transgendered people identify in ways that do not correspond to some behaviors encouraged in them since birth. In this way, gender can be seen to be the product of the complex interaction between the individual and society.

In order for transwomen to be accepted as feminists, anti-trans feminists must accept how transwomen and non-transwomen are included in feminism. This view was expressed by the blogger Tekanji.

> I think that in order to get society to a place where the transgendered
> (et, al) are accepted – be they woman-identifying, man-identifying,

neither or both – is to get to a place where a person's choice is not seen as genderdized. In that way, I see the struggle of women-born-women and the transgendered (et, al) to be one and the same: we all want the same opportunities, rights, and freedoms as men-born-men have traditionally have, as well as the ability for the traditonally "feminine" to be seen as something of equal value so that men-born-men can aspire to it, too. If "masculine" and "feminine" were seen as equal, then I am quite sure that the gender binary wouldn't be nearly as important as it is now. [...]

Feminists understand how gender is created by society. In order to accept transwomen as feminists, we must undo gender. Judith Butler also shared this view. Butler (2006) expressed how we must question the definition of what a woman is. Society has created this concept of masculinity and femininity also. These three paradigms can not be used to define the category of a woman.

Conclusion

Anti-transwomen feminists believe only sex born females can be feminists due to their definition of radical feminism. This definition is popular among Second Wave feminists. This defintion deals with issues regarding gender equality for women only (Lorber, 2005). Also, due to their definition of a woman, transwomen can not be considered legitimate feminists. Pro-transwomen feminists consider transwomen as feminists because they breaks the norm of sex and gender roles. Pro-transwomen feminists use the broad definition of feminism from the Third Wave of feminism. This definition acknowledges diversity within feminism (Baumgarder & Richards, 2000). All feminists agree on gender equality, however, not for all.

Future research should explore body issues and identity related to transfeminism. Anti-transwomen feel body issues play a role in feminism while pro-transwomen feel identity is a major factor. Identitfy should be explored further since it has plays a key role in the life of transwomen and non-transwomen feminists. Also, does orientation play a role in feminist beliefs? Most anti-tranwomen are known as radical or lesbian feminist. This should be investigated further. A measurement scale in transfeminism has not been created and future research should include this. One limitation of this study was the limited empirical articles in transfeminism available.

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Does Winning the Heisman Trophy Guarantee Professional Football Success?: An Analysis of Heisman Trophy Winners from 1946 to 2004.

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Abstract

Every year since 1935, the Heisman Trophy has been awarded by the Heisman Trust of New York City to "an individual who deserves designation as the most outstanding college football player in the United States." The award has become the symbol of achievement in college football and is the single most recognizable award in collegiate athletics. This award is also, arguably, the most prestigious individual award in any American sport. Though expectations are set high, not all Heisman Trophy winners have professional careers that parallel their collegiate ones. The purpose of this research was to select every Heisman trophy winner from 1946 to 2004 and evaluate the success of their professional careers. Each Heisman Trophy winner was placed in one of four categories based on objective data from their professional career. These categories are labeled as Outstanding, Commendable, Disappointing, and Non-Existent. Once each player's career was analyzed and categorized, we attempted to answer the question: Does collegiate success translate into success at the professional level? Based on the analysis of data, from the last fifty-

eight Heisman Trophy winners, twenty-five of these (43%) had NFL careers that were deemed "disappointing." Ten of the last fifty-eight Heisman Trophy winners (17%) had "outstanding" professional careers.

Introduction

In America, sports have the power to take center stage. When a city's team wins a championship or loses a game at the last second, this is what appears as the lead story on the nightly news or on the front page of the newspaper the next day. Sports bring a community together and bring out the passion of Americans whose emotions go up and down with the success and failure of their teams. The biggest revenue generating and most popular sport in America, both collegiate and professional, is football. The National Football League (NFL) generated $7.8 billion in revenue in 2010, and the overall operating income was $1.034 billion in 2008-2009. The most valuable franchise in the league, the Dallas Cowboys, is worth a staggering $1.8 billion (Plunkett Research 2010). In 2010, college football programs combined to make a profit of over $1 billion for the first time. The profit of the 68 teams that play in the six major conferences went up 11 percent. The University of Texas in Austin generated almost $94 million in revenue, earning nearly a $69 million profit (Isidore 2010).

When football players get to the collegiate and professional level, they have a burden of not only playing well for their coaches, their teammates, and themselves, but also for the millions of fan who are watching them every second they play. Players must practice and prepare themselves for each game, because if they don't perform well, they will be ridiculed and scrutinized for the entire season. A player at the collegiate level who can exceed the expectations of fans and perform exceptionally every game is praised like a hero. Since that player was so successful at college football, the same is expected of them at the professional level.

However, collegiate success does not always translate to professional success. The game is different on many levels, and the differences have an impact on the player's success. This study will look at the most successful collegiate players in the history of football and the quality of NFL careers they had. In determining which Heisman Trophy winners have been the most successful, this study will utilize data on their NFL careers.

Since 1935, the Heisman Trophy has been awarded by the Heisman Trust of New York City to "an individual who deserves designation as the most outstanding college football player in the United States" (Heisman Trophy 2011). The award has become the symbol of achievement in college football and is the single most recognizable and sought-after award in collegiate athletics. The award is also arguably the most prestigious individual award in all of American sports.

The award was named after John Heisman, who made significant contributions and innovations to football strategy and the game itself. Heisman was born in Cleveland, Ohio in 1869. He played football at Brown University from 1887-1889 and the University of Pennsylvania from 1890-1891. He was a Head Coach for 35 years, serving at Oberlin College, University of Akron, Auburn University, Clemson University, Georgia Tech University, the University of Pennsylvania, Washington & Jefferson College, and Rice University. He compiled a record of 181 wins, 70 losses, and 8 ties, and his 1917 Georgia Tech team won the national championship. Heisman was inducted into the College Football Hall of Fame as a coach in 1954. Heisman suggested dividing the game into quarters

instead of halves and developed one of the first shifts. He was a strong proponent of the legalization of the forward pass in 1906, and originated the "hike" that the quarterback shouts to start each play. Heisman died in 1936 (Heisman Trophy 2011).

The Heisman Trophy Trust governs the policies and procedures by which the balloting process is conducted. The United States is divided into six sections, and each section has 145 media votes, totaling 870 media votes across the country. Additionally, every former Heisman winner has a vote as well. In 1999, The Heisman Trophy agreed to develop a special program to allow the public to become part of the balloting process by permitting one fan vote eligible in the overall tabulation. This brought the total number of voters for the 2009 Heisman race to 926 (Heisman Trophy 2011).

There is so much attention given to the recipient of this award, in addition to the amount of money NFL teams may spend in signing this individual to a professional contract. Needless to say high expectations are set for their professional football careers. However, not all Heisman trophy winners have careers that parallel their collegiate ones. The purpose of this research is to select every Heisman trophy winner from 1946 to 2004 and analyze their professional career to determine how successful it was. The modern era of college football began in 1946, following World War II, with the passing of the GI Bill. The bill provided college or vocational education for returning World War II Veterans, and this led to a dramatic increase in college enrollment and fan interest that led college football to become as popular as it is today (Verstegen 2011).

Each Heisman Trophy winner will be placed in one of four categories based on objective data from their professional career. These categories are labeled as Outstanding, Commendable, Disappointing, and Non-Existent. These categories will be clearly defined, so that once each professional career is analyzed, it will be clear which category each player belongs in. Once each player's career is analyzed and properly categorized, we may answer the question: does collegiate success translate into success at the professional level? Since Heisman Trophy winners, as a group, are clearly the most successful college football players, it is a good choice to examine them.

Once a player is selected as the recipient of the Heisman Trophy, the player will always be synonymous with the trophy, and their entire career will be analyzed by sportswriters. Many sportswriters and sports networks have their lists of the greatest Heisman Trophy winners, or the most overrated or underrated, or the biggest flops. These lists can be found through ESPN, Sports Illustrated and The Sporting News, among many other sports outlets. These usually are framed or titled as "The Ten Biggest Heisman Trophy Disappointments/Flops" or "The Ten Best Heisman Trophy Winners." However, a detailed, systematic analysis of each Heisman trophy winner is missing. This current study intends to analyze the professional football accomplishments of every Heisman Trophy winner from 1946 to 2004. This analysis can inform the professional football organizations and the average football fan what they should expect to see from the professional careers of Heisman Trophy winners.

Literature Review

Research on the impact of winning the Heisman Trophy on football player's professional careers is non-existent in the social science literature. However, there are some published pieces of journalistic accounts on this topic. Bill Pennington's The Heisman: Great American Stories of the Men Who Won (2004) gives detailed profiles of the lives

and careers of a number of Heisman trophy winners spanning several decades. For each player, the college career is explained in depth, including the season which that player won the award. Specific games in which the Heisman trophy winner played exceptionally well are looked at in depth, with quotes from some of these individuals about a particular game and season. Pennington puts the trophy winner's season in perspective and looks at what was occurring in the nation around that time and what else was going on in sports. Also, the professional career of the player is explained, as well as their life after college. Some of the players profiled include Paul Hornung, Ernie Davis, Jim Plunkett, and Roger Starbuch. The book's first chapter is dedicated to the Downtown Athletic Club and the trophy's namesake, John W. Heisman. The impact John Heisman had on the game of football is explained, as well as his influence on the Downtown Athletic Club. The reason for the trophy being named after him is also given. In the preface of the chapter, the author does a great job describing the prestige of the award. The Heisman trophy is compared to all other most valuable player awards in professional and collegiate sports. Pennington notes that no other award symbolizes excellence like the Heisman Trophy.

Tim Layden's article on the Sports Illustrated website titled "NFL, College Football have Fundamental Differences," (November 2006) gives specific differences between collegiate and professional football. Covering college football for most of his career Sports Illustrated assigned him to cover professional football. Layden came up with eight differences between the NFL and collegiate football. One of the key differences is the speed of the games. In the NFL, the game is faster paced, and the players have to react quicker and make their decisions quicker. However, in college Layden mentions, you are more likely to see "cutbacks" from the running back and quarterback, leading them to gain more yards. In the NFL, defensive players are usually able to   tackle the ball carrier regardless of the "cutbacks" running backs or quarterbacks make. Another difference given is the attitude. NFL players are being paid to play. They have families to feed, and they treat the game like a business. College players, on the other hand, are playing for fun, and most will never play the game professionally. After this, Layden notes that in the college game teams who are behind by several touchdowns or points are more likely to shift momentum and win games than in the professional game. Emotions are a bigger part of the college game. Momentum can swing dramatically in college football, leading some teams to score 35 points in the final quarter. In the NFL, however, teams are less likely to lose a big lead in the final quarter. This leads to Layden's final two differences: the clock and youth in the college game vs. player maturity in the professional game. In college football, the clock stops on every first down. In the NFL, there is a running clock, so the only way there will be a big comeback is if there are a high number of turnovers. Lastly, the NFL features some of the best athletes in the world, coached by the best coaches, and they are all paid millions of dollars. Since college players aren't paid, their performance is less predictable than their NFL counterparts.

Sportswriters and sports networks often rank Heisman trophy winners, usually the top ten, based on the biggest success in the NFL and the biggest busts. Some sportswriters have given explanations as to why they believe collegiate success doesn't translate to the same success at the professional level. One of these sportswriters is Allen Barra and his article "Why Heisman Winners are NFL Also-Rans," published on Bloomberg.com (December 2009). Barra asks if the Heisman Trophy goes to the most outstanding college football player in the country, then why are so many of them not playing in the NFL? One of the reasons he gives is maturity. Most of the Heisman Trophy winners, he says, peaked

when they were 20 or 21, so their college years are when they played their best. Other players, like Tom Brady, peaked in their professional careers. Barra quotes Aaron Schatz, creator of footballoutsiders.com, who thinks that the voters for the Heisman Trophy simply don't pick the best player. He feels that in college a player's flaws are less noticeable than they are in professional football. Barra also suggests that statistics play too much of a role when voters decide who they are going to vote for. He says lineman and defensive players can play well, but will never have the statistics that voters salivate over.

Many sports analysts like to rank different aspects of sports, on television or in print. Ivan Maisel, in his book The Maisel Report, (2008) lists what he thinks are college football's most overrated and underrated players, coaches, teams, and traditions, among other things. One of his chapters is dedicated to who he thinks are the most overrated Heisman trophy winners. For instance, he lists Charles Woodson, Heisman Trophy winner in 1997, as the most overrated winner in history. His main reason is that he believes that Peyton Manning should have won the trophy that year, not Woodson, and that the only reason Manning didn't win was because he was held to a higher standard and that his team did not go undefeated, like Woodson's team. Maisel lists nine other players on his list, including Paul Hornung, Eddie George, and Tim Tebow.

Methodology

This research will be a population study, where every Heisman Trophy winner's professional career from 1946 to 2004 will be analyzed. Even though the Heisman Trophy was first presented in 1935, the data collection process will begin with the Heisman Trophy winner of 1946 since this is widely considered the beginning of the modern college football era. No Heisman Trophy winners after 2004 will be included in this analysis since they will not have had sufficient amount of time to develop their professional careers. An analysis of an individual's collegiate career is not significant to the study, because each player won the Heisman Trophy, which is presented to the most outstanding player in college football. It can be assumed that each winner had an outstanding college career. However, the career statistics of each player who played in the NFL will be analyzed, as well as the statistics of each season when determining which category they will be placed in. While some of these players may have played in other professional football leagues, such as the Canadian Football League and NFL Europe, only a career in the National Football League or the American Football League (which would eventually merge into the current National Football League) will be analyzed since this is considered a level playing field for all of the players.

After the professional career of each player is examined, they will then be placed into one of four categories based on their performance. These categories are Outstanding, Commendable, Disappointing, and Non-Existent.

An Outstanding rating will be given to those players whose NFL careers are among the best in NFL history. Their career statistics for their positions should rank among the best in NFL history. They will have produced many high quality seasons, which can include Most Valuable Player awards. They will have been selected for numerous Pro Bowl appearances, be selected to numerous All-Pro teams, and they will have had a career that would lead to nomination and possibly selection to the Pro Football Hall of Fame.

A Commendable rating will be given to those players who had a consistency of seasons that contributed to the team they played for. They were starters for most of the

seasons they played, and could have been selected to one or two Pro Bowls. They were not among the best players in the NFL history, but were among some the better players in the league at the time they played.

A Disappointing rating will be given to those players who played a number of seasons in the NFL, but did not make great contribution to their teams. They played as back-ups and/or did not consistently play during each season. Their statistics were mediocre and their career could have ended early due to injury or other reasons. These players could have one of two high quality seasons, but their other seasons were not impactful.

A Non-Existent Ranking will be given to those players who, for whatever reason, did not play in the NFL.

These categories are defined as such so that any knowledgeable person can look at the careers of the players and would be able to identify which category they belong in. In doing so the researcher has attempted to establish a certain level of face validity for these categorizations. This research will also establish inter-rater reliability to test the consistency of player categorization. Reliability is the consistency and/or stability of a measuring instrument. Inter-rater reliability is the extent to which different raters rate the same material similarly (Chambliss and Schutt, 2010). This study will use two raters (including the author), who are knowledgeable about college and professional football. These raters will independently rate the professional careers of each Heisman Trophy winner from 1946 to 2004. A comparison will be conducted on the consistency of the categorizations of each rater.

Research Questions

The study will aim to answer the question; Do the most successful college players, Heisman Trophy Winners, also have successful professional careers? The study will look to see how successful or unsuccessful each player's professional career was, and then analyze them as a group as well. The study will also look to see if there are other factors that have influenced the professional success of these players. For example, do quarterbacks who win the Heisman have more successful professional careers than running backs?

Data Analysis and Findings

In total, the professional careers of 58 Heisman Trophy winners were analyzed. Ten of them, about 17 percent, had outstanding careers. Seventeen of them, about 29 percent, had Commendable careers. Twenty-five of them, about 43 percent, had Disappointing careers. Six of them, about eleven percent, had Non-Existent careers.

Two of the players who had outstanding careers won the trophy before 1960. Two of them played during the 1960s, two of them won the trophy during the 1970s, three of them won the trophy in the 1980s, and one during the 1990s.

Out of the seventeen winners with a commendable career, six won the award before 1960, one won the award in the 1960s, two in the 1970s, four in the 1980s, three in the 1990s, and one in the 2000s.

Out of the twenty-five with disappointing careers, four won the trophy before 1960, six won the trophy in the 1960s, five won the trophy in the 1970s, three won the trophy in the 1980s, five won the trophy in the 1990s, and two won it in the 2000s.

Three of the winners who had Non-Existent careers won the trophy before 1962. One won the trophy in 1993 and the other two won the trophy in the 2000s.

Thirty-three of the Heisman Trophy winners were running backs, which is more than half of the current sample. These players either played running back, halfback, or tailback. Five of these players had outstanding careers (about 15 percent), eleven had commendable careers (about 33 percent), 13 had disappointing careers (about 39 percent), and three had non-existent careers (about 9 percent).

Twenty-two of the Heisman Trophy winners were quarterbacks. Three of these players had outstanding careers (about 13 percent), four had commendable careers (about 18 percent), twelve had disappointing careers (about 55 percent), and three had non-existent careers (about 13 percent).

Four other players played positions other than quarterback and running back, they are: corner back, wide receiver (two), and lineman. Two of these players had outstanding careers and two had commendable careers.

From the data it is clear that the Heisman Trophy rarely is awarded to anyone other than a running back or quarterback. However, the data shows that running backs who win the Heisman Trophy have more success in the NFL than quarterbacks. Forty-eight percent of the backs who won the Heisman Trophy either had an outstanding or commendable career, while 68 percent of quarterbacks who won the trophy either had disappointing or non-existent careers. One possible reason may be that during a game, running backs are rotated in and out of the playing field while the starting quarterback will often play the entire game. This may serve to shorten the careers of some quarterbacks and lengthen the careers of some running backs. The data collected shows that quarterbacks who won the Heisman often found themselves serving as back-ups to start their careers. Those who had outstanding or commendable careers did not start having an impactful career until a couple seasons into their career. For backs, half of the winners had either outstanding or commendable careers and half had either disappointing or non-existent careers.

The six Heisman Trophy winners who had non-existent careers were unique cases. Richard Kazaier, a running back who won the trophy in 1951 playing for Princeton, received a contract offer for the Chicago Bears, but instead decided to attend Harvard Business School. He later served in the Navy for three years before starting his own business (Pennington 114). Pete Dawkins, halfback who won the trophy in 1958 for Army, went on to become a Rhodes Scholar at Oxford University where he studied philosophy, politics, and economics (Pennington 151). Both of these players decided to pursue an academic career rather than playing professional football. Both of these players won the trophy in the 1950s. Had they won the trophy more recently, the money offered by the NFL today, which can go into the millions of dollars for first round draft picks, could have influenced these players to play professional football.

Ernie Davis, a running back who won the trophy in 1961 playing for Syracuse, was the first pick in the 1962 NFL draft for the Washington Redskins, and was eventually traded to the Cleveland Browns. However, he was soon diagnosed with leukemia and never played a game in the NFL. He died in May 1963 (Pennington 170-173). Davis' situation was tragic, and he could not control that he did not play in the NFL.

Charlie Ward, a quarterback who won the trophy in 1993 playing for Florida State, made it clear that he would only play in the NFL if he was selected in the first round of the NFL draft. When he wasn't, he decided to play in the NBA, where he was selected

in the first round of the NBA draft by the New York Knicks (White 2006). Ward was a talented athlete who decided to pick one sport over another.

Eric Crouch, a quarterback who won the trophy in 2001, was drafted by the St. Louis Rams in third round and was projected by them to play wide receiver. Dissatisfied that he wasn't given a chance to play quarterback, Crouch announced his retirement before he played a game (Associated Press 2011).

Jason White a quarterback won the trophy in 2003. He went undrafted in the NFL draft. He was eventually signed by the Tennessee Titans but eventually retired, citing a knee problem (J. White 2005). Ward, Crouch, and White are prime examples of how tough it is to be a quarterback in the NFL. Even though all three won the Heisman Trophy, neither of them were projected to have good NFL careers, and as a result, they all didn't play a single game in the NFL.

Inter-rater reliability was used in this research to test the reliability of the four evaluative categories. Both raters are more knowledgeable than the average fan about collegiate and professional football. The raters worked independently when categorizing each player; using the same descriptions of the predetermined categories. Each rater evaluated the 58 Heisman Trophy winners and placed them in the predetermined categories. Both raters were fairly consistent on rating the players and then placing them in one of the four categories. The raters were in agreement, concerning their ratings, 94.8 percent of the time. Two players who were rated in the commendable category by one rater were rated outstanding by the other. One player who was ranked disappointing by one rater was rated commendable by the other rater.

Overall, the data shows that winning the Heisman trophy and success in collegiate football does not guarantee success at the professional level. The combination of outstanding and commendable careers that have come from Heisman Trophy winners from 1946-2004 are slightly more (two) than the total number of disappointing careers that has been produced by Heisman Trophy winners. Even the most successful college players aren't guaranteed a successful career in professional football. An instance of this would be Archie Griffin. He is the only player to have won the Heisman Trophy twice, in 1974 and 1975, while playing running back at Ohio State University. He played seven seasons in the NFL for the Cincinnati Bengals, and never made a Pro Bowl or had more than 200 touches in a season. In his four seasons at Ohio State, Griffin ran for 5,589 yards, which is almost double his NFL total of 2,808 yards, even though he played three more seasons in the NFL than college.

Recommendations for Future Research

The Maxwell Award, like the Heisman Trophy, is given out to the best collegiate football player in America. Even though it was first given in 1937, two years after the Heisman Trophy was first awarded, it is not as prestigious as the Heisman. The award is given annually by the Maxwell Football Club. The Heisman Trophy and Maxwell award do not always go to the same individual. For example, in the past ten years, both awards were given to the same player on three occasions. Future research can analyze the professional careers of Maxwell Award winners and compare them to the careers of Heisman Trophy winners. In doing so, one could also analyze which award is a better predictor of NFL success.

While this study determined if a player had a successful NFL career or not, it

did not study the overall non-football professional careers of Heisman Trophy winners. Winning the Heisman Trophy means that that player will always be synonymous with the award. Because of this, sports writers will be focused on the future NFL success of these individuals. However future research should take into consideration not just the professional football careers of Heisman trophy winners, but should also include a more comprehensive analysis of their lives and careers outside of professional football. One possible research study could focus on the non-football careers of Heisman trophy winners compared to the non-football careers of "regular" football players.

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Undocumented and Unafraid: Undocumented Latino Youth, Identity, and Society

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Abstract

A misunderstanding exists about the true nature of the relationship of Latino adolescents' identity and activism in Chicago. Media portrayals of Latino youth identities in society are problematic because they are framed as mostly negative (Shinnar, 2008). As a result, this misunderstanding could lead to public policies that criminalize this population. These portrayals in turn, may hamper the creation of a positive identity for undocumented Latino youth. This study is intended to understand the relationship between social activism and undocumented identity. Six undocumented Latinas aged 17 to 26, within two different youth organizations in the Chicago area were interviewed concerning undocumented Latino youth identity and social activism. The implications of this study hold promise for filling the gap in our misunderstanding of undocumented Latino youth identity and social activism in Chicago.

According to the 2000 US Census, approximately thirty-one million people living in the United States are foreign born; Latin Americans make up over half (52%) of these individuals. Mexicans alone accounted for 9.2 million foreign born residents (U.S. Census , 2000). The large numbers of Latin Americans in the U.S. illustrates the importance of positive perception between all people, in order to have an undamaged relationship within society. Because identities are built on perceptions, the need for a positive identity for the undocumented Latino youth is crucial. Throughout the years, Latino youth identities have been portrayed in the media and in society as problematic; the undocumented legal status of Latino youth is and has been negatively portrayed through society (RS, 2008).

In 2006, people from around the nation gathered to march and rallied against anti-immigrant laws (Flores-Gonzalez, 2010). From these marches, as well as many more anti-immigrant laws, youth-led organizations came about, protesting for their rights as undocumented U.S. residents. This civic engagement empowered the youth to "come out," share their undocumented stories and for once be "undocumented, unafraid, and unapologetic." (Immigrant Youth Justice League & Nuestra Voz, 2011).

This study investigates undocumented Latino youth identity through social activism in the Chicago area; what are the ways in which undocumented Latino youth are affected by their legal status? A lack of understanding exists about the true nature of Latino adolescents' identity, the organizations they lead and their importance. Such misunderstanding could lead to public policies that criminalize or ignore the undocumented Latino youth and their needs.

Literature Review

Due to the geography and the diverse accessibility to resources in each nation, there has always and is still a large migration of Latin Americans to the United States; contemporary migration is more commonly linked with a greater number of undocumented individuals (Gonzales, 2008). Due to this, most of the literature concerning undocumented or "illegal" migration in the United States is primarily focused on Mexican, labor migration (Genova, 2002). Formerly conducted studies have been concerned with the migration aspect, as opposed to the immigrants themselves, or what that immigrant status means to migrants. This study focuses on the identity of *youth* immigrants, and how the undocumented impacts immigrant's everyday lives. This study will analyze what undocumented identity means among Latino youth, and what changing the youth immigrant's legal status might imply for their sense of self.

The psychologist Erik H. Erikson (1950), coined the terms "identity" and "identity crisis," as he developed his terminology for his studies of adolescents. Though Erikson's terminology and research was inspired by his assimilation and immigration experiences to the United States, he applied the vocabulary and his studies towards adolescence. He defined adolescence as the time in life in which youth are in need of finding their own identity and purpose. These two continuously debated expressions are now commonly linked with the assimilation and adaptation process of immigrants, in this case specifically with youth immigrants.

Through the understanding of the thought process by which Erikson (1950) developed the controversial terms, "identity" and "identity crisis," we can see the important link of immigrants and youth. Seeing the reason for Erikson's interest in identity, immigration, and his application, youth, bringing these two bodies of literature, immigration and youth, is an inevitable and necessary task. Because both populations are confronted by the crisis of understanding oneself and his/her place in a designated society,

it is difficult to recognize that after more than fifty years, scholars had not yet joined the research fields. It is not until now, that we see the importance of understanding what it means to be a youth immigrant, especially undocumented youth.

Children of immigrants and immigrant children, have a large disadvantage compared to children in a culturally American household (Zhou, 1997). Many social scientists believe that there are differentiations between the children of immigrants, immigrants of children, and all those in between. Ruben Rumbaut (1991) coined the phrase "one-and-a-half-generation" to describe the group of children who emigrated at a very young age, and are not exactly foreign nor native. The exact ages differ from scientist to scientist, but according to Min Zhou (1997), culturally, the second generation children are those children of immigrants as well as those children foreign born arriving during their preschool years, while the 1.5 generation are all those arriving between six years and thirteen years old, and the 2nd generation would be able to include all immigrant children, youth, and adults older than thirteen. Many social scientists disagree with these exact numbers, but there is a general agreement that there are differentiations caused by different experiences, resulting in drastic inconsistencies in children, these differences being psychological, cultural, mental, and especially social.

Due to the obstacles that immigrant children confront, their lives are considered to be more difficult; many of them have a non-conventional relationship with their parents. Because they migrated at an early age, they know both their native language, to speak with their family members, and English, to be able to associate with others in society. Therefore they are needed by their parents to translate for them, causing a reverse in power between parent and child, opposing the typical hierarchy in the family (Zhou, 1997). The adolescence stage is one which is subject to confusion, being an immigrant complicates this stage that much more. Seeing the complex issues immigrant youth confront, understanding their identity, especially that of the undocumented youth is necessary to a more complex understanding of the obstacles they confront.

The "undocumented identity" is a subjectivity still in process of being defined today. Though the generations are established, the 1, 1.5, and 2nd generations, there is still a difficult task understanding what each means. Who is culturally a foreigner and who is culturally a native; how does this impact the youth's daily relationships? Much of the research implies that the younger generations wish to assimilate, in order to "fit in" at school and be like their friends, causing dispersion of their own culture (Zhou, 1997). Zhou also references the identity issues many that immigrant children confront, the questions they are many times unable to answer: which "side" should I stay loyal to, can I be both, how should I act or portray myself?

Through many marches in 2006, many youth came out and lobbied against the anti-immigration laws (Flores-Gonzalez 2010, Gonzalez 2008). Due to the solidarity of the undocumented, as well as many U.S. born citizens, thousands of people conjoined to march for immigrant rights (Flores-Gonzalez, 2010). Many of the demonstrators marched with their families, friends, old, and young community members (Gonzales, 2008). Throughout the nation, activists marched, leaving their jobs, schools, and other important events to bring nation-wide attention to this national crisis.

Out of the large demonstrations and marches in 2006, many activist groups came about. The new generation took charge of these movements, as they realized the importance of youth presence and interactions within the protests. *"Plyer vs. Doe 1982"* is a law passed by the Supreme Court in 1982 allowing undocumented youth to participate in the public

school system within the United States, granting undocumented children and youth the right to learn and attend schools in the United States without the fear of deportation (Plyer vs. Doe, 1982). Even though education is a right as humans, undocumented youth see this as a great opportunity not easily taken for granted; when they are finally able graduate, they are given few choices for careers and lifestyles (Gonzales, 2008). Undocumented youth is the population which struggles the most to find jobs, they are unlikely to take the jobs in the fields, after having studied, yet unable to have decent jobs because of the lack of a social security number, and struggle to go college and have a career due to the inability to receiving financial aid. Therefore when the undocumented youth graduate high school, and if they have the luxury of attending and graduating college, undocumented youth are unable to find work, and therefore find themselves advocating and lobbing for the undocumented rights.

Lobbing and activism are two of the few tactic strategies undocumented youth are left with. After the 2006 marches, many youth were drawn to being involved in their communities (Flores-Gonzalez, 2010), out of which a few organizations came about in the Chicago area. Two of these organizations have been formed since, one representing the inner city youth, Immigrant Youth Justice League, while Nuestra Voz represents the undocumented youth in the suburbs of Chicago. The two work together to promote higher education within the Latino community and attain social equality. This study will evaluate youth involved in these two organizations, in order to understand their sense of identity and activism within their community.

Methods

Interviewing

This study was conducted in a qualitative fashion, using interviewing techniques. The interviews were conducted in an environment chosen by the respondents, home, coffee shop, and a meeting room. The interview was lead in semi-structured format, to allow for any exploratory questions. Though most of the questions were the same, there were a few inconsistencies in the questionnaires, differentiating the previously conducted interviews, with the ones directed by me. These interviews, are being used for a data bases, and therefore contain many questions, due to that, they typically ran for two hours each.

Sample and Access

According to Cornelius's study on interviewing undocumented immigrants (1982), social scientists do not believe there is an existing method of sampling which will provide accurate information from the interviewees. Because I personally was undocumented for many years, I am able to identify with the topic and the interviewees, bridging the gap between the interviewer and the interviewee, allowing a more fluid conversation by pointing out the commonalities and struggles between the interviewer and interviewee.

The study includes a sample of six participants, three of which were previously interviewed by a professor, and three which I conducted personally. The participants are all Latino undocumented youth involved in activist groups in the Chicago area, four involved in the Immigration Youth Justice League, and two in Nuestra Voz.

The participants were asked to be in the study, after meeting them through various forms (e.g. professors introducing us, previous interviewees, and meetings). Though some object to the thought of a snowball sample, many researchers have used this technique

among undocumented immigrants, and have found it to be most resourceful (Cornelius, 1982). This method allows for cross-checking information provided by respondents and their peers. Due to the small number of participants and the snowball method used in this study, it is not generalizable for any population.

Data Organizing

Due to the study being a spinoff of an existing research, the questionnaire was previously made, and simply formatted for this research. The questionnaire ranged from questions about the organization, to their family life, typically ending with their personal identity. Though most of the questions were the same, a few questions were developed and asked during the session of the interviews, depending on the statement made by the interviewee (see interview schedule in appendix).

After conducting the interviews, analyzing the data through a systematic coding scheme was arranged. Thematic coding was completed in order to pinpoint the important quotes and be able to correctly compare the data. Through the coding, it was evident that identity, empowerment, and civic engagement are linked in the lives of undocumented youth.

<div align="center">

Results and Discussion

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After thematic coding, three major themes arose: undocumented, identity, and civic engagement. These three terms gave evidence for the theory undocumented identity is likely to become a positive one through civic engagement. As the coding process continued, the development of understanding the identity of the undocumented youth in Chicago is much more clear. The following section I share in three parts, determined by the coding, how undocumented youth share in their own words how they talk about it.

Undocumented

For the use of this study, the term "undocumented" is defined as the legal position which denies many the possibility of having citizenship in the United States. In 2004, 40.5 percent of Mexican immigrants living in the United States live with an undocumented status (Schaefer, 2010); this shows the significant number of undocumented Mexicans living in the U.S., and why this is such a hot topic in today's news. While interviewing, many of the youth stated the difficulties they confronted with the status given to them as children, these quotes show the passion yet confusion they feel with their undocumented status.

Laura, a youth organizer from Immigrant Youth Justice League(IYJL), stated the following in her interview after being asked what being undocumented means to her.

> [Undocumented is] I guess, probably, not existing. Because if you can't vote and if you can't travel and if you can't do a lot of things for fear that people might find out that you're, you're not, you don't have certain documents you can't do a lot of things and so you try to live a comfortable life but comfortable doesn't necessarily mean happy so I don't know. Just like hiding, being really cautious, being in the shadows. A lot of undocumented people have identified with always being limited, I don't know, I always like dreaming of things that you wish you could do but you can't.

This instance shows the difficulties confronted by undocumented youth living in the U.S. The restrictions they confront on a daily bases are evident, and the "invisibility"

and lifestyle they have by "living in the shadows" is mentioned by her; Laura states being comfortable overshadows the importance of being happy. She makes it clear that undocumented status is typically linked with being limited.

Similar to what Laura mentioned, another young woman also from IYJL, Ruth, stated:

> To be honest with you I don't think I've ever been a citizen in my entire life. One because when I was 9 [I left Mexico], I didn't know what it was to be a citizen[there] and now that I'm a grownup, I think that I still don't know what's like to be a citizen.

Like Laura, Ruth also mentions the obstacles created by being undocumented. Ruth is unaware of how it feels like to belong in a nation, she mentions she has never known what being a citizen is like. Since she left Mexico, her nation of citizenship, at a young she never understood what that meant, and now she is older yet still unable to comprehend this notion. This idea is likely to cause confusion, and some sort of hatred from within, which in turn could become a social tragedy.

> While the last youth from IYJL, Teresa, mentions:
> [Undocumented, to me means a] lack of personhood, officially unrecognized by the government as a person. Yeah [be]cause like, I mean it's this weird thing where, I mean, you're literally are not considered a person by the government… I think for young people it's an identity we're still trying to understand because for a long time we grew up hearing that it's something bad, it's something that we need to hide. Not just from our parents, right, but from everyone else and it's something that we hear politicians like talk about negatively and criminalize, and so I think it's psychologically an identity that is very hard. It's worse than being gay sometimes. But I don't know I think once you start understanding it as a group of people who can also organize and share experiences and share strategies and all those things like it becomes something to gain strength from.

Similar to what Laura and Ruth stated, Teresa's quote gives a deeper understanding to what it means to be undocumented. She explains the difficulty undocumented youth confront with their legal status while living in the U.S., the negative identity that they carry in their hearts on a daily bases. She clearly states the hardship that comes with having this negative and criminalized identity, and how this is a dynamic paradigm that changes as youth start to organize politically.

Identity

Now I turn to the theme of identity, the term Erikson developed for one of his stages of youth development. Within this context I use the term identity to understand the individuality or uniqueness of the undocumented Latino youth. While interviewing the informants, I understood the importance of having this as a theme; developing a healthy identity is one of the largest dilemmas they confront, by not having one, or having a criminalized one. The following interviews show the process of identification.

The excerpt below shows the confusion Katelyn has while trying to identify

herself.

> Like they [American citizens] have a social [security number]so it will show up as their identity, when you're undocumented you have to get a fake social, so it's kind of like, you're not even in the system, or trying to steal somebody's identity, and it's like oh you're not that person. They're not scared at all but if you're having a fake identity, it's kind of like you're not in the system or your using someone else's identity. … I think I would just call it undocumented, if somebody said how you would want to be called, undocumented, illegal, or alien, I would just say Katelyn. I have been here in this country since I was 8 and I have a record, I'm going to school, I have straight A's, that's how I would refer to it.

This quote shows the difficulties she confronts on a daily base, by not having a social security number, as well as the fear ignited in her by not having her personal identity. Katelyn speaks of identity in the legal spectrum as well as the social spectrum, by stating that not only is it difficult in the legal aspect, by being unable to work and drive, but in the social world as well. Her uneasy words demonstrate the confusion entailed by not being able to identify with a nation, but simply by her name and her school status.

Within the same confusion, Ruth is unable to give a clear identity to which she belongs:

> [I am] queer, undocumented, woman of color, and I think that's it… I think so or I'd like to say there are two ways. I consider myself very gay and I like to be open about my sexuality but I also feel like there is two identities or two labels that I use a lot and that's being queer and undocumented. And I don't think I've ever even thought about me being Mexican or being a Mexican person living in America or anything like that. To me it's always been about being queer and being undocumented.

Ruth shows the similarity between her two different identities, being gay and being undocumented. She explains the commonality between the two, and how they are both taboo identities in many ways. This is a great way of showing how "coming out of the shadows" is important to the individual youth and show their true identity, although she is unsure of what her identity is other than queer. Although Ruth, was unable to identity as Mexican or American because she feels American but is not fully accepted as one, Laura, is able to self-identify with her nation of origin, Mexico.

> Because my parents always told me that I was born in México and that we were from México growing up, I always identify myself as Mexican first. I know that I've had a lot of conversations with people where they say that we've been here for decades, or for over a decade and so we are American and I understand that. But it's just like something that's very deeply rooted that my parents told me as I was growing up. So I am Mexican first and I am American second. And those are like I mean, I'm Latina, I mean that's the easier term I guess, unless I'm more specific than a Mexican.

Laura states that she does not feel American, even though she lives in the United States. These data shows the significant conflict that arises from the undocumented youth, and the difficulties they confront when asked to identify themselves with a nation.

Laura is able to identify with her nation of origin due to her strong relationship with her parents, but this statement shows the likelihood that this could cause a conflict among the undocumented youth.

CIVIC ENGAGEMENT

Civic engagement is last important theme that came about during the coding. This term refers to the impact organizing has on the undocumented Latino youth identity. The following excerpts show the positive yet, conflicting dynamic identities created by organizing through the respective organizations. Ruth, one of the youth organizers states the following about the IYJL organization:

> It's about, creating a space where undocumented youth can come together and actually share their stories but more than that, it to me is a place where people can get empowered, especially undocumented youth, can be empowered by others and we can share resources and learn from our stories in order to fight for our rights…Then after everything was done and IYJL was born I think that I saw IYJL as almost like my own and I think that most of my involvement comes from thinking that I have to take care of this organization because it's so special and because it also affects my life and because I was there from the beginning.

She identifies the organization as a sanctuary almost, where youth can tell their stories and be empowered by their pasts and others around them. She clearly states how the organization helps the youth in many ways, by empowering them and giving them a safe place to discuss their past. She discusses the owning process of the organization, and how it starts to become part of her. Something similar happens in the organization Nuestra Voz with Katelyn.

> [American citizens] …were like oh my God the illegals come here and this. I would just sit there; never in my mind would I speak up and tell them, or argue about it. Now I see it, in junior year, that I'm not afraid that I'm undocumented, I would explain what it is to be undocumented. I think it would have made more sense if back then, listening to them and explaining the other side of the story, because I think they see it as more stereotype and think that all illegal immigrants take citizens jobs, but it was like this is me, my name, I am a student here, that you have known the whole entire year, we have shared stories, were sitting in a classroom, I'm not just that undocumented, or that illegal immigrant coming here, I'm a student here just like everybody else.

> Katelyn makes it clear to us the difference that being involved in Nuestra Voz causes not only socially, but for her self-esteem. She mentions that prior to being involved, she would have never confronted her peers about the name-calling, "illegal," yet now she looks back on a particular situation, and wishes she could have stood up to them and corrected her peers. The greatest outcome of this statement is that she is now, after working with Nuestra Voz, she is able to stand up for her beliefs and herself, giving her a higher sense of self.

Conclusion

This study was a pilot research, which was limited to the undocumented Latino youth in two youth immigrant organizations in the Chicago area. During the summer of 2011, interviews were conducted to identify the relationship between civic engagement and positive undocumented youth identity. Due to the inability to conduct numerous interviews, this work is not generalizable, this study is unable to state that all undocumented youth feel this way, but it does show the importance of the need for such studies.

After analyzing this study, we realized the importance that civic engagement has on the formation of a positive identity for the undocumented youth through civic engagement.it helps them realize that it is not a personal dilemma, but social problem. The deepest implication is that it is clear that we need to identify a positive identity for the undocumented youth, for their social survival. If 40.5 percent of Mexican immigrants are undocumented (Schaefer, 2010), that leaves millions of people living in the U.S. living with a negative self-image. I recommend that studies like this be replicated on a national scale in order to correctly identify the impact of civic engagement within the undocumented Latino youth population. Further research of this topic is essential for the integration of the incoming population, and assisting in non-criminalized identity.

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Appendix A

Interview Scheme-1

Can you fill me in about your migration story?
Can you tell a little about your schooling experiences early on in the U.S.?

Could you talk to me about high school?

Did your school have any resources (inaudible)?

So, what were some challenges that you faced in high school?

How did you find out you were undocumented?

So what challenges have you faced in college?

How do your parents feel about your involvement in activism?

So the next few questions are about your identity and how you identify yourself. So what terms do you usually use to identify yourself?

So what does the term American mean to you?

So then, what does it mean to be a citizen in this country?

What does it mean to be undocumented in this country?

And last question, so how is being undocumented currently affecting you?

Interview Scheme 2-
Questions
I Biographical
    1.   **Migration**

Can you tell me your migration story? (When and how come to the U.S.)
    2.   **Tell me about your schooling experiences:**

When did you start school in the U.S.?
Where you placed in the bilingual/ESL/ELL program? If so, for how long?
How supportive is your school of undocumented students?
Teachers?
Counselors?
What resources are available for undocumented students?
How would you describe your school's approach towards social justice?
          Encouraging of student political/civic participation?
How does your school respond to immigrant rights activism?
Responses to your activism by staff?
Responses to your activism by peers?
What has driven you to graduate from high school?
If in college, What has driven you to attend college?
What challenges do you (or will you) face in college?
How are you able or plan to pay for college?
II Organizing
I am interested in learning about your civic and political engagement prior to your involvement in Nuestra Voz.
Besides NUESTRA VOZ, what has been your involvement with immigrant rights?
Have you attended immigrant rights marches? Which ones?
Besides NUESTRA VOZ, what others things do you do that are political? (rallies, marches, writing letters to elected officials, voting)
Besides NUESTRA VOZ, what other organizations have you been involved with? (Ask for details about these organizations)
What kind of organization is this?
How long have you been involved?
Is this an immigrant rights or immigrant related organization?
Is this a youth-led or youth-oriented organization?

Now I want to ask you some questions about NUESTRA VOZ. (SKIP IF NOT A MAIN LEADER)
 In your own words, what is NUESTRA VOZ about?
How did NUESTRA VOZ get started?
Why was the organization created?
When was it created?
Who were the founders of NUESTRA VOZ?
Tell me about the members of NUESTRA VOZ?
How many? Who are they? Immigrants/Allies
How is NUESTRA VOZ organized? What is its structure? (If not clear, is there a president, etc)

How are decisions made in NUESTRA VOZ?
How does NUESTRA VOZ deal with disagreement and conflict?
What challenges does NUESTRA VOZ face? Internally? Externally?
How does NUESTRA VOZ deal with these challenges?
What kind of events or activities does NUESTRA VOZ do?
Describe NUESTRA VOZ's past, current and future campaigns (such as Coming Out)?
Get history of activities.
How successful has NUESTRA VOZ been in meeting its goals or actions?
In your opinion, what has led undocumented youth to organize through NUESTRA VOZ?

Now, I want to ask you about your personal involvement with NUESTRA VOZ.
How long have you been involved in NUESTRA VOZ?
How did you become involved with NUESTRA VOZ?
Why did you become involved with NUESTRA VOZ?
What is your role in NUESTRA VOZ?
What is the extent of your involvement? Do you actively participate in meetings? events?
How would you describe your relationship with other members?
III I want to ask you some questions about the influence of your family on your activism
1. **Parents's role in shaping activism**

How have your parents influenced your activism?
How have they responded to it? Do they support it? Why or why not? Did they always?
Do they have some fears and concerns, what are they? Have they changed in this?
Which of their behaviours and attitudes have shaped the way you thing about immigration politics?
Do they sometimes express responsibility or guilt about your status? How so?
Would you consider your parents activists and if so how?
What are the main differences between how you and your parents see/understand immigration politics?
How do your parents feel about the possibility that you may become legalized but they may not?
2. **Representation of Parents in Dream Politics**

When you first started speaking out on this issue did you mention/ include your parents?
In what ways? Has the way you talk about your parents and your family changed in the last year and how? Did it change since the Senate Dream vote in December and if so how so?
How do you feel when people suggest that parents are responsible ones and not the kids?
When you heard Congressional representatives suggest that the children were innocent but the parents might be to blame?
Have you had conversations with your parents about this? What has happened in these conversations?.
How do you think the current youth movement is relating its struggle to family? Can you provide some examples in the movement? In your own case/life?
3. **Siblings' relationship to activism**

Do you have siblings who are also undocumented? Are they older or younger?

Are they activists as well? If so, what do they do?
How do you relate your own activism to your siblings and the possibility of opportunities for them?

IV Finally, I want to ask you some questions about your identity and your political participation as an undocumented youth.
When did you learn that you are undocumented?
How did you learn about your status?
When did you realize <u>what it means</u> to be undocumented?
What did you think when you realized what it means to be undocumented?
When did being undocumented became an issue in your life? Why?
What does being undocumented mean to you? How does it affect you?
What does it mean to be undocumented in this country?
Could you define undocumented identity?
What does undocumented, unafraid and unapologetic mean for you?
How do you see yourself in terms of belonging in the U.S.?
How will legalization change all this?
In your view what is the most important reason/argument why undocumented youth should be legalized?
How did you feel when DREAM did not pass in December? Why do you think DREAM did not pass?
Have you participated in any coming out? If so, why did you do it? what were your feelings when you did it?
Why did you do it?
Why do you think it's important for undocumented youth to come out?
Why have you become a youth organizer for immigrant rights?
How would you describe the support you have received from home, school, and your community to be engaged politically as an undocumented youth?
Would you consider this activism something you are doing primarily for yourself or for your family as well? Explain how you see it and why
When youth claim they are doing this for others or speaking for those who can't, what do you think they mean?
What are your thoughts about the DREAM/CIR debate last year? How would you respond to the claim that youth are primarily thinking of themselves and not of the larger undocumented community or of the families when they advocate for DREAM?

Federalist versus Anti-Federalist An Analysis and Comparison of Political Ideologies

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Abstract

Today the Constitution is largely accepted as one of the most effective governments in the world. In many circles the process of its creation and ratification is unquestioned. However, with such basic facts as the identities of the writers of the Anti-Federalist letters left unknown the workability of their ideas for the ideal government are paths much less traveled by and most often left in the shadows. The Federalist and Anti-Federalist views will be explored here through the writings and speeches of James Madison and Patrick Henry respectively.

Introduction

"The liberties of a people never were, nor ever will be, secure, when the transactions of their rulers may be concealed from them." – Patrick Henry

The Constitutional Convention began May 14, 1787. The meeting convened in the East Room of a two story statehouse in Philadelphia, Pennsylvania. The doors were shut, the blinds were closed, and the delegates swore each other to secrecy. These secret meetings were held for the following four months, ending officially on September 17th. During this convention our current form of federal government was framed, the Constitution was written, now the debates would begin. In order for the Constitution to be ratified 9 states had to agree to it. In each state factions quickly developed, the Federalists and the Anti-Federalists. One of the key figures in the Federalist faction was James Madison, and Patrick Henry was the better known champion of the Anti-Federalists.

Much is known about the Federalists, they play a key role in history books, their papers are required reading in many high school government classes, and their views are widely known across the populace of America. However, the Anti-Federalists are lesser known. Some of the key facts are still shrouded in doubt, and they are integral to our understanding of the Anti-Federalists. The number of total authors and who they were is not widely known or largely agreed upon; for example the author writing as the Federal Farmer was thought to be Richard Henry Lee, but in 1974 Gordon S. Wood came out against this conclusion, in an article published in the William and Mary Quarterly called *The Authorship of the Letters from a Federal Farmer* stating that there was no proof in Lee's memoirs that this was him and the writing styles did not match among other issues. That same year Herbert Storing, who was working on *The Complete Anti-Federalist,* agreed on page twenty four of that publication that the support for Lee being the Federal Farmer was weak, however, so was the argument against that notion. Another issue is that the number of Anti-Federalist papers is still unknown, though most printed editions carry the 85 in which the subject matter seems to be similar to the Federalist papers.

Because much is left unknown about the Anti-Federalist's and their written work it sets us up to see and be taught mainly the Federalist perspective of the time period; leaving what the Federalists thought was best for America commonly known, and causing the majority of Americans to remain ignorant as to what the Anti-Federalists believed was ideal. What did most Anti-Federalists feel was the best path to take? Were the Articles entirely beyond repair? Did they commonly feel that it was in the best interest of the nation, at that time, to scrap all efforts of making the Articles workable? What inspired the creation of this faction reacting against ratification of the Constitution? I want to delve into those views and answer those questions, to do this I want to learn and illustrate the beliefs and convictions of Patrick Henry and view them in contrast to those of James Madison and other Federalists.

Chapter One Synopsis: Federalist Beliefs as Viewed Through James Madison

James Madison was one of the key leaders of the Federalist movement, and roughly a third of the Federalist Papers are believed to be authored by him. He is known as the father of the Constitution, and had a plan for a new government written out before he even arrived at the Constitutional Convention. His desire for a new governmental structure had to do with

his experiences as a member of the Continental Congress; he was greatly affected by the poor reputation America was gaining as we were increasingly unable to pay off our debts. This greatly impacted international relations, and was affecting a treaty in the works to maintain passage on the Mississippi river. Madison saw several key issues as causing these problems. First, the states were not responding to the national governments requisitions for funding, this impacted our troops in the Revolutionary War, and it killed our ability to pay even the interest on our debts. He also felt the national government was not strong enough, it was internationally known that America could not make treaties without consulting the states, which greatly affected any possible treaties and led to an increasing disrespect for American ambassadors. It was also known that issues of factionalism were starting to arise, and should there be an attack on one state, the others may not send in their militias. The national government could not defend the country, they could not run the important mechanisms for the country, and they could not earn any respect in the international arena.

Chapter Two Synopsis: Anti-Federalist Views, Concentration on Patrick Henry

Patrick Henry was one of the better recognized Anti-Federalists, there seems to be a general consensus that he did not write the Anti-Federalist papers under a pseudonym, but he did lead the charge against ratification at the Virginia Ratification Convention. He was a well recognized orator, particularly leading up to the Revolution, and is recognized as a founding father who championed republicanism and historic rights. He did not attend the Constitutional Convention, stating that he 'smelt a rat in Philadelphia', and was a strong opponent of ratifying the Constitution. He was a strong supporter of state's rights and felt that 'securing the sovereignty of the states secures the liberty of the people'. The greatest threats to liberty that he perceived in the Constitution trace back quickly to the lack of a Bill of Rights in the original draft, but there were other issues. He felt that there was not enough structure to prevent the usurpation of power, that you could not expect law makers to punish themselves (for example the impeachment process), that sharing he power to tax would over complicate matters as well as loyalty of tax collectors to the nation which would result in an angry populace, and that it took far too much to amend the document. As to the latter he mentioned several times that all it would be either a third of congress being against something or four small states opposed to the amendment to prevent it from occurring. Lastly, he spent a good deal of time attacking ambiguities in the document: the necessary and proper clause, the supremacy clause, and the description of how representatives would be assigned in particular. In his speeches he spends a good deal of time describing the corruptibility of the system, and proposing unexplored alternatives. He would stand by the requisitioning system, he pushed for a bill of rights to be added to the document prior to ratification, and was all for eliminating any trace of ambiguity from the document as a prevention of corruption and usurpation.

Chapter Three Synopsis: Were the Arguments of Patrick Henry Reasonable

Patrick Henry's key arguments were for the amending of the requisition system, the removal of ambiguities, the addition of a bill of rights, and a basic all around increase in state power. This will not go into what if scenarios, we will not be exploring 'what would have happened if…' By analyzing each issue it is clear exactly where they would have led. If you look at Patrick Henry's argument[1] that if a state does not fulfill a requisition

the state would lose control over all key systems that it would need to run. Firstly, in order for Congress to take over the running of those systems it would need the funds to do so, the funds it did not receive from the state. Secondly, it derails slightly from his thought process; meaning he seems to be alright with surrendering basically all of the state's power in the Union until requisitions are paid, making the national government stronger than the government of that particular state. This greatly conflicts with his intense distrust and suspicion of centralized power and could easily be corrupted should that power requisition an amount it was known that the states could not or would not pay. His next argument, removal of ambiguities such as the Necessary and Proper Clause and the Supremacy Clause, seem rather reasonable at the start. If removing the ambiguity meant applying more restrictions to it and further detailing what it meant, it may have been reasonable depending upon what those restrictions and details were. If it meant removing that portion entirely the Constitution's title as a 'living document' could be greatly hampered as both of those clauses have played key roles in United States history, the positivity of the roles they played being left to political debate. Lastly, his call for a bill of rights, this did happen but it did not quite go as he planned. He had further arguments over what the amendments were and what they entailed, but the inclusion of this bill of rights can be deemed reasonable.

Chapter Four Synopsis: Comparing and Contrasting the Motives of Henry and Madison

Quite obviously there is a lot to contrast here, but in comparing one would be surprised. In reading the notes of the Constitutional Convention it is easily observed that Patrick Henry's suspicion is far from unique to him. They spent four months locked in the East Room debating many of the things that Patrick Henry illustrates; the corruptibility of government officials, the strength of the executive office, numbers of representation, and the ambiguities left in the document. After spending four months debating these points it eventually came to mutual consensus that they had done as well as they could and it would be moved through the ratification process that Patrick Henry was such an integral part of. Both Henry and Madison recognized there were weaknesses in the Articles of Confederation, and ironically both men feared a usurpation of power from the people into the hands of a leader or leaders. These men chiefly contrast in how they believe this would come about: Henry believed this usurpation would come from the power given to the national government, and that you could not trust men to govern themselves. Madison feared this event would come to pass through factionalizing, resulting in one group gaining enough power to take the nation for a ride, but by breaking up and dividing these powers you could greatly decrease these chances. Henry felt that centralizing power was akin to centralizing liberty; the result would be liberty being taken from the many to benefit the powerful few. Madison followed the thought that by leaving power so decentralized you were leaving flaws in the protection of the country, which could lead to an attack and take over, or leave it open for the states to factionalize and either break the union or commandeer power. Neither trusted politicians, their distrust just followed different tracks.

Conclusion:
Many of Patrick Henry's arguments were reasonable, and considering them would have done or did not cause any harm. However, the total ability to declare them all reasonable has not yet been discovered in my line of research. Knowing exactly what Patrick Henry

meant plays a key role in answering this question, and considering the implications and 'what if's' cannot be taken too far without entering the realm of fiction. As of right now there are many variables to be examined and offshoots to be trimmed.

1: 'in case Virginia shall not make punctual payment, the control of our custom-houses, and the whole regulation of trade, shall be given to Congress, and that Virginia shall depend on Congress even for passports, till Virginia shall have paid the last farthing, and furnished the last soldier…even striking us out of the union and taking away all federal privileges till we comply…but let it depend upon our own pleasure to pay the money in the most easy manner to our people'

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The Babies and Bathwater of Children's Programming:
A qualitative study of authentic and inauthentic expressions of affection in kids' shows

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Abstract

　　Traditional wisdom is that children watch too much television. While it may be true that children in the United States watch a massive amount of television as compared to children in other countries, the underlying premise that television is bad may be a bit overstated. First, the notion that children are passive receptacles of antisocial media is an exaggeration of Bandura's theory of observational learning. Research has shown that children are active agents who make meaning from messages that they receive; they are not automatons who watch television and mindlessly copy what they see. Second, children's television is not wholly and completely negative. Antisocial images do exist in children's shows, but there are other messages that are communicated as well. The present study explores a pro-social message that is particularly prevalent in children's programming: affection. The sample included the top two most popular children's television programs among kids aged seven to ten for the years 2002, 2006, and 2010. Results indicate that two forms of affection, authentic and inauthentic, frequently appear in shows of this genre. Whereas authentic expressions of affection were intended to communicate genuine liking

for another person, inauthentic expressions were used to be mean, manipulate the target, or to disguise true feelings. These two types of affection were found to be differentially applied in predictable ways based on the relationship between the actor and the target. Implications of prolonged exposure to these two different types of affection are discussed.

The television viewing habits of American children represent one of the premier issues of our time. Children between the ages of 8 and 10 spend an average of 3 hours and 17 minutes per day in front of the set, which is more than the instructional time they spend in school (Hepburn 1995; Roberts & Foehr, 2008). This is important not only in terms of what they are learning from the shows they watch, but also because it reduces the amount and types of interactions they have with family, friends, and peers. While they are tuned in to their favorite shows, they are most likely not engaging in other developmental activities such as playing sports, reading, or talking about their day with their family (Bronfenbrener, 1979).

Children are thought to be particularly vulnerable to advertising. Marketing agencies are well aware of this fact. Corporations pay large sums to reach particular audiences because they know that mere exposure improves attitudes toward their products (Leccese, 1989; Zajonc, 1968). The valence of the attitude is further enhanced by associating products with favorable images and outcomes (Ross et al, 1984).

The big spenders in the advertising industry apparently believe that children are a captive audience just waiting to be influenced by whatever messages appear on the screen. This logic is at least partially supported by social learning theory (Bandura, 1976). Children who observe rewards being paired with a behavior are more likely to engage in the behavior at a future time. Conversely, children who observe punishments being paired with a behavior are less likely to reproduce it (Bandura & Walters, 1963). It is precisely this application of "vicarious learning" that inspires corporations to pay handsome sums to make sure that children are exposed to attractive peers who are rewarded in very obvious ways for using the company's products. Not coincidentally, it is also the key theory underlying much of the research on the effects of prolonged exposure to television.

Research emanating from this perspective has led parents, educators, and psychologists to argue against portraying violence and other antisocial behavior in positive ways (see, for example, www.CARU.org). There have also been urgent calls for parents to limit the overall amount of television their children are allowed to watch (e.g., Jason & Fries, 2004; Viadero & Johnston, 2000). To the extent that their interpretation of social learning theory is an accurate version of reality, they have every reason to feel this way. It is frightening to think of how much antisocial behavior could be learned by watching the volume of television that most kids take in (Poulos, Harvey, & Liebert, 1976).

At the same time, denouncing television altogether might be an inappropriate response. What is lost in the rush to minimize television exposure is that there are all sorts of messages in children's programming, not just antisocial ones. So, despite the fact that the overwhelming amount of research on the effects of television viewing has focused on its negative aspects, the reality is that we may need to take a more balanced view of the situation.

This study investigates how one form of prosocial behavior—affection— manifested in children's programming in the years 2002, 2006, and 2010. The purpose of looking at affection across several years was to determine whether writers and producers had certain, set ways of depicting this emotion. If they did, then some of the same themes

should appear across episodes of the same series, and perhaps across series within a particular timeframe. This, in turn, would allow us to gain a more complete picture as to what children might be learning when they watch these shows.

Social Learning Theory and Children's TV

The central tenet of social learning theory is that people learn by observing the rewards and punishments that follow from the actions of others (Bandera, 1977). This idea has had a significant impact on how we think about the effects television has on child development, whether as a virtual substitute for a babysitter or as a means of delivering quality educational material. If children are inclined to do as they see, it is extremely important that we take note of how much television they watch and the qualitative nature of its content.

The hallmark study in this area was the Bobo doll experiment (Bandura, 1965). In this study, children were divided into two groups. Children in both groups were placed one at a time in a room with an adult and several toys, one of which was a Bobo doll. One group saw the adult act aggressively toward the doll while the other group saw the adult behave in a neutral fashion. Consistent with Bandura's prediction, children in the "aggressive" condition were more likely than the group in the "neutral" condition to act violently toward the doll when they had the opportunity to do so.

Researchers have extrapolated from Bandura's study to propose that television viewing works in much the same way. That is, if a little boy sees a rabbit act violently toward a coyote, he is more likely to engage in a similar behavior in the future. Numerous studies have supported this basic application of vicarious learning (Comstock, Chaffee, & Katzman, 1978). Coyne, Archer, and Eslea (2004) found that adolescents between 11 and 14 were more likely to perform an act of indirect aggression if they had seen a video displaying either indirect or direct aggression beforehand. In another study, Wood, Wong, and Chachere (1991) found that children and adolescents were more likely to act violently in an unconstrained social environment after viewing a violent video.

These effects are not limited to the short-term. Huesmann, Moise-Titus, Podolski, and Eron (2003) conducted a longitudinal study to explore the relationship between media violence in childhood and aggressive behavior in early adulthood. Their sample included children growing up in the 1970's and 1980's. They first examined the children's viewing habits over a two-year span either in first and second grade or in third and fourth grade. The researchers then followed up with the participants 15 years later via interviews with the participant and a person close the participant. The results of their study revealed a statistically significant relationship between early exposure to aggression in the media and violent tendencies later in life.

There has been one glaring weakness, however, that has marred the bulk of research in this area. Several of the studies on the harmful effects of television have suffered from compromised ecological validity as a result of having been conducted in laboratory settings (Anderson, Lindsay, & Bushman, 1999; Tobin, 2000). It is therefore somewhat difficult to make conclusive statements about how the stimuli are perceived in homes and classrooms. As Daly and Perez (2009) advised, additional research performed in naturalistic settings is necessary to further validate the results produced in sterile laboratory environments.

Nevertheless, the sheer volume of research on exposure to violence and aggression in the media has led to meaningful insights about the potentially negative effects it can have (American Psychological Association, 1993). Considerably less is

known about the effects of exposure to pro-social behaviors as displayed in children's programming. As Lemish notes, "If it is indeed possible to learn negative behaviors from television, would it not follow that it is also possible to learn positive, pro-social behaviors as well?" (Lemish, 2007). If we are to have a valid, comprehensive picture of what children watch, we must transcend our fixation on the negative to consider the possibility that positive modeling goes on as well.

Ironically, evidence supporting this position can be found in a study that looked extraordinarily similar to the original Bobo doll experiment. Pirot and Schubert (1978) demonstrated that affectionate behaviors could be elicited in children by allowing them to watch adults engaged in affectionate interactions. Children who were subjected to "neutral" behaviors did not imitate the model, suggesting that it was something other than the disposition of the children or their developmental status per se that led to their actions.

This finding gives us more than glib optimism when it comes to the imagining the potential effects of prolonged exposure to positive media images. As Hearold (1986) cautioned a quarter century ago, our concerns over the negative aspects of seeing violence and aggression have been out of proportion with the true impact of television viewing. His meta-analysis performed on the existing literature at the time revealed that viewing pro-social images had a stronger effect on children than did viewing images of hostility or aggression. So, while it may be a popular truism that we need to protect children from the dangerous world of television, the available research suggests that we may need to expose them to more of the "good" that it has to offer.

The present study aims to fill the gap in our understanding of one pro-social, positive message that appears in the media, namely affection. A content analysis of children's animated television series from 2002, 2006, and 2010 was performed to identify the nature of affection in this genre.

Method

Sample

Our goal was to explore the nature of affection as it is portrayed in television shows that were specifically designed for children. In that spirit, a list was complied of the highest rated television shows for the seven to nine year-old age bracket during the years 2002, 2006, and 2010. From that list, we selected the top two series that were designed for children between the ages of seven and older. The final list included *Jimmy Neutron*, *SpongeBob Squarepants* (2002), *Hannah Montana*, *The Replacements* (2006), *iCarly*, and *SpongeBob Squarepants* (2010; Nielsen Research, 2011[1]). Two episodes were randomly chosen from each of series resulting in a total of 18 episodes that were used in the data analysis for this study. The names of the specific episodes appear in Table 1.

From each episode, only the storyline was coded. The opening and the credits were excluded from the study because they were identical or near identical in every episode within a season and coding them each time would have led to unnecessary redundancy in the data. The final dataset included 387 minutes and 12 seconds of coded material.

Procedure

Both authors coded each of the 18 episodes independently, paying close attention to the number and duration of affectionate behaviors. In addition, the type of affection, as well as the characters' sex (male, female, androgynous, no sex, or other), age group (adult, adolescent, child, baby, or indefinable), and relationship (friend, parent, pet, peer, relative, rival, sibling, spouse, stranger, offspring, and other) were recorded. The

decision to include these categories was based on Coyne & Whitehead's (2008) landmark study on aggression in animated children's films.

Differences in codes were resolved via dialogue between the two researchers. As a result of our discussions, several types of affection were eliminated, including casual smiling, applause from an audience, affection toward oneself (e.g., bragging), and affection toward inanimate objects (e.g., food). The final operational definition of affection included verbal and nonverbal expressions of liking that occurred between one person (i.e. actor) and at least one other person (i.e., target).

In analyzing the data, we became aware that there were scenes in which multiple actors committed acts of affection directed at the same target. In order to maintain consistency, we decided to count one act of affection for every actor within a scene as opposed to counting only one total act of affection per scene. Therefore, if two actors praised one target, the data were coded to reflect one act of affection per actor for a total of two acts of affection for that scene.

Once the data were labeled, it was possible to begin analyzing our data. We relied on grounded theory to guide this process (Strauss & Corbin, 1998). We chose grounded theory because it is exploratory in nature. Our goal was to break new ground by capturing the true nature of affection as it is expressed in children's television shows. Rather than beginning with a firm set of hypotheses, we allowed the data to influence our interpretations and to lead us to new questions.

The first step was open coding. We examined the data across the three time points to identify major themes. This was followed by a division of broader categories into subcategories that more precisely described the nature of the phenomenon. Once we settled upon basic themes and labeled the categories and subcategories, we began the process of axial coding, which allowed us to examine the interrelationships between themes as they occurred in the television programs. We then employed selective coding to build a theory that explained how and under what conditions the process of affection takes place. It is through these steps that the "story" of affection in children's television emerged.

Results

The overarching theme that emerged from the data was a distinction between what we call "authentic" and "inauthentic" affection. Authentic affection relates to expressions of genuine liking. Inauthentic affection, on the other hand, looks like authentic affection in form, but is driven by disingenuous motives, such as a desire to be mean (e.g., sarcasm), to trick another person into complying with a request, or as a form of reaction formation.

Authentic affection

Examples of authentic expression were found in every episode of every series across all three time points. Thus, it appears as though children who watch these shows were exposed to a consistent stream of positive images of affection. What's more, almost none of the examples of authentic affection were contaminated with inauthentic affection. In other words, it was rarely confusing as to the spirit of what the actor was trying to convey.

The relationship between actor and target was a key determinant in the expression of authentic affection. Authentic expression was commonly shown between friends, parents and children, relatives, married couples, and love interests. It was rarely exhibited between rivals. Superficial levels of authentic affection did occur between strangers, however. For example, ordinary acts of customer service had some of the same

elements of authentic affection as typically occurred between friends, such as helping to solve a problem (e.g., hunger).

The parent-child relationship was particularly diverse. Parents were seen as helpful and loving when they were present. Miley's father in *Hannah Montana* was very active in helping her solve problems by providing advice and emotional support. Jimmy Neutron's parents were portrayed as being below their child in terms of intelligence, but they were extremely proud of and affectionate toward their son.

These positive elements of the parent-child relationship were hardly universal. The major storyline in the *SpongeBob SquarePants* episode "The Return of Triton" centered on the reunion of a harsh father and his spiteful son. Although the father was saddened by their prolonged separation, the viewer comes to learn that he was the also the cause of it as he banished his child to a cage as a form of punishment. This was the only parent-child relationship that was seen in either episode of the *SpongeBob SquarePants* series.

The biological parents in *iCarly* and *The Replacements* were uninvolved in their children's lives. Carly lived with her brother, and the two children in *The Replacements* ordered surrogate parents to replace their own from whom they had been orphaned. These dynamics must be taken into consideration when evaluating how affection manifested between children and their parents because they define the parameters as to what types of interactions were possible.

Situational factors also played a part in determining when and how authentic affection was expressed. Actors were more likely to self-disclose and to engage in certain physical acts of authentic affection (e.g., kissing) in pairs than when they were in groups. Thus, it appeared as though there was a private nature to some expressions of authentic affection that was not true of other types of expressions. The same preference for privacy also appeared to be true of certain expressions of inauthentic affection, such as exaggerating the importance of a relationship in order to get a target to do a favor that might not otherwise be done.

Verbal and non-verbal expressions of authentic affection often occurred simultaneously. This was especially apparent when showing empathy or support. Friends, colleagues, and parents were all witnessed standing or sitting close to the target, maintaining eye contact, and offering suggestions as to how to go about solving a problem.

At other times, authentic affection was almost completely restricted to either verbal or nonverbal behaviors. This is best exemplified in cases involving one friend defending another from a bully. Sometimes the defense was entirely verbal, with assistance being limited to a reprimand or a criticism directed at the bully. In other situations, the actor would physically defeat the bully, as was the case in the "Insecurity Guard" episode of *The Replacements* when a member of the school staff assaulted several students who were ostensibly threatening the main character, Todd.

Another verbal form of authentic affection was referring to a target by a nickname. This method was used primarily by parents, and was most pronounced in the show *Jimmy Neutron*. Interactions between colleagues and between friends frequently involved the use of nicknames as well. It should also be noted that the use of a nickname was similar in some ways to name calling. The primary difference being that the former was intended as an expression of authentic affection whereas the latter was used as an act of aggression and usually focused on a target's weakness or deficit.

Offering to include a target in a joint activity was another common way of

expressing authentic affection. This strategy was apparent in all episodes across all series suggesting that it is a principal way that writers and producers portray affection. There was no consistent trend regarding acts of social competence preceding the invitations, which may have been appropriate for modeling a skill that is of extreme importance to children in the targeted age range.

The use of sarcasm was sometimes used to communicate authentic affection. Although more often used as a form of inauthentic expression, sarcasm was occasionally used to open the door to intimate conversation. The principal difference between the use of sarcasm as an act of authentic affection as opposed to an act of inauthentic affection was the relationship between the actor and the target. Close friends were more likely to use sarcasm in authentic ways whereas rivals were more likely to use it to mock an enemy. Another difference distinguishing authentic from inauthentic uses of sarcasm centered on nonverbal indicators. Sarcasm that was accompanied by a smile, touch to the shoulder, or gentle elbow to the side was far more likely to be meant as an act of authentic expression than sarcasm that was unaccompanied by these nonverbal cues.

A prototypical example of sarcasm being used to express authentic affection occurred during the episode "Good Golly Miss Dolly" when Dolly Parton teased her friend and colleague, Miley, about a song bemoaning unrequited love. Dolly, knowing that the song was about Miley's real life struggle to deal with a crush, complimented her lyrics in a sarcastic way letting her know that it would be beautiful when "there really is a boy." Dolly followed up on her sarcasm with self-effacing humor regarding her own marriage. This strategy was apparently to show Miley that she could relate to relationship issues and that she was not trying to be offensive. Once she sensed that Miley was open to conversation, she made an effort to sit close to her on the couch. At that point, she returned to her use of humor by admitting that she had forgotten that "being a girl is harder than walking through a balloon shop with a porcupine purse." In the end, Dolly was able to assist Miley with her feelings and give her sage advice because her creative use of sarcasm allowed her to enter into a genuine conversation about the problem.

Another way of crafting sarcasm into authentic affection is to use it to call attention to a target's strengths. In the "Good Golly Miss Molly" episode mentioned above, Dolly makes use of this strategy twice, once with Miley's father and once with Miley herself. Common to both manifestations was the use of smiling and touching to ensure that the target knew that the sarcastic commentary was not meant to be hostile. These subtle cues, combined with the preexisting relationship between the actor and the target, reduced the likelihood that the target would wrongly interpret the sarcasm as being mean-spirited.

Emphasizing the importance of a relationship was another frequently used method of expressing authentic affection. Several different characters across all of the series made mention of the pleasure they gained from being in a Platonic, familial, or romantic relationship with a target. Some also mentioned the distress that would ensue if the relationship were to end. Oftentimes, comments to this effect were made to a third party as opposed to being directed at the person about whom the affection was being expressed.

Still another way that characters expressed authentic affection was to praise the target's accomplishments. Sometimes this would entail an immediate achievement, such as when Jimmy Neutron's friends were amazed at one of his inventions, while other times it involved a friend or parent marveling at the target's full body of work. Interestingly, targets rarely deflected the praise, instead choosing to brag or thank the actor for the

acknowledgement.

The use of "baby talk" also signified authentic affection. It should be noted, however, that none of the episodes portrayed an actual baby as a baby. One baby was a friend who was dressed up as a baby. Another was a grandmother who had been morphed into a baby by a contraption built by her grandson. In both cases, actors addressed the baby with simple speech, cooing sounds, and affectionate smiles.

Among non-verbal expressions, touching the shoulder or back, hugging, and sitting close were all common ways of communicating authentic affection. The most striking difference in these expressions was along the animated versus non-animated dimension. Characters in *Hannah Montana* and *iCarly* made liberal use of touching whereas those in *Jimmy Neutron*, *The Replacements* and *Spongebob SquarePants* were less likely to engage in these types of behavior. It was unclear as to why this difference would be observed along the animated versus non-animated line.

Finally, there were only a few noticeable differences between males and females in the expression of authentic affection. Males were less likely to hug other males, even though they were often observed hugging females. Females, on the other hand, hugged both males and females. Other forms of physical affection were similar between the sexes. Males and females slapped hands and "gave dap" to members of the same and opposite sex.

Inauthentic affection

Inauthentic affection was more varied in purpose, but less varied in process. Whereas the goal of authentic affection was to express genuine liking of the target, there were several different goals associated with displays of inauthentic affection. One of these goals was to mock the target using sarcasm. Sometimes this would occur during a contemptuous exchange between rivals as a method of calling attention to a perceived shortcoming. During these incidents, it was common to note unappealing aspects of physical appearance or to comment on an alleged lapse in judgment.

Another common goal of inauthentic affection was to manipulate a target. Actors would pretend to genuinely like the target in order to gain trust, which they would later exploit to their advantage. Ironically, this method was not limited to rivals. Friends would sometimes exaggerate their affection for a target if they wanted to use that friend strategically to gain personal profit or favor.

Occasionally, inauthentic affection was used as a form of reaction formation. In other words, inauthentic affection was used to communicate affection in such a way as to disguise true feelings. In these cases, inauthentic affection was not manipulative, but rather a defense mechanism to protect the actor from acknowledging true feelings that may not have been socially approved.

The frequency of each type of affection—authentic and inauthentic—appeared to be related to series as well. For example, the actors in *Jimmy Neutron* were less likely to use inauthentic affection to manipulate a rival than were actors in *Hannah Montana*, suggesting that the writers were trying to capitalize on a different definition of "affection" in the two episodes.

One of the most common forms of inauthentic expression was sarcasm, the content of which included false apologies, false compliments, and exaggerating the importance of a relationship. An example of a false apology can be found in the *Hannah Montana* episode, "Ooh, Ooh, Itchy Woman." In that episode, Miley was happy that her class was selected to go on a camping trip. However, her happiness faded when she learned that she and her friend would be sharing a tent with their archrivals. The moment

of most significant import for our present purposes came when Miley and her friend were required to wash the class' dishes as a punishment for calling their rivals a mean name. When the rivals dropped off their dishes, one of them purposefully knocked over the clean dishes so that all of the dishes would have to be rewashed. The offender quickly apologized in a sarcastic voice. The tone and cadence of her apology was meant to make it obvious to Miley and her friend that the apology, like the affection it was conveying, was inauthentic.

The false compliment was another common strategy for expressing inauthentic affection. An example of this strategy occurred in the "Gramma's Secret Recipe / The Cent of Money" episode of *SpongeBob SquarePants*. SpongeBob, the protagonist, was walking his pet snail, Gary, when they ran into Mr. Krabs, SpongeBob's employer. SpongeBob noticed that Gary was acting funny, and told Mr. Krabs that he normally does that before he finds coins, after which a coin was pulled towards Gary's shell. Mr. Krabs was fascinated by this occurrence, and asked SpongeBob why he had never thought to bring Gary to work with him. SpongeBob responded by telling Mr. Krabs that he had specifically told him that it was against policy. Mr. Krabs laughed and denied that he had ever set such a policy. He proceeded to pick up Gary, pet him, and call him "talented." Although, Mr. Krabs probably believed that Gary is talented, his true intentions were not to make SpongeBob or Gary feel good. Instead, his actions were for his own benefit because he wished to use Gary for personal financial profit.

In terms of reaction formation, a commonly used strategy was to deny interest in the target. An example of this can be found in an episode of *The Adventures of Jimmy Neutron, Boy Genius* called "I Dream of Jimmy / Raise the Oozy Scab." Jimmy's teacher paired him with his crush and rival, Cindy Vortex, in an oceanography project. Jimmy did not want Cindy to be part of the project because he did not want to admit to himself or others that he had fond feelings for her. So, he devised a project that he was sure no girl would like hoping to convince Cindy to recuse herself from it. If he had been successful, he could have continued to hide his feelings will maintaining that it was not his fault that she had self-selected out of the process. Unfortunately for him, his strategy did not work as Cindy elected to remain part of the project.

Summary

Taken together, these results suggest that affection as displayed in popular children's television programming is a multifaceted phenomenon. Children are exposed to what we call "authentic affection" when they see an actor behave in ways that are intended to express genuine liking. However, they are also witnesses to affection being used for ulterior and sometimes antisocial purposes. These cases of "inauthentic" affection embody the idea that affection can be used to manipulate others or to disguise true feelings. All of this takes place within context in which parents are seen as absent (50%), helpful and loving (33%), or replaceable (17%).

Discussion

The results of this study indicate that affection has indeed been part of children's programming over the past decade. More importantly, however, is the general finding that the nature of affection ranges from genuine and pro-social to disingenuous and antisocial. Therefore, it is important to take a nuanced look at how children might be affected by viewing these images.

Because the sample included episodes of the top rated television programs for the age bracket of interest, it is clear that many children were, in fact, exposed to the messages that comprised the data for this study. While no mechanism was in place that

would allow for conclusive statements about how children were affected by watching these shows, it is theoretically plausible that they were incrementally more likely to draw on a repertoire that included behaviors that they saw.

With this in mind, it is important to compare and contrast the nature of inauthentic expressions of affection vis-á-vis other antisocial behaviors. If it is true that children who are exposed to violence are more likely to rely on violence when they confront a situation they do not like, then it stands to reason that they may also come to believe that inauthentic affection is an appropriate response when they wish to trick someone, hide their true feelings, or be critical. Given that these antisocial expressions are not likely to be punished, they may be even more attractive options for children as they encounter similar situations in their own lives.

Extending the findings of this study to a firm conclusion is not fully warranted, of course, as there were several limitations that restrict such a confident interpretation. The sample from which the data were drawn was small and limited to television shows that were designed specifically for children. Although this was a theoretically defensible starting point, additional research is necessary to determine if other shows that children watch include examples of authentic and inauthentic affection of the type described here. The findings from this future research would most likely be affected by the fact that a high proportion of Spanish-speaking children watch telenovelas that depict qualitatively different forms of affection than are ordinarily seen in children's programming.

A quantitative analysis would further clarify and elaborate on our results as well. Comparisons could be made between years to determine if trends exist in the data. For example, it would be useful to know if expressions of inauthentic affection have been declining or rising over the past decade. Other comparisons could be made to ascertain whether certain types of shows, such as animated versus non-animated, are more likely to contain the "good" authentic form of affection as opposed to the "bad" inauthentic form of affection. Analysis of this variety would complement the descriptive analysis provided here.

Additional research is also required to determine exactly how children process this information. Simply knowing that they are exposed to certain behaviors, whether pro-social or antisocial, does not guarantee that they will produce them at a later time (Bandura, 1978; Blumberg, Bierwirth & Schwartz, 2008). On most occasions, actors who were engaging in inauthentic expressions of affection did so in ways that were intended to make the lack of authenticity known to the viewer, but not the target. While this is perhaps a necessary condition for the development of the plot, it may lead children to believe that it is easy to fool or manipulate other people, and that it is funny to do so when it works. It is not obvious to us that strategies such as these are in any way superior to more direct forms of aggression or any better for children's development overall.

Conclusive statements were not the goal of this study; the mission was to provide a thorough description of affection as it manifests in children's programming. Given the results we obtained, it appears fully warranted to insert exposure to inauthentic affection into discussions of what is "wrong" with the television children watch. Children could be walking away with the idea that it is socially acceptable to mislead people into thinking that you like them if you stand to profit in some way from doing so. It is truly disappointing if this is the reality of the world today. However, given the quantity of authentic affection that is displayed in these same shows, we must be careful to account for all of the messages to which children are exposed, not only the ones we find objectionable.

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Footnotes

[1] To request a copy of the data set provided by the Nielsen Company, for defensive purposes only, contact the researchers with information provided above. Please note that this information may not be used for academic, research, or commercial purposes without first acquiring a license from the Nielsen Company. Contact the Nielsen Company for more information about acquiring a license.

Table 1
Sample of Episodes from Series by Year

Original Air Date	Episode Name
2002	
Jimmy Neutron	
Sept. 20, 2002	Granny Baby / Time is Money
Sept. 27, 2002	I Dream of Jimmy / Raise the Oozy Scab
Oct. 30, 2002	Phantom of Retroland / My Son, the Hamster
SpongeBob SquarePants	
March 1, 2002	Nasty Patty / The Idiot Box
March 8, 2002	As Seen on TV / Can You Spare a Dime?
March 15, 2002	No Weenies Allowed / Squilliam Returns
2006	
Hannah Montana	
May 12, 2006	It's a Mannequin's World
June 10, 2006	Ooh, Ooh, Itchy Woman
Sept. 29, 2006	Good golly, Miss Dolly
The Replacements	
Sept. 8, 2006	CindeRiley / Skate-Gate
Sept. 9, 2006	The InSecurity Guard / Quiet Riot!
Dec. 2, 2006	Zoo or False? / Master Pho
2010	
iCarly	
Jan. 29, 2010	iWas a Pageant Girl
March 19, 2010	iFix a Popstar
May 8, 2010	iBelieve in Bigfoot
SpongeBob SquarePants	
July 5, 2010	The Clash of Triton
July 9, 2010	Gramma's Secret Recipe / The Cent of Money
Sept. 18, 2010	Shellback Shenanigans / Hide and Then What Happens

Note. Release dates are based on information provided by iTunes.

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Vicarious Social Undermining: The Negative Effects of Workplace Aggression on Non-Target Employees' Job Withdrawal, Intention to Quit, and Supervisor Satisfaction.

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Abstract

Unfortunately, workplace aggression is a problem for organizations. Many employees report that they have witnessed or been the direct target of workplace aggression. Aggression in the workplace can take many forms; some forms are overt and cause damage immediately, whereas other forms are hidden and damage victims over time. Social Undermining is a covert and chronic type of aggression that deliberately hinders a person's positive reputation and/or positive relationships in the workplace. This research project investigates a new type of social undermining, vicarious social undermining. Vicarious social undermining is the indirect experience of social undermining and occurs when one observes social undermining but is not the direct target. Full-time and part-time employees (n=164) from a diverse group of industries completed an online questionnaire

assessing their experience of vicarious social undermining, employee job withdrawal, intention to quit, supervisor satisfaction, and organizational commitment. The results indicate that vicarious social undermining is related to several harmful outcomes for the employee and the organization including job withdrawal, intention to quit, and supervisor satisfaction. Specifically, the more vicarious social undermining participants experienced, the more likely they were to engage in job withdrawal behaviors. Employees that experienced vicarious social undermining also reported a greater intention to leave the organization compared to employees that were not exposed to vicarious social undermining. Vicarious social undermining was also related to ratings of supervisor satisfaction; the more undermining participants experienced, the less satisfied they were with their supervisor. Finally, vicarious social undermining was not found to influence organizational commitment.

Workplace aggression is a problem that both impacts employees and organizations. Because workplace aggression can take on both physical and psychological forms, it is extremely serious and can have severe consequences. Although, it is rare that instances of psychological aggression make the news, compared to physically violent cases, they are much more likely to occur in the workplace and may have long term effects on the targets (Pool & Birkelbach, 2011). The study of workplace aggression is important because people spend more of their time at work than almost any other activity. In addition to earning money to provide for themselves and their families, a person's job is often an important part of his or her social identity. Furthermore, the social relationships one has at work are a great source of satisfaction for employees and these relationships can help employees accomplish their work effectively. When an employee is the target of workplace aggression, all of these benefits of work can be threatened. Essentially, the necessity of working becomes a problem for the person when one is the target of aggression.

Employees that are the target of workplace aggression can experience several negative outcomes including increased somatic complaints, poor psychological well-being, and emotional exhaustion (Barclay & Aquino, 2010). It is also likely that an employee who is a victim of aggression will take these problems homes with them.

Not only can workplace aggression be damaging to the target both psychologically and physically, but it can also harm the organization. If workplace aggression is not controlled, an organization may lose valuable employees, experience increased turnover intentions, lower organizational commitment, and negative perceptions of organizational justice (Barclay & Aquino, 2010).

Researchers have described workplace aggression in terms of how visible the aggressive act is and whether the damage is immediate or builds over time. Pool and Birkelbach (2007) described a typology of aggression created by crossing two dimensions. The first dimension is characterized by how overt vs. covert the aggressive act is. The second dimension is characterized by how acute vs. chronic the aggressive act is. When combined, the two dimensions create four types of aggression: overt/acute, overt/chronic, covert/acute, and covert/chronic. Physical assault would be an example of aggression that is both overt and acute. Sexual harassment and verbal abuse are typically thought of as overt and chronic because these acts occur more than once and are not typically hidden from others. Some types of sabotage like equipment tampering that cause immediate and even devastating results would be a good example of covert and acute aggression. Social undermining is an example of chronic/covert aggression because it is done in a hidden way and continues over time.

Social Undermining

Social Undermining is a "behavior intended to hinder, over time, the target's ability to establish and maintain positive interpersonal relationships, work-related success, and favorable reputation" (Duffy, Ganster and Pagon, 2002, pg. 332). Compared to other forms of workplace aggression, social undermining seems to be relatively common and is likely to occur more frequently than other aggressive acts. One of the hallmark characteristics of social undermining is that it is a covert and chronic form of aggression (Pool & Birlebach, 2007). Covert aggressive behavior is typically easy for the specific target to detect, but difficult for others to recognize as aggressive. Additionally, covert forms of aggression can be easily disguised and may be only noticeable to the victim and perpetrator. In short, any single act of undermining can be explained away by the source. Chronic aggressive behavior involves psychological and nonphysical assaults that lead to negative effects over time and after continued exposure. Over time, the cumulative effect of the repeated aggressive acts builds up leading to the negative outcomes. Social undermining has it true negative impact on the target only after some time has passed. The target of social undermining must perceive the source's behavior as intentional and the impact of these behaviors are insidious, persisting over time. Covert and chronic aggression, like social undermining, may even be perceived as normative behavior within a group.

Previous research has demonstrated the effects of social undermining on targets of both coworker and supervisor undermining. Most of the effects found in research have been negative, ranging from a decrease in supervisor support to a decrease in organizational commitment. In one of the first studies to investigate social undermining in the workplace, Duffy et. al (2002) developed a new scale to assess supervisor and coworker undermining. Their items were based on social undermining measures of non-work relationships. Because most of the items from the original measures had little to do with the workplace, the authors made modifications and adaptations to suit workplace behaviors. Their results revealed that supervisor social undermining was negatively related to supervisor support and self-efficacy, and positively related to active counterproductive behavior and somatic complaints (Duffy et. all, 2002). A serious limitation of this study involves generalizing the findings to other populations. The participants in this study were sampled from the national police force in the Republic of Slovenia. This population is likely to be very different from the average accountant or cashier in the United States.

Pool and BIrkelbach (2007) developed a new measure of social undermining with a diverse sample of part- and full-time employees in the United States. Across two sources of social undermining (supervisors and co-workers), they found that social undermining is comprised of two distinct factors: interpersonal hostility and obstructionism. Their results revealed that victims of co-worker social undermining retaliated across all three measures of retaliation regardless of whether the undermining was interpersonally hostile or obstructing. The pattern of results for supervisor social undermining was somewhat different. Participants retaliated across all three measures of retaliation behavior when their supervisors obstructed them but not when they were interpersonally hostile (Pool & Birkelbach, 2007). Because this measure of social undermining was validated on a broad sample of participants from different organizations and occupations, it is hoped that the findings may be applied more generally.

A study was conducted to investigate the emotional and behavior reactions to

social undermining (Crossley, 2009). This study found that the victim's perception of an offender's motives was an important predictor of a victim's reaction. More importantly, the severity of an act of social undermining was positively related to the amount of anger a victim had towards an offender. Interestingly, the severity of the offense was not associated with a victim's sympathy. Anger was also found to relate positively to revenge and avoidance, while sympathy was negatively associated with avoidance and positively associated with reconciliation. This study helps us to realize that a person's perception and interpretation of the social undermining they experience can have negative effects that may impact those around them (such as revenge and avoidance).

Another variable that may be affected by social undermining is job withdrawal. Job withdrawal is a compilation of acts or intentions that reflect the negativity of an employee's job attitude. Hanisch and Hulin (1990) developed a way to measure job withdrawal. Their study consisted of 82 academic and 84 nonacademic staff members. "A series of questions about organizational withdrawal was included that asked the respondents about their behavioral and psychological withdrawal from their work roles including unfavorable job behaviors, lateness, absenteeism, turnover intentions, and desire to retire" (pg. 65). In this study, Hanisch and Hulin acknowledge that organizational withdrawal is a form of avoiding dissatisfying work situations. Therefore, those who engage in job withdrawal may be doing so as a way to avoid workplace aggression, including social undermining.

Intention to quit is another variable which can be influenced by social undermining. Intention to quit is an employee's intent to exit the organization. Boroff and Lewin (1997) tested their model by using employees' loyalty to their organization and their perception of grievance procedure effectiveness as independent variables. This study found that among those who reported being treated unfair by their employer, more loyal employees were less likely to intend to leave the organization compared to those who were less loyal. It is clear that when employees that have other employment options believe they are being mistreated, they are likely to start the cognitive process of exiting the organization.

Job satisfaction may also be influenced by social undermining, especially if a supervisor is the one doing the undermining. A paper on destructive leadership behavior (Einarsen, Aaslan, & Skogstad, 2007) identifies three categories of destructive behavior; tyrannical, derailed, and supportive–disloyal. Within these categories, there are two measures, totaling four types: anti-organization behavior, pro-organization behavior, anti-subordinate behavior, and pro-subordinate behavior. This paper helps illustrate the importance a supervisor's actions plays in their subordinates' job satisfaction and supervisor satisfaction as well.

Another variable that social undermining can impact is organizational commitment. Organizational commitment is an employee's attitude toward their organization based on affective, cognition, and action readiness commitment. Duffy et. all (2002) found a positive relationship between organizational commitment and supervisor support, as well as a negative relationship between organizational commitment and supervisor undermining. The magnitude of both supervisor support and supervisor undermining did not differ significantly for organizational commitment.

Vicarious Social Undermining

Past research has shown that there are negative effects on those who experience social undermining directly, including reduced organizational commitment and perceptions

of supervisor support, but it is unclear whether one has to be a direct target of social undermining in order to be negatively impacted by it. It is possible that without being personally targeted, an employee can still observe social undermining and experience negative outcomes. We define vicarious social undermining as social undermining that is observed by someone who is not the target; the victim of vicarious social undermining is the person who is indirectly, rather than directly, exposed to it.

There is no known research on vicarious social undermining, but research relevant to and conceptually similar is available. Sexual harassment and social undermining are both deviant workplace behaviors and may be classified as job-related stressors. A job stressor, as defined by Kahn and Byosiere (1992), is a "stimuli generated on the job and having negative consequences, physical or psychological, for significant proportions of people exposed to them" (p. 598). In both cases, the victim knows they are being targeted and the behaviors may be observed by others. Ambient sexual harassment is defined as the indirect exposure to sexual harassment (Richman-Hirsch & Glomb, 2002). A person experiences ambient sexual harassment if they witness, hear about or are mindful of the sexual harassment of others (Glomb, Richman, Hulin, Dragsow, Schneider, & Fitgerald, 1997). We believe that ambient sexual harassment and vicarious social undermining should also be classified as job related stressors because those observing are being exposed to the stimuli. They may not be the person targeted directly, but employees that witness ambient sexual harassment do clearly experience negative outcomes.

A study on ambient sexual harassment (Glomb et. all, 1997) found a negative correlation between ambient sexual harassment and job satisfaction, as well as a positive correlation between ambient sexual harassment and psychological distress. Those who knew about sexual harassment, but were not the direct target of, were less satisfied with their jobs and had higher levels of psychological distress. Another study on sexual harassment found a positive correlation between upsettingness ratings that were personal and bystander ratings (Hitlan, Schneider, & Walsh, 2006). This means that a positive relationship developed between how upset a respondent was by their own personal harassment and by the harassment of others; these variables influenced each other.

One study investigated whether the negative outcomes caused by sexual harassment toward women and ambient sexual harassment extended to the men in the workgroup (Richman-Hirsch & Glomb, 2002). The findings revealed that men do experience negative outcomes as a result of the amount of sexual harassment in the workgroup. The men in this study experienced lower job satisfaction and greater psychological distress in work groups where women were being harassed. All three of these studies illustrate that negative effects of sexual harassment are not limited to the targets alone, but they impact other workers in the group as well.

Another group of researchers investigated whether comparable findings would emerge for another type of workplace harassment, ethnic harassment. This study found that individuals who witnessed or knew about ethnic harassment, but were not the direct target of, still experienced negative consequences and that these consequences were comparable to consequences experienced by the actual victims (Low, Radhakrishan, Schneider, & Rounds, 2007). Bystanders appeared to experience stress after "bearing witness to acts of harassment based on ethnicity, listening to explicit accounts of these incidents, or even having firsthand observations of such events" (Low, et. all, 2007, pg. 2290).

Miner-Rubino and Cortina (2007) conducted a study on the effects of vicarious exposure of misogyny at work. This study found that the more women observed hostility toward other women, the lower their job satisfaction and psychological well-being.

Psychological well-being in turn related to physical well-being. This study further found that low job satisfaction was also associated with lower organizational commitment and greater job withdrawal. This study shows that although there are primary effects for observed hostility, those effects influence other variables. These studies all clearly illustrate that merely witnessing and being indirectly exposed to negative workplace behaviors can lead to problems for individuals and organizations.

Present Research

Previous research has shown that social undermining (Duffy et. all, 2002; Pool & Birkelbach, 2007) has clear negative effects on the target. Other research reveals that baring witness to sexual and ethnic harassment (Glomb et. all, 1997; Hitlan et. all, 2006; Low et. all, 2007; Miner-Rubino & Cortina, 2007) have negative effects on employees that are not necessarily the specific targets of the harassment. The present research will expand our understanding of social undermining by investigating whether the negative outcomes associated with the behavior impact others beyond the specific target. Specifically, we investigate the relationship between vicarious social undermining and several important work-related outcomes including job withdrawal, intention to quit, supervisor satisfaction, and organizational commitment.

We predict that when a person experiences vicarious social undermining, that person will display more job withdrawal behaviors. High reported frequencies of vicarious social undermining will predict increased reports of job withdrawal behaviors.

We also hypothesize that vicarious social undermining will be positively related to intention to quit. The more a person witnesses vicarious social undermining, the more likely they will want to leave their organization.

It is expected that supervisor satisfaction will be negatively impacted by vicarious social undermining. The more vicarious social undermining an employee experiences the lower supervisor satisfaction that employee should have.

We hypothesize that there will be a negative relationship between vicarious social undermining and organizational commitment. We believe that an employee's commitment to their organization can be impacted by the acts of their supervisor, specifically undermining coworkers.

Method

Participants

Participants in the present study were full-time (42.1%, $n = 69$) and part-time (57.9%, $n = 95$) employees, with a majority (90.2%, $n = 148$) residing in Texas. More than half of the participants described themselves as full-time students (60.4%, $n = 99$), with the remaining 39.6% describing themselves as either part-time students (6.7%, $n = 11$) or not currently students (32.9%, $n = 54$). The majority of the participants were female 68.9% ($n = 113$). The ethnicity of our participants was diverse with the three largest groups indicating that they were Hispanic (48.2%, $n = 79$), White, non-Hispanic (33.5%, $n = 55$), or Multi-racial (8.5%, $n = 14$). Participants worked in a variety of industries, but the most common were Retail (14.6%, $n = 24$), Health Care and Social Assistance (12.8%, $n = 21$), Arts, Entertainment, Rec (9.1%, $n = 15$), and Teaching (7.9%, $n = 13$). The age of participants ranged from 18 to 64, with an average age of 26.74 (SD = 11.493).

Participants' also completed questions describing their supervisors. Over half of the participants' supervisors were female (53.7%, $n = 88$) and most supervisors' were identified as either White, non-Hispanic (50.6%, $n = 83$), or Hispanic (27.4%, $n = 45$).

Our participants reported that they interacted with their supervisors in person at least 2-3 times a week (28.7% daily; $n = 47$, 27.4 % multiple times per day; $n = 45$, and 20.1% 2-3 times per week; $n = 33$). Interactions with supervisor ranged from less than once a month to multiple times a day, with daily being the most frequent (28.7%, $n = 47$).

Measures

    Vicarious Social Undermining. To measure vicarious social undermining we used a modified version of the *Social Undermining Questionnaire* developed by Pool and Birkelbach (2007). We modified the questions to assess how frequently participants witnessed a supervisor socially undermine a coworker. Using a 6-point scale with anchors from *never* (1) to *everyday* (6), participants indicated how often they observed their supervisor intentionally do each of 20 specific behaviors to a coworker (see Table 1, pg. 13). The original social undermining questionnaire contained two subscales: interpersonal hostility and obstructionism. The interpersonal hostility subscale consisted of 13-items, with questions ranging from "hurt coworkers feelings" to " did not defend a coworker when people spoke poorly about them", and the obstructionism subscale consisted of 7-items, including questions that ranged from "Nagged a coworker" to "took advantage of a coworker" For simplicity, we chose to focus on the overall amount of vicarious social undermining reported by participants rather than the subscales of interpersonal hostility and obstructionism.

Table 1.

Vicarious Social Undermining Questionnaire

Items

How often have you observed your SUPERVISOR intentionally do the following to a COWORKER?

Hurt a coworker's feelings?

Let a coworker know that they did not like them or something about them?

Talked badly about a coworker behind their back?

Insulted a coworker?

Belittled a coworker's ideas?

Spread rumors about a coworker?

Delayed work to make a coworker look bad or slow them down?

Given a coworker the silent treatment?

Put a coworker down when they questioned work procedures?

Talked down to a coworker?

Made a coworker feel unwanted?

Made a coworker feel incompetent?

Did not defend a corker when people spoke poorly about them?

Did not give as much help to a coworker as promised?

Nagged a coworker?

Took a coworker for granted?

Took advantage of a coworker?

Distracted a coworker when they were doing something important?

Been too demanding of a coworker's attention?

Prevented a coworker form working on his or her goals?

Positive and Negative Affect. Watson, Clark, and Tellegen's (1998) *Positive and Negative Affect Scale* (PANAS) was used to measure employees' general feelings and emotions and was used, in this study, to limit the number of confounding variables that may influence the perception of vicarious social undermining behaviors and contribute to levels of job withdrawal, intention to quit,supervisor satisfaction, and organizational commitment The measure contains two, ten-item subscales that include words that describe different types of feelings and emotions. Participants indicated to what extent they had felt "interested, distressed, excited, upset, strong, guilty, scared, hostile, enthusiastic, proud, irritable alert, ashamed, inspired, nervous, determined, attentive, jittery, active, and afraid" during the past few months. Responses were tallied on a 5-point Likert-type response format ranging from *very slightly or not at all* (1) to *extremely* (5).

Job Withdrawal. Job Withdrawal was measured using Hanisch and Hulin's (1990) *Job Withdrawal* questionnaire. This measure consists of 14 items which participants were asked to indicate how often they engaged in the activities listed within the last year. Items ranged from "Failed to attend scheduled meetings?" to "Intentionally worked slower?" The response scale ranged from *Never* (1) to *Daily* (7).

Intention to Quit. Boroff and Lewin's (1997) 2-item *Turnover Intention* scale was used to measure intention to quit, along with an item we added, which was "I considered requesting to be transferred to another position within my organization". The Boroff and Lewin (1997) items included, "I seriously considered quitting my job." And I looked for a new employment opportunity outside of the organization". Responses were tallied on a 7-point scale ranging from *Strongly Agree* (1) to *Strongly Disagree* (7).

Supervisor Satisfaction. Supervisor Satisfaction was measured using four questions from Spector's (1994) *Global Job Satisfaction* scale and eight questions based on items taken from the Leadership and Knowledge Management Index that is included as part of the federal government annual employment survey (Federal register; rules and regulations, 2006). Participants were asked to indicate their level of agreement with the statements provided about their supervisor. Anchors for this section ranged from *Disagree Very Much* (1) to *Agree Very Much* (7).

Organizational Commitment. To measure organizational commitment we used the affective organizational commitment subscale from the *Meyer and Allen Commitment Scale* (Meyer & Allen, 1991). Past research has revealed that affective commitment has the strongest relationship with other variables most of the time. We chose to use 1 of the three types of organizational commitment in order to shorten our survey length. Participants indicated the extent to which they agree or disagree with 6-items on a 7-point Likert scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (7). Items included both positive and negative references such as, "I would be happy to spend the rest of my career with this organization" and "I do not feel 'emotionally attached' to this organization".

Procedure

The Qualtrics web-based survey system was used to create, post, and administer

the questionnaire. After providing consent, participants completed several background and demographic questions including their sex, ethnicity, highest level of education, religious affiliation, industry of employment, state residency, work status (full-time or part-time), hours worked per week, length of tenure, and how many people report to their supervisor. Participants were also asked about their supervisor's demographics, including sex, ethnicity, level of education, interaction, an estimation of age, and religion.

Next, participants completed a measure of vicarious social undermining from their supervisor with a modified version of Pool and Birkelbach's (2007) *Social Undermining Questionnaire*. Participants then completed questions evaluating their the intention to quit including the 2-item *Turnover Intention* (Boroff & Lewin, 1997) scale and an additional item we added. The *Meyer and Allen Commitment Scale* (Meyer & Allen, 1991) was completed next, followed by questions measuring *Job Withdrawal* (Hanisch & Hulin, 1990). Supervisor satisfaction was measured next using the supervisor subscale of the *Global Job Satisfaction* (Spector, 1994) scale and items based on the *Leaderhsip and Knowledge Management Index* (Federal register; rules and regulations, 2006) followed by the *Positive and Negative Affect Scale* (Watson, Clark, & Tellegen, 1988).

The survey was administered to college students and workplace employees. Each participant was asked to recruit at least two more participants. Some students were offered the opportunity to receive class/extra credit toward a psychology class if they participated in the study, but were able to earn extra credit in another matter if they chose otherwise.

<div align="center">Results</div>

A five step hierarchical multiple regression was used to test our hypotheses regarding vicarious social undermining and its negative effects on job withdrawal, intention to quit, supervisor satisfaction and affective organizational commitment. In Step 1, positive and negative affect were entered simultaneously as control variables. Participants' sex was the next control variable added in Step 2. In Step 3, length of employment and the number of hours the participant worked per week were added simultaneously as control variables. We next added the amount of people that report to the participant's supervisor as well as their supervisor's sex in Step 4. In Step 5, we added vicarious social undermining as a predictor variable. Four hierarchical multiple regressions were conducted to investigate each of our outcome measures: Job Withdrawal (JW), Intention to Quit (ITQ),, Supervisor Satisfaction (SS), and Affective Organizational Commitment (AOC). The results of the hierarchical regression analyses using job withdrawal, intention to quit, and supervisor satisfaction and the *B* weight estimates for the full regression model are shown in Table 2 (pg.19).

Job Withdrawal

In Step 1, negative affect explained unique variance for job withdrawal, $R^2 =$ .107 ($p < .01$). Negative affect was positively related to job withdrawal. The greater the participant's overall negative affect the more job withdrawal the participant had. In step 2, participants' sex was found to be unrelated to job withdrawal. Interestingly, the number of hours worked per week was also found to explain a significant amount of the variance in job withdrawal, $\Delta R^2 = .034$, ($p < .05$) in step 3. The number of hours worked per week was negatively related to job withdrawal; the fewer number of hours our participants worked, the more likely they were to engage in job withdrawal. In step 4, neither supervisor's sex nor the number of employees that report to the supervisor was significant. In step 5, vicarious social undermining was found to be positively associated with job withdrawal,

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$\Delta R^2 = .057$ ($p < .01$). The vicarious social undermining a participant reported, the more likely they were to engage in job withdrawal. These results support hypothesis 1.

Intention to Quit

In Step 1, positive affect explained unique variance and was found to be negatively related to ITQ, $R^2 = .224$ ($p < .01$). The more positive affect a participant had, the less likely they were to report intending to quit their job. Participants' sex was unrelated to intention to quit in step 2. Step 3 revealed that neither the number of hours worked per week nor the length of employment predicted intention to quit and Step 4 revealed that neither the supervisor's sex nor the amount of employees that report to the supervisor accounted for significant variance in intention to quit. Finally, supporting our hypothesis, vicarious social undermining was found to be positively related to intention to quit, $\Delta R^2 = .076$ ($p < .01$). Those who experienced greater vicarious social undermining also reported higher intentions to quit their jobs.

Supervisor Satisfaction

In Step 1, positive affect was found to account for some of the variance of supervisor satisfaction, $R^2 = .117$ ($p < .01$). The more positive affect a participant had in the past few months, the more satisfied they reported they were with their supervisor. Similar to the previous outcome measures, participants' sex was found to be unrelated to supervisor satisfaction. In step 3, the number of hours worked per week was found to be related to overall supervisor satisfaction, , $\Delta R^2 = .052$ ($p < .01$). This relationship was negative, suggesting that participants who worked more hours, were less satisfied with their supervisor. Neither the number of employees that report to the supervisor nor supervisor sex was significant. In Step 5, vicarious social undermining was associated with supervisor satisfaction, $\Delta R^2 = .237$ ($p < .01$). Supporting our hypothesis, the negative relationship revealed that the more vicarious social undermining a participant witnessed, the less satisfied he or she reported they were with their supervisor.

Affective Organizational Commitment

In Step 1, positive affect was found to account for unique variance in affective organizational commitment, $R^2 = .177$, ($p < .01$). The relationship was negative revealing that the more general negative affect an employee possessed, the less organizational commitment they had. Participants' sex, employment length, the number of hours worked per week, the number of employees that report to the supervisor, and supervisor's sex did not predict affective organizational commitment. Finally, our hypothesis that vicarious social undermining would be associated with reduced levels of affective organizational commitment was not supported.

Table 2

*Summary of Hierarchical Regression Analysis for Individual Difference and Coworker
Undermining Predicting Retaliation Variables*

Variables	JW	ITQ	SS
	B	B	B
Step 1			
Negative Affect	.287**	.018	-.034
Positive Affect	-.136	-.472**	.337**
Step 2			
Negative Affect	.267**	.002	-.046
Positive Affect	-.122	-.461**	.346**
Sex	-.118	-.110	-.071
Step 3			
Negative Affect	.256**	-.009	-.064
Positive Affect	-.135	-.473**	.331**
Sex	-.111	-.108	-.057
Tenure	-.095	.009	-.044
Hours Worked per Week	-.168*	-.086	-.231**
Step 4			
Negative Affect	.251	-.008	-.036
Positive Affect	-.143**	-.480**	.325**
Sex	-.108	-.111	-.023
Tenure	-.091	.013	-.057
Hours Worked per Week	-.163	-.083	-.211*
Employees that report to Supervisor	.059	.045	-.060
Supervisor Sex	.013	-.001	.130
Step 5			
Negative Affect	.224**	-.051	.019
Positive Affect	-.126	-.447**	.290**
Sex	-.126	-.148	.012
Tenure	-.083	.032	-.072
Hours Worked per Week	-.187*	-.110	-.161*
Employees that report to Supervisor	.027	.000	.006
Supervisor Sex	.042	-.007	.070
Vicarious Social Undermining	.247**	.288**	-.505**

Note. JW (Job Withdrawal), ITQ (Intention to Quit), SS (Supervisor Satisfaction).
        $*p<.05, **p < .01$

Discussion

Workplace aggression is an ongoing topic of study and research. Because people spend most of their lives at work, it is important to better understand what problems may cause harm or decrease effectiveness. One form of workplace aggression is social undermining. This study found that one does not have to be the direct target of social undermining to experience the negative effects. The results indicate that vicarious social undermining is related to negative outcomes of job withdrawal, intention to quit, and supervisor satisfaction, but not organizational commitment. Employees who were victims of vicarious social undermining were found to have higher job withdrawal tendencies. That is, missed meetings, were late to work, intentionally worked slower, etc. Intention to quit was also higher as a result of experiencing vicarious social undermining. That is participants considered quitting their job and looked for a new employment opportunity, as well as considered requesting to be transferred to another position. Supervisor Satisfaction was lower for employees who reported higher levels of vicarious social undermining compared to those who did not report high levels of vicarious social undermining.

Limitations

Although most of our hypotheses were supported, this study did have some limitations. First, we collected fewer participants than we initially hoped for. Even though we had enough power to detect the effects, more participants would increase the reliability of our findings. Also, when running our analysis we might have replaced or omitted a few variables, such as supervisor sex and participant sex because they had no effect on any of the criterion. Other variables that could possibly replace the previously mentioned may be supervisor's level of education. A majority of the participants of this study were part-time employees. This is a limitation because it allows our study to be more applicable to those with part-time jobs

Future Research

The next logical extension of this program of research will be to investigate other organizational variables that might moderate the relationships between vicarious social undermining and the outcome variables we studied. Baron and Kenny (1986) define a moderator as "a qualitative or quantitative variable that affects the direction and/or strength of the relation between and independent or predictor variable and a dependent or criterion variable" (pg. 1174). For this study the relationships that would be affected by a moderator are those between the predictor (vicarious social undermining) and criterion (job withdrawal, intention to quit, supervisor satisfaction, and organizational commitment. One variable that appears to be a good possible moderator is perceived organizational support (POS). For example, employees with high perceived organizational support will buffer the effects, decreasing the negative effects of vicarious social undermining, while low perceived organizational support will strengthen the expected negative relationships. Another topic for future investigation is to determine whether the factor structure of vicarious social undermining is the same as the two-factor structure of social undermining. We imagine that even if the factor structure of vicarious social undermining is the same, the interpersonal hostility factor may have more of an impact than obstructionism factor.

Conclusion

This project contributes to the limited amount of knowledge we have of social undermining. We were able to document that although a person may not be the direct target of social undermining, they may still be victimized by vicarious social undermining. The outcome variables we investigated, job withdrawal, intention to quit, and supervisor satisfaction, have meaningful consequences for the individual and the organization. This fact suggests that focusing only on the relationship between the perpetrator and target is revealing just part of the whole problem. Social undermining has consequences not only for the direct target, but for others in the workgroup as well. These consequences will ultimately end up costing the organization if the undermining is not addressed.

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Synthesis of Nickel and Nickel Hydroxide Nano-powders by simple Hydrazine Reduction

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Abstract

  The synthesis of nano-powders has been studied in past years because of their sizes and characteristics. The purpose of this experiment is to see if nickel (Ni) and nickel hydroxide (Ni(OH)$_2$) nano-powders can be synthesized using a simple hydrazine reduction application at room temperature. Nickel and nickel hydroxide nano-powders were synthesized chemically through the reduction of nickel chloride (NiCl$_2$) by hydrazine hydrate (N$_2$H$_2$) in an aqueous solution. The powder was analyzed using x-ray diffraction (XRD). The particle size was found by using the Williamson-Hall plot. We found that we were able to produce nano-powders using this simple synthesis method. The reaction produced nickel that was 8.19 and 9.22 nm. A precipitate was formed in the synthesis of Ni(OH)$_2$, but further research is being conducted to conclude what the product is. The addition of poly (vinyl pyrrolidone) (PVP) into the Ni(OH)$_2$ and Ni synthesis are also undergoing further studies. Further study would also be needed in order to see if these powders are applicable for battery and fuel cell use.

Introduction

Nanoscale materials symbolize a new realm of matter and offer a variety of contributions to the sciences and technology [1]. A nano- particle is a solid particle that ranges in size from one to one hundred nanometers (nm). Nano-particles usually have different electronic, optical, magnetic, and chemical properties compared to their bulk materials because of their small sizes and large surface areas [2]. Since nano-particles are small and offer such large surface areas they tend to be more reactive with other molecules [3]. In recent years, metal nano-particles have received increasing attention from many researchers because of the way they can be prepared, characterized, and the many applications that they are used for. Many methods have been developed in order to prepare these fine metal powders [4]. Some of these methods include the complexation-precipitation method [5], urea decomposition [6], microemulsion synthesis [2], and many others. Some of the applications metal nano-particles can be used for include chemical catalyst, conducting paints, pigments, magnetic recording devices, drug transporters, etc [5,7]. Since nano-particles can also be used in batteries and fuel cells, this paper focuses on a simple synthesis for these two applications.

Using nano-particle in batteries can have many benefits. These small particles can reduce the probability of the battery catching on fire because they provide the ability to use less flammable electrode material [3]. By coating the surface of the particle it can increase the power given by the battery and decrease the time it takes to charge the battery. This is possible because it increases the surface area of the electrode allowing for more current to flow between the electrode and the chemicals available in the battery. A final benefit that nano-particles can offer is they can increase the shelf life of a battery. When the battery is not being used the small particles can separate the liquids in the batteries from the solid electrodes.

Platinum is usually the catalyst used in fuel cells, but because it is so expensive many companies are using nano-particles of platinum to reduce the cost for them. Companies are also trying to use other nano materials to replace the platinum. Fuel cells have membranes that allow certain ions to pass, while others are prohibited. With nano-particles the companies that make fuel cells can make more efficient membranes, and may be able to build lighter weight and longer lasting fuel cells [3]. Since nickel nano-particles can be a good chemical catalysts, finding a simple way to prepare them can help to reduce the amount companies spend on fuel cells.

There are some limitations in performing a synthesis reaction that needs to be considered. Agglomeration of the nano-particles is the process in which the particles collide and adhere to each other due to turbulence forming agglomerates, a round mass. Agglomeration can decrease the particles surface area for condensation and/or chemical reaction [8]. If agglomeration occurs it can cause nano-particles to be poor adsorbents and catalyst. Nano-particles naturally want to aggregate, and this can affect the high surface areas that nano-particles offer. Researchers' main concern is to try to prevent agglomeration. Many are trying to control the shape and size of these nano- particles because they can potentially be important for the many applications they are used in [7]. Stabilizers such as poly (vinyl pyrrolidone) (PVP) are often used for particle protection and are able to decrease particle size [9].

There have been many studies done on the synthesis of nano-particles in recent years. We present a simple, inexpensive, and efficient chemical method of synthesizing

nickel and nickel hydroxide powders with nanometer sized particle. In this study we are trying to see if we can synthesize nickel and nickel hydroxide nano-powders using a simple hydrazine reduction application at room temperature, so we have the ability to use them for battery or fuel cell applications.

Methods

Materials.

The materials used in this experiment were of analytical grade and did not required purification. The 99.95 % $NiCl_2$ was supplied from Alfa Aesar, 85% N_2H_2 solution was from Fisher Scientific, and the sodium hydroxide (NaOH) was supplied by EM Science. Distilled (DI) water was used throughout the whole experiment.

Synthesis of Nickel nano-powder.

Four solutions were prepared and labeled, two of them A and the other two B. Solutions A were made by adding .5 g of $NiCl_2$ to 60 mL of DI water to each of the beakers. Solutions B were prepared by adding 1.004 g of NaOH in 20 mL of DI water, along with 20 mL of hydrazine hydrate to each. Solutions B were then added to solutions A all at once forming a royal blue solution. Two of the solutions were then sonicated for 15 minutes, left to sit for 15 minutes, and then sonicated again for 15 minutes. The other two beakers were just left to sit without sonication. The pH of all four solutions was recorded every hour, then every three hours. Once the reaction was over, the precipitate was filtered, washed, and dried. Another synthesis was then performed adding 1.5 g of PVP to solution A, and leaving solution B alone.

Synthesis of Nickel hydroxide nano-powder

Many different solutions were observed, but mainly two different solutions were prepared and labeled A and B. In solution A, 1.19 g of NiCl2 was dissolved in 50 mL of DI water. Then 200 mL of ethanol was added forming a clear green solution. In solution B, .4 g of NaOH, 1.5 mL of hydrazine hydrate, and 200 ml of DI water were all combined forming a clear solution. Solution B was then loaded into a buret. The pH of solution A was recorded, and then solution B is added to solution A drop by drop. The pH of the solution is recorded every 10 mL until 80 mL is reached. The solution was then left to sit over night for further reaction. The precipitate was then filtered, washed, and dried. The same synthesis was performed, but 3 g of PVP was added along with the NiCl2, ethanol, and DI water. All other steps were conducted in the same manner.

X- Ray Diffraction.

XRD scans were used on the synthesized Ni and Ni(OH)2 powders. A Siemens D-500 diffractometer with Cu Kα radiation (λ= 0.15405nm). XRD scans were conducted at a step size of 0.05 degrees and dwell time of 1 s. The tube source was operated at 35 kV and 24 mA. A Williamson-Hall analysis was done on each sample to calculate the particle size with nickel powder as the standard for instrumental broadening.

Results:

We were able to obtain Ni nano-powder from the simple hydrazine synthesis. Figure 1 shows a typical XRD pattern of the Ni standard powder that was used to compare the experimental Ni nano-powders, which can be seen in figure 2 and 4. The calculated particle size of the Ni that was sonicated was 8.19 nm, and the Ni powder that did not go through sonication produced powder that was 9.22 nm. Figure 6 shows the standard XRD pattern of Ni(OH)2 powder. The XRD pattern for the precipitate that was formed from the Ni(OH)2 synthesis can be seen in figures 7 and 8.
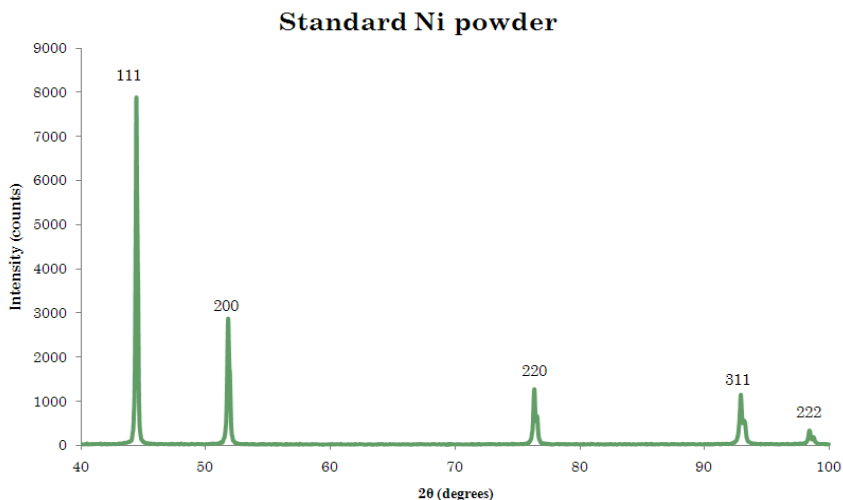
Figure 1: XRD pattern of nickel standard powder.
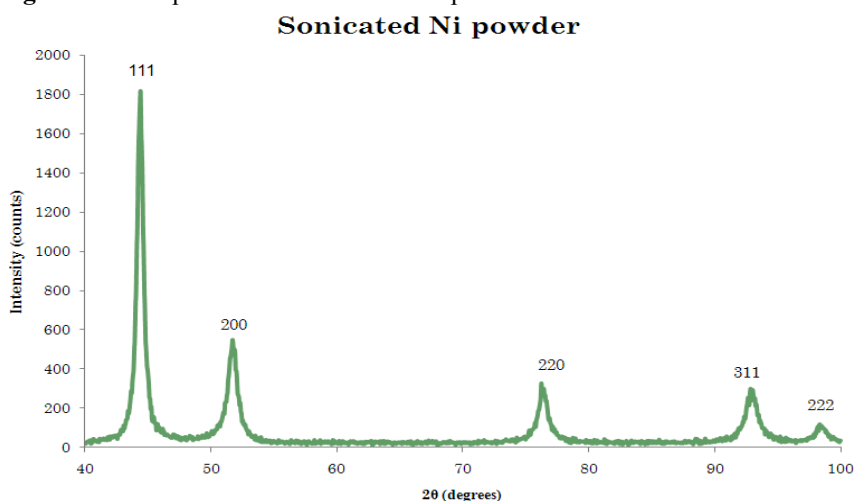
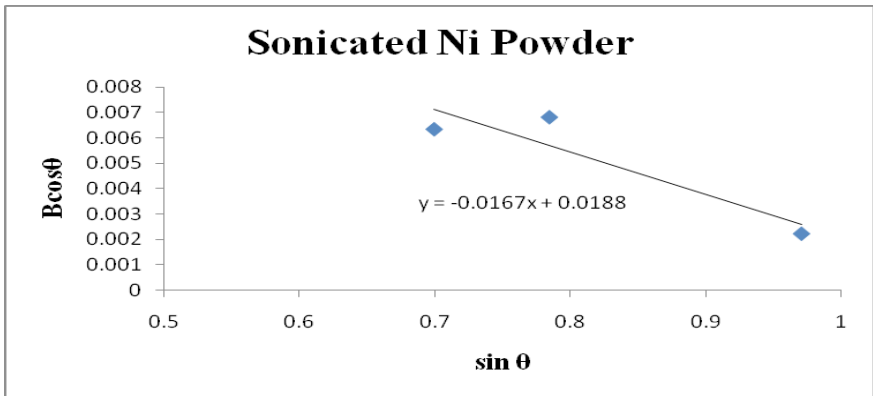**Figure 2:** XRD pattern of nickel powder that was sonicated.

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Figure 3: Williamson-Hall plot for XRD of sonicated nickel powder. Y-intercept of line used to help calculated the particle size of the powder.
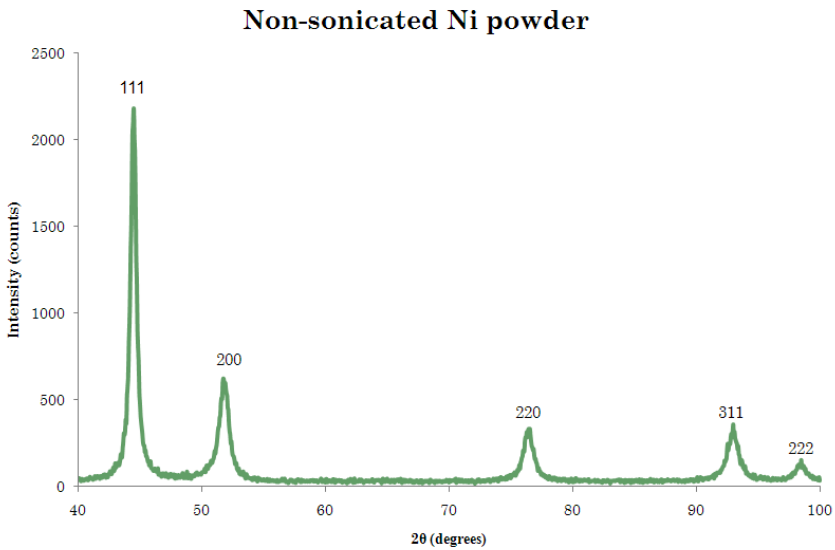

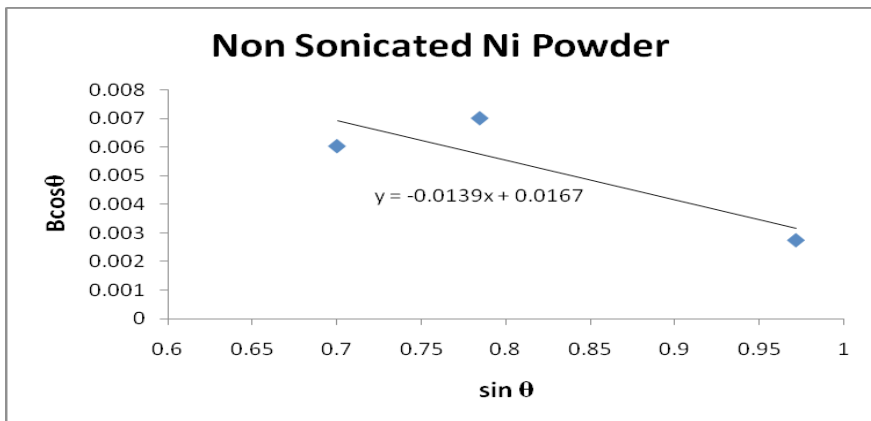**Figure 4:** XRD pattern of nickel powder that was not sonicated.

Figure 5: Williamson-Hall plot for XRD of non-sonicated nickel powder. Y-intercept of line used to help calculate the particle size of the powder.
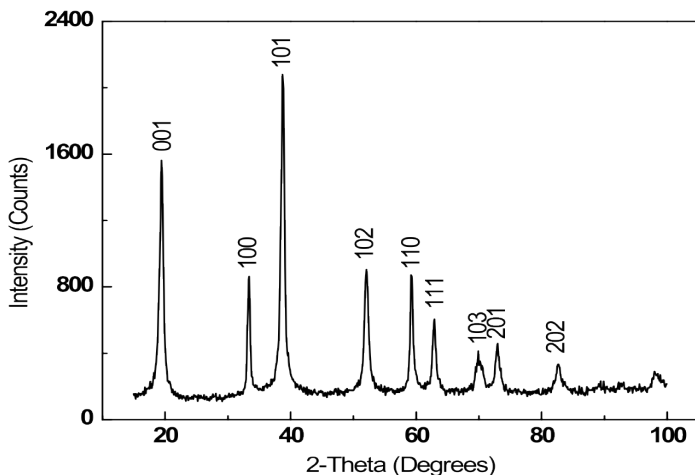

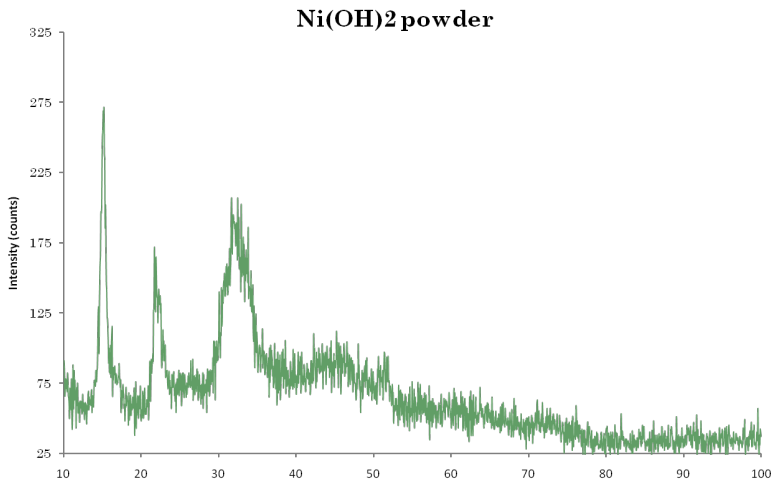**Figure 6:** XRD pattern of standard nickel hydroxide powder.

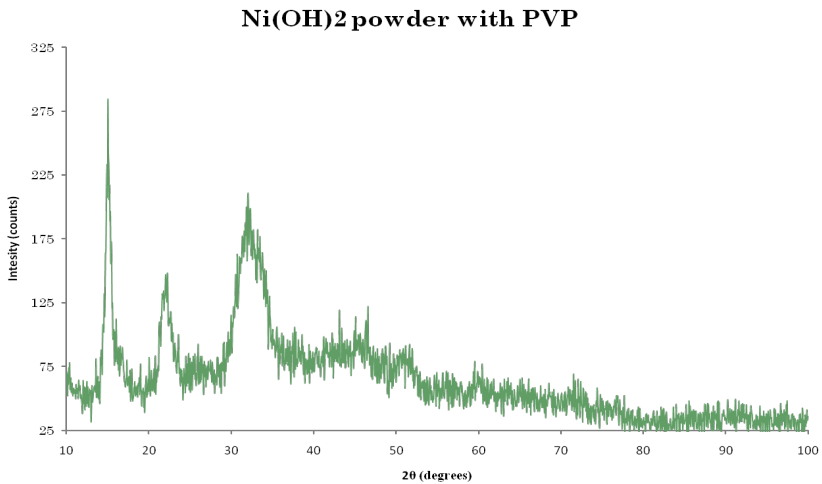**Figure 7:** XRD pattern of powder from the synthesis of Ni(OH)$_2$.

Figure 8: XRD pattern of powder from the synthesis of Ni(OH)$_2$ with PVP.

Discussion:

The nickel XRD patterns in figure 2 and 4 were confirmed to be nickel with the JCPDS database (PDF # 04-050). According to knowledge of nickel's structure and other studies done the nickel is a face-centered cubic (fcc) structure, which can be seen by the diffraction peaks. According to a similar study done by LIU Xiaodan, et. al., the peaks they obtained are similar to the ones obtained in this experiment(111, 200 ,220, 311, 222), in which case it can be concluded that the particles prepared are of pure nickel of fcc structure [4, 7]. The sizes of the nickel particles were calculated using the Williamson-Hall plots (figures 3 and 5) by using the first three peaks of the XRD patterns of nickel powder (figure 2, 4). The broadening caused by the instrument was eliminated from the crystallite size calculations by using the standard nickel XRD pattern (figure 1). We can confirm that nano-particles were formed because of the broadening of the diffraction peaks in figures 2 and 4 compared to figure1. The broadening of diffraction peaks shows that the powders particles are in the nanosized range [5, 10]. We also confirmed the size of the particles by using the Scherrer formula: $L = k\lambda / B \cos\theta$, where L is the average crystalline size, λ is the wavelength of 0.15405 nm, B is the additional broadening (in radian), and θ is the Bragg angle [4].

Nickel is known to be easily oxidized to be oxides or hydroxides by water [2]. In this experiment we used sodium hydroxide, which has a critical role in the formation of nickel powders [4]. Hydrazine hydrate is a weak reducing agent at low pH's. The ability for hydrazine to be able to reduce the nickel ion in a solution is affected by the pH [11]. In another similar study done by Da-Peng Wang, et. al, it states an alkaline solution with proper pH is a necessary factor to make sure the right reaction occurs [4]. For our reactions, the formation of nickel nano-particles was favored at a solution of pH 13.5. The equation for the formation of nickel can be expressed as:

$$2[Ni(N_2H_4)_3]^{2+} + 4OH^- \rightarrow 2Ni + N_2 + 4H_2O + 5N_2H_4 \qquad (1) \qquad [4].$$
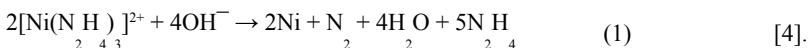
The precipitates of the Ni(OH)2 synthesis were examined in the same manner. We can see the XRD patterns of the precipitate formed in figures 7 and 8. From figure 6 and one's own knowledge we can conclude that Ni(OH)2 was not formed. Research is still being conducted to conclude what was formed from the synthesis.

When faced with the limitations, agglomeration, of a synthesis reaction a stabilizer can be used. There are many different stabilizers that can be used, but in this study PVP was used. It is said that PVP is to form a layer of molecular membrane around the particle to prevent inter-contact between the particles [7]. PVP also reduces surface tension and has an effect on steric hindrance. The synthesis of nickel with PVP has formed some black particles, but is still undergoing a reaction, which can be seen by the continuous evolution of bubbles. The solution for this reaction has gone from a royal blue color to a deep purple color. As for the synthesis of Ni(OH)2 with PVP we can see the XRD patter in figure 7. For this solution it went from a green solution to a milky baby blue color solution.

Metal nano-powders, as we know, can be used for various applications. With this simple hydrazine reduction synthesis we are able to form nickel nano-powders in an inexpensive and effective way. As stated before, in this study we wanted to see if nickel and nickel hydroxide nano-powders could be formed with a simple hydrazine reduction

at room temperature. Even though we were not able to produce Ni(OH)2 nano-powders we were able to achieve the synthesis of pure nickel powder which were of nanosize. Research on the synthesis of Ni and Ni(OH)2 are still ongoing.

Conclusion:

In conclusion we have seen that it is possible to synthesize nickel nano-powders using a simple hydrazine reduction synthesis at room temperature. From the analysis of the XRD and Williamson-Hall plot we were able to find the particle size of Ni to be 8.19 nm (with sonication) and 9.22 nm (without sonication). As for the $Ni(OH)_2$ further research is being continued to conclude what the precipitate is, and why the reaction did not form the $Ni(OH)_2$ powder. With this ability to synthesize nickel nano-powders, with an effective synthesis, we will be able to use them for batteries and fuel cells.

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My βIG Fat Math Model: β-Cell Compensation and Type 2 Diabetes

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Abstract

In this work we mathematically explore the biological consequences of the effect of over-nutrition, fat accumulation, and β-cell function in a model of the progression of Type 2 diabetes (T2D). More specifically, we focus on the effects of fat mass in the liver and the mechanism underlying the initiation and progression of β-cell failure. This mathematical model is based on a previous model that considers glucose-insulin and β-cell mass dynamics. We incorporated fat (assumed to grow linearly), the direct effect of insulin sensitivity, and the effect of β-cell sensitivity in our model. We assumed that β-cell sensitivity embodies a logistic response by initially increasing as fat accumulates due to the compensatory response triggered by increased glucose levels. As fat continues to accumulate, β-cell sensitivity decreases due to β-cell failure and eventually β-cells begin to die. The threshold at which β-cell compensation fails marks the clinical onset of T2D, which with time can progress to the stage where it is no longer reversible due to severe loss of β-cell mass. Using the theory of dynamical systems we analyze the various stages of T2D, investigate whether weight loss in the pre-diabetic and diabetic stages would reverse T2D, and study when this treatment strategy is no longer effective.

1 Introduction

The possibility of recovering from Type 2 diabetes (T2D) in the pre-diabetic and diabetic stages through diet interventions is of current interest to many researchers today [26]. T2D has long been described as an incurable progressive disease. Traditionally individuals over the age of 40 were thought to have the most risk of diabetes however, recent evidence show obesity has become one of the major contributing factors to T2D ([12], [21]). Approximately 4 to 8% of children and 10 to 20% of adults worldwide are obese and nearly 35.7% of new T2D cases are obese adolescents [21]. Nearly 150 to 220 million individuals were predicted to become diabetic by 2010 and 300 million by 2025 worldwide [29]. In 2010, the International Diabetes Foundation reported more than 300 million individuals had diabetes exceeding the predicted number for 2025 ([29], [31]).

This epidemic of T2D is rapidly spreading globally and has become one of the major health treats due to the changes in lifestyle including behavioral and environmental fac- tors ([2], [4], [10], [29]). In the long-term, diabetes left untreated causes or exacerbates conditions such as heart, kidney, and nervous system disease, stroke, high blood pressure, erectile dysfunction, blindness, and limb amputations; many of these diseases being the leading causes of death in the U.S. [24]. Furthermore, a study by Dr. Yale predicts obese children diagnosed with diabetes before age 20 are susceptible to additional complications in the long-term from T2D and now a body mass index (BMI $>$ 30) serves as a clinical indicator for risk of T2D ([?] [30]).

Overnutrition, inactivity, and other environmental factors contribute to weight gain. Overweight individuals consuming excessive glucose-content meals can progress to pre- diabetic stages where β-cell compensation is initiated and later progress to the diabetic stage where β-cell dysfunction occurs leading eventually to β-cell loss [27]. Below, we present background on the glucose-insulin regulatory system, β-cell function and com- pensation, β-cell sensitivity, insulin resistance, and the effects of fat accumulation in the liver.

Several mathematical models have been developed to describe the mechanisms under- lying glucose-insulin regulation ([24], [26], [37]), however few consider fat as either a direct or indirect effect on liver insulin sensitivity [34]. The model proposed investigates the effects of fat in both the blood by free fatty acids (FFA) and in the liver as triglycerides (TG). The impact of fat on insulin sensitivity are not well understood. Recent findings suggest a link between TG, FFA, and insulin sensitivity although these mechanisms are not consistent in the literature ([33], [34], [35], [36]).

When does T2D become irreversible and when does β-cell overcompensation fail? The research presented aims to describe the dynamics of insulin, glucose, β-cell mass, and fat change. The findings of our model will offer information on the threshold values of insulin resistance, β-cell overcompensation, and fat mass by considering the stability analysis of relevant parameters. The model will also be compared to the data of the study by Lim et al. [15]. The long-term goal of this line of research is to arrive at clinical recommendations for intervention strategies dependent on the stage of progression of T2D.

2 Overview of Progression of Type 2 Diabetes

Type 2 diabetes (T2D) is characterized by the progressive decline of β-cell function and terminal insulin resistance [28]. T2D is understood to be incurable although a change in diet and regular physical activity can lead to reduced symptoms and prevent the onset of diabetes ([15]), [21] both treatment and intervention strategies targeted to obese individuals [?]. In 2011, a study concluded T2D was reversible by modifying caloric intake and glucose content [15]. Differences in glucose levels, insulin concentration, and fat

mass in both the pancreas and liver were collected to test whether or not negative energy balance alone could restore insulin sensitivity, release β-cells from excessive exposure to fatty acids, and reverse β-cell overcompensation. The 12-week follow-up of the 8-week study concluded that 9 of the 11 obese individuals with T2D (less than 4 years) were recovered. These findings are indeed remarkable and offer plausible preventative and intervention strategies that require further investigation. Overnutrition and lack of physical activity can lead to both insulin resistance and β-cell dysfunction [17]. The initiation of insulin resistance and β-cell compensation define the pre-diabetic stage of T2D. Progression of β-cell dysfunction and failure mark the clinical onset of T2D and is the point of interest in this research.

It has been understood that insulin-glucose mechanisms behave in a negative feedback loop [22] where a rise in glucose level triggers the release of insulin from β-cells which in turn, lowers glucose levels, causing insulin levels to decline. However, this feedback mechanism occurs only if liver cells can detect insulin. Often patients with excess FFA's or adipose tissue may develop insulin resistance where the liver does not respond to insulin effectively. Blood glucose levels increase and β-cells must then compensate for the elevated blood glucose by eventually overworking, known as '"overcompensation". This cascading effect is supported in literature suggesting insulin resistance is a prerequisite in this progression of T2D. The proposed mathematical model is a simplification of the dynamics connecting fat accumulation, glucose-insulin regulation, and β-cell mass. Findings can contribute to health education, prevention and intervention strategies, and future research.

2.1   Glucose-Insulin behave in a Negative Feedback Loop

The body metabolizes food into glucose, one of the body's primary source of energy. Glucose is transported throughout the body through the blood. When blood glucose level rises, β-cells within the pancreas respond by secreting a hormone called insulin. Insulin molecules attach to receptors on liver cells in order to signal these cells to absorb glucose. Hence, insulin is a hormone which aids in lowering the blood glucose to normal glucose levels, known as normoglycaemia. Glucose-insulin regulation for a normal individual behaves in a negative feedback loop [22]. A rise in amount of blood glucose triggers β-cells to release insulin, moreover insulin secretion increases. The uptake of glucose by liver cells reduces blood glucose levels and hence insulin levels also decline.
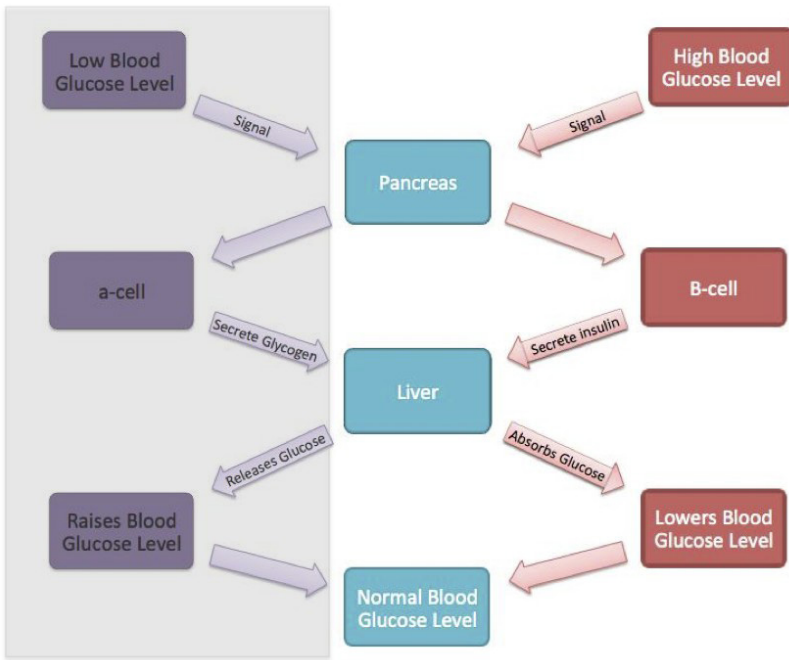
Figure 1: Flow chart for glucose-insulin regulatory system: negative feedback loop

2.2 Role of β-cell sensitivity, β-cell compensation, and development of β-cell failure

Consider Figure 3(a), for a normal individual, the secretion of insulin is triggered by the rise in blood glucose levels β-cells synthesize and secrete insulin into the blood stream. The insulin binds with insulin receptors on liver cells and glucose is absorbed from the blood stream. Insulin sensitivity refers to liver cells' response mechanism to the insulin. As insulin sensitivity decreases more insulin is needed to effectively reduce blood glucose levels and β-cells begin to expand in order to secrete more insulin into the blood stream Figure 3(b). In this cycle some of the β-cells start dying because they have been over-worked. This is called β-cell depletion. When this happens, the β-cells mass decreases causing less insulin to be secreted which normally reduces the glucose levels in the blood. But this time, the glucose levels rise because the liver does not receive enough insulin from
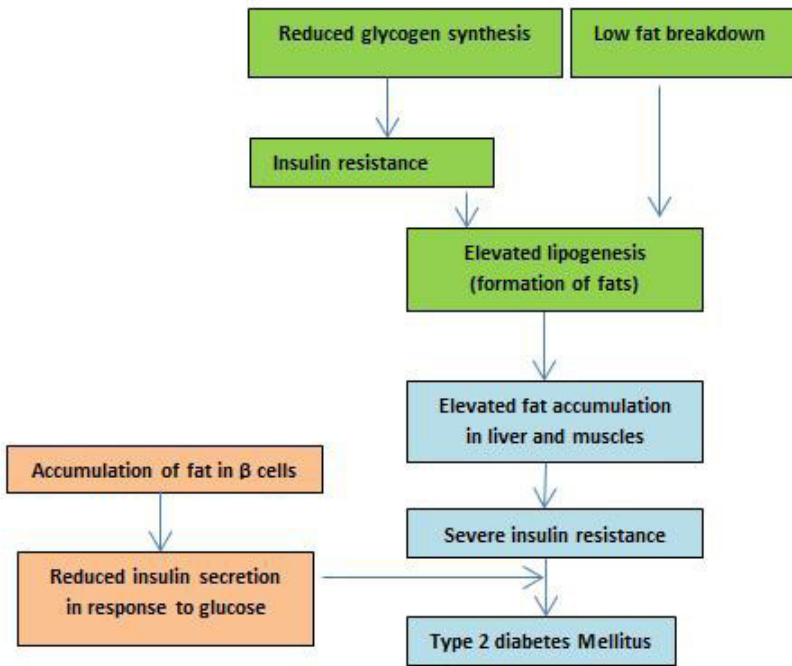
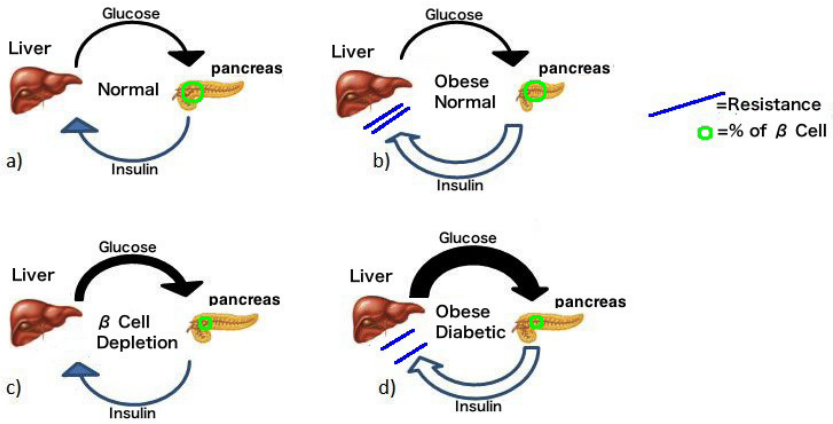Figure 2: The development of Type 2 diabetes: considering Insulin Resistance and β-cells

Figure 3: β-cells and the insulin pathway

the β-cells Figure 3(c). In Figure 3(d), the liver is insulin resistant and thus unresponsive to insulin. Since we have β-cell depletion, the glucose levels in the blood stays high. In order return to normalglycemia a person has to resort to insulin shots.
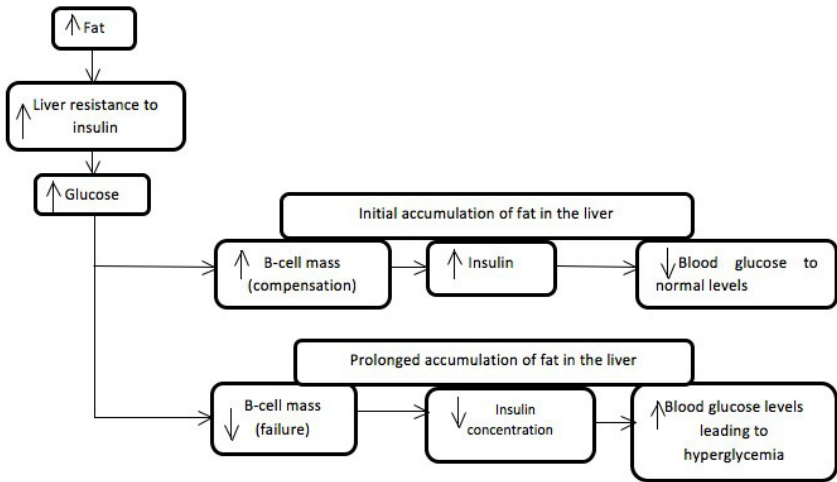
Figure 4: Short-term fat accumulation can lead to the progression of β-cell compensation during the initial stages. Long-term fat accumulation influences β-cell failure.

2.3 Adipose Tissue and Free Fatty Acids (FFAs) in the Liver and Insulin Sensitivity

The liver plays a key role in glucose level regulation by removing up to 50% of glucose in the blood. Weight-gain leads to fat accumulation in the body. Excessive free fatty acids (FFAs) in the blood prevents liver cells to respond appropriately to insulin. Under normal conditions the presence of insulin activates liver cells to take up glucose. When glucose is absorbed by liver cells it is stored as either glycogen or fatty acids which are broken down when blood glucose levels are low. Excess fatty acids accumulate in the liver where they are converted into triglycerides which make up fatty tissue around the liver. Furthermore, adipose tissue in the liver triggers the production of more fat. Overweight individuals are at a higher risk of T2D marked by increased susceptibility to insulin resistance and β-cell overcompensation.

Insulin sensitivity refers to how well liver cells respond to insulin. Adipose tissue in the liver prevents insulin molecules to bind to liver cell receptor sites and also causes liver cells to be unable to recognize the presence of insulin. High blood glucose levels are maintained

in the blood and continuously rise as glucose buildup increases. In consequence, β-cells expand and overwork in order to compensate for the excess glucose present. Consequently, the β-cell mass begins to decrease because the cells are unable to sustain the high demand for insulin secretion for longer periods of time. β-cells then become dysfunctional and potentially die off over time. When β-cell mass decreases, the amount of insulin secreted also decreases leading to elevated blood glucose concentration. At this point, the liver is unable to bring down the glucose level in the blood, and the person is diagnosed as diabetic.

Free fatty acids (FFA) are acids that can be transported in the bloodstream and may potentially have a central role in the liver-insulin sensitivity [34]. High FFA concentration has been shown to stimulate hepatic glucose production and inhibit insulin-stimulated glucose uptake, leading to high blood glucose concentrations [34]. TG can be accumulated in the liver as triglycerides (TG). The source of TG could be either excess glucose in the blood, free fatty acids, and/or the diet [36]. Therefore, measuring the amount of FFA in the blood could give us an estimate of the overall sensitivity of the liver. Also, liver sensitivity has been linked directly to FFA even before they are stored as TG in the liver ([34], [35]). The intent of this research is to investigate the role of adipose tissue and FFA's on β-cell compensation and reversal of T2D.

3 βIG Fat Math Model

3.1 Basic Model: Topp et. al.

Mathematical models of insulin and glucose dynamics are widely available in the literature but few consider the dynamics of β-cell mass coupled with glucose-insulin dynamics [26]. Topp *et al.* (2000) was one of the first to describe the negative feedback loop using a system of three nonlinear ordinary differential equations observed in insulin-glucose regulation and incorporate long-term dynamics of β-cell mass. The model presented is an expansion of previous work [26] which includes the physiological response of plasma glucose concentration (G), insulin concentration (I), and β-cell mass (B). Where the change in plasma glucose concentration with respect to time ($\frac{dG}{dt}$) depends on the amount of glucose secreted naturally by the liver, a, and how much is lost naturally b, or removed by the uptake induced by insulin that is dependent on insulin sensitivity, S_I. Insulin changes with respect to time ($\frac{dI}{dt}$) based on the amount secreted by the β-cells given their sensitivity to high glucose concentration, S_I, and the clearance rate, k, representing uptake of insulin by the liver, kidneys, and insulin receptors. Lastly, change in β-cell mass ($\frac{dB}{dt}$) depends on growth induced by increasing levels of glucose, h, death by overcompensation, m, and natural cellular death, g. Following are the equations used in the Topp paper:

$$\frac{dG}{dt} = a - (b + S_I I)G, \tag{1}$$

$$\frac{dI}{dt} = \frac{dBG^2}{e + G^2} - fI, \tag{2}$$

$$\frac{dB}{dt} = (-g + hG - mG^2)B \tag{3}$$

where G represents plasma glucose concentration, I represents insulin concentration, and B represents β-cell mass. Definitions of parameters are listed in Table 1. In the following

sections 1 to 3 we propose three modifications to the model which incorporates thre

4   Model 1: Adipose Tissue effects on Insulin Sensitivity

Our first model considers the fat accumulation in the liver in the form of adipose tissue. Here we focus on AT and its effect on the system. The equation governing the change in, AT, the rate of change of triglycerides in the liver.

$$\frac{dG}{dt} \;=\; a - \left(b + \frac{S_I I}{1 + \tau AT}\right) G \tag{4}$$

$$\frac{dI}{dt} \;=\; \frac{dAT(1 - \frac{AT}{k})BG^2}{e + G^2} - fI \tag{5}$$

$$\frac{dB}{dt} \;=\; (-g + hG - mG^2)B \tag{6}$$

$$\frac{dAt}{dt} \;=\; AT(G, I) \tag{7}$$

The new equation introduced is $\frac{dAT}{dt}$ which accounts for the amount of adipose tissue assumed to be in the liver. For this model AT's accumulate in the liver at a rate jG. The term $\frac{pAT}{1+\Lambda I}$ denotes the degradation of TG that is dependent on the amount of insulin present as well as the amount of AT present.

$$\frac{dTG}{dt} \;=\; jG - \frac{pAT}{1 + \Lambda I} \tag{8}$$

where j is AT accumulation, p is AT degradation in the liver, and Λ is the rate at which insulin prevents AT tissue to be degraded from the liver.

In this case insulin liver sensitivity depends on the amount of fat in the liver $S_I(AT) = \frac{S_{I0}I}{1+\tau AT}$ illustrating how the increase of fatty acids around the liver induces liver-insulin sensitivity to decrease. In our model, we assume that insulin cell sensitivity is affected by fat in a logistic manner. When the amount of fat is small, β cells increase in size in order to compensate for the liver insulin resistance. After some point of prolong compensation, k/2, β-cells begin to die due to overwork. We model this initial increase followed by a decrease in β-cell mass that is promoted by fat induced insulin resistant with. A logistic effect $dAT(1 - \frac{AT}{k})$ on the sensitivity of β-cells.

4.1 Time series

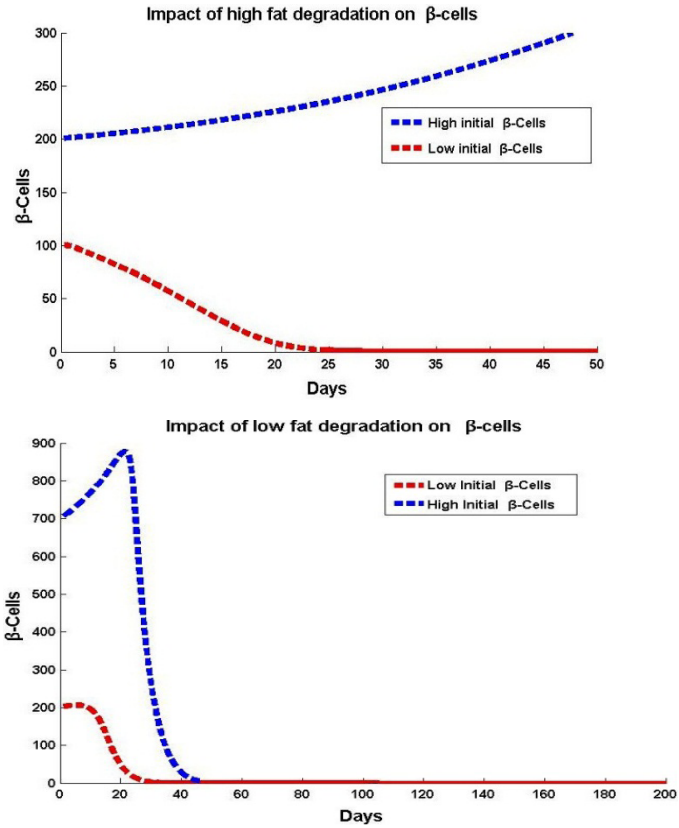Figure 5: **(a) β-cell mass versus time with a high AT degradation p (top) and (b) β-cell mass versus time with a high AT degradation p (bottom).** For high degradations of AT depending on the initial conditions of β-cells the individual will tend to physiological state or pathological if β-cells are low, but if there is a low fat degradation β-cells will always tend to pathological

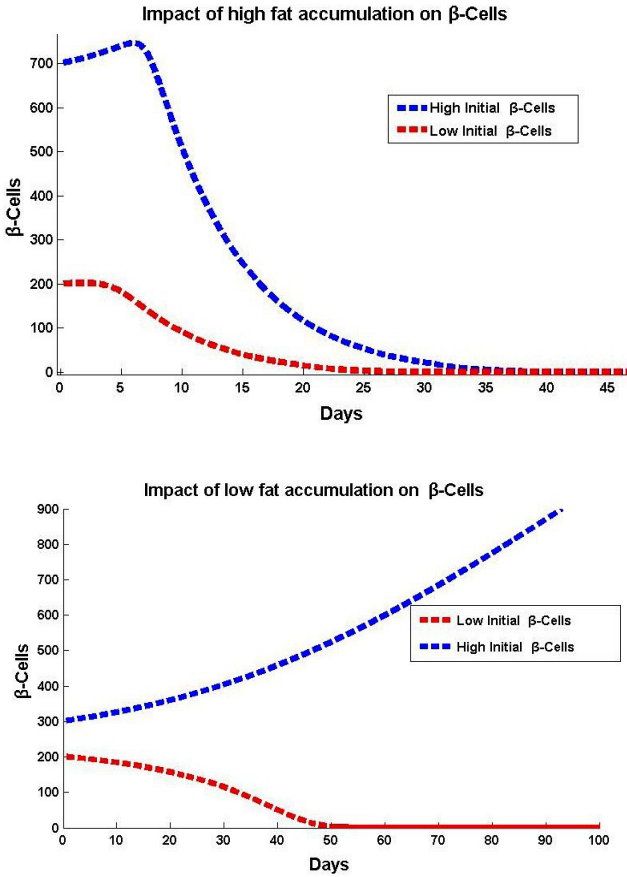Figure 6: **(a)** **β-cell mass versus time with a high AT accumulation j *(*top) and (b) β-cell mass versus time with a high AT accumulation** j **(below).** For high accumulation of AT an individual will always tend to go to pathological state, but for low fat accumulations the individual will either tend to physiological with high β-cells or pathological if β-cells are low

4.2   Bifurcation Analysis

The four bifurcation diagrams corresponding all the variables in our system with respect to the degradation of fat,p, are utilized to gain insight into the various stages of *T2D*. Here as before we fixed all parameters and vary only p. We note a vertical asymptote where at that point the model is not biologically relevant. When p low when is to the left of the asymptote for the unstable equilibrium corresponding to G=250 the only fixed point for insulin is zero. When p is larger than this value, there is bi-stability, with low initial conditions for β cell mass, β-cell mass decreases. You can reach the point of no return in 2 ways; One by not decreasing your fat enough or by decreasing your β-cell mass to a point where you cannot recover. Fat accumulated,j, can also be used as a bifurcation parameter. When fat accumulation in the liver is high, than the only fixed point that exists is for zero insulin that corresponds to the pathological equilibrium point. The point of no return in this case is denoted by the rate at which you accumulate fat in the liver. If you accumulate a high amount of AT in the liver your beta cells will tend to pathological. If you decrease your fat accumulation in the liver, then your β-cell mass can stabilize to the physiological equilibrium point. The point of no return however is reached also depending on how much β-cells you have. If your β-cells mass is already below the unstable manifold, then your β-cell mass will decrease even if you do not accumulate much AT in your liver.

4.3   Analysis of parameters *a*, *j* and *p* on both β-cell sensitivity and insulin sensitivity

Presented here are the effects of three parameters on β-cell sensitivity and insulin sensitivity. We consider endogenous glucose production by the liver illustrated by the parameter *a*, rate of adipose tissue production, *j*, and rate of adipose tissue degradation *p*. The relationships with glucose production and adipose tissue degradation rate are curvilinear and linear. Here, we plotted the relationships corresponding to the different equilibrium points. An increase in glucose production, *a*, leads to the increase in β-cell sensitivity and a decrease in insulin sensitivity whereas, an increase in the rate of adipose tissue breakdown, *p*, leads to the decrease in β-cell sensitivity.
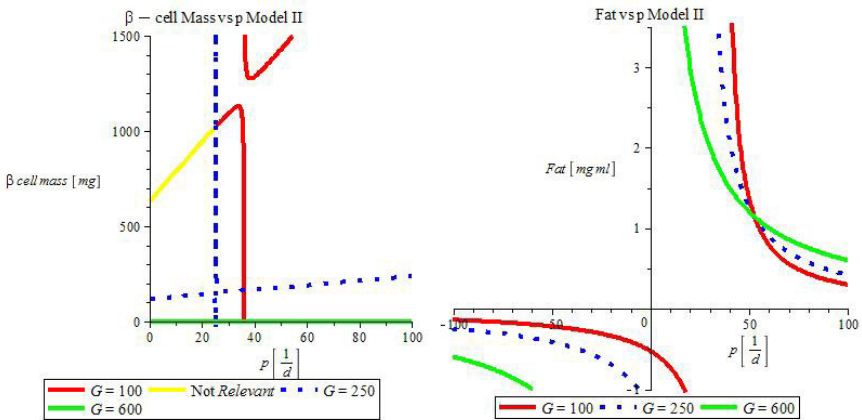
Figure 7: **(1) Adipose tissue vs** p **and (2) Insulin vs** p**, and (3)** β**-cell versus** pCurves represent the equilibrium points corresponding to the steady state values of glucose G= 600,250 and 100 (see legend) for various p values. The bifurcation diagrams for the AT degradation in the liver. To the left of the blue asymptote no matter how much β-cell mass the individual has is going to tend to go to the pathological state. For higher AT degradations to the right of the blue asymptote if β-cell mass is above the unstable manifold β-cell mass will tend to physiological state but if they are below the unstable manifold they will tend to go to the pathological state.
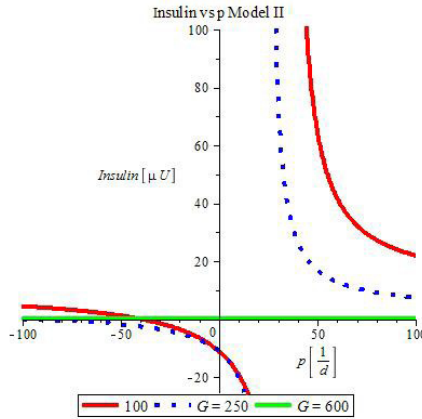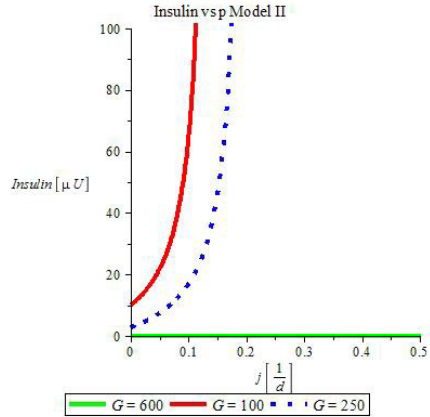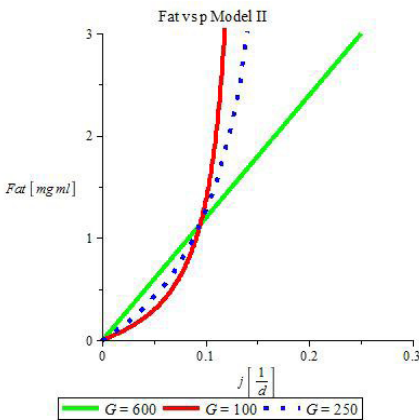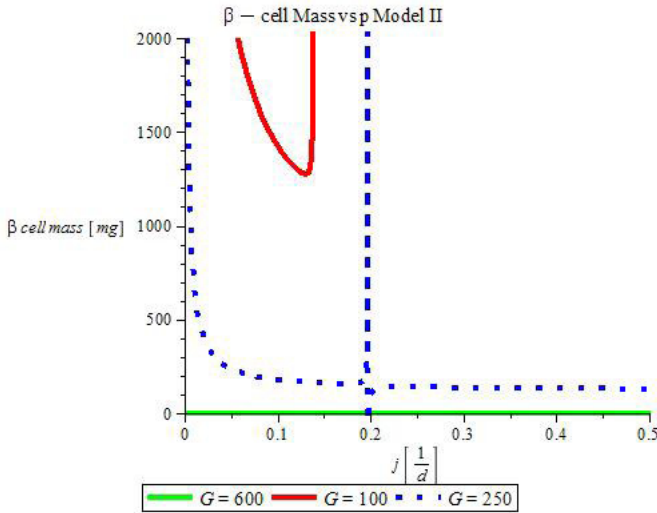
Figure 8: **(1) Adipose tissue vs j and (2) Insulin vs j, and (3) β-cell versus j** Curves represent the equilibrium points corresponding to the steady state values of glucose G= 600,250 and 100 (see legend) for various j values. The bifurcation diagrams for the AT accumulation in the liver. To the left of the blue asymptote that is with low AT tissue accumulation reaching a physiological state is possible given that */beta*-cell mass is above the unstable manifold. For high AT accumulation to the right of the blue asymptote if β-cell mass will always tend to go to pathological state.
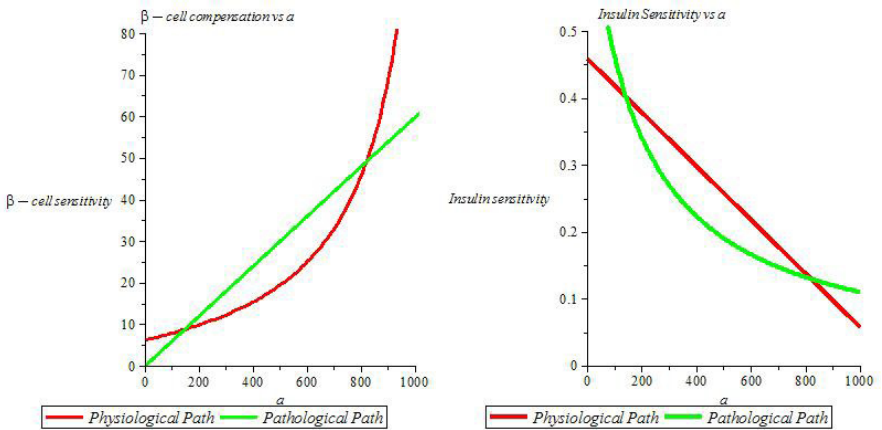
Figure 9: An increase in a leads to an increase in β-cell sensitivity and decrease for insulin sensitivity for both the pathological and physiological states.

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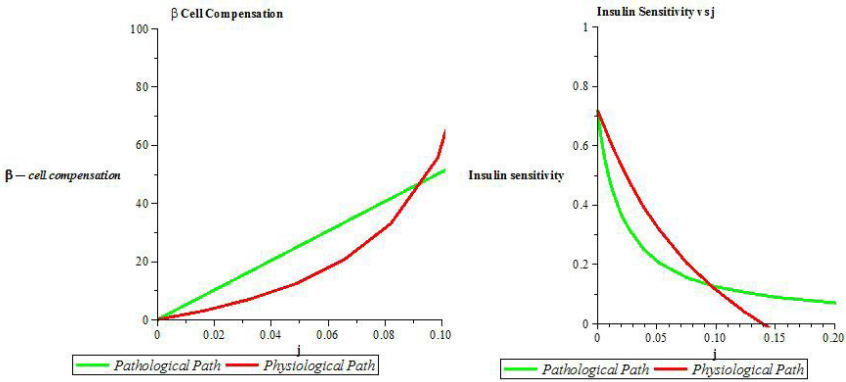
Figure 10: An increase in **j** leads to an increase in β-cell sensitivity and decrease for insulin sensitivity for both the pathological and physiological states.

5   Model 2: Fat Accumulation as a Linear Function

We proposed a simple model of fat to see if the more complicated equation for fat, which models more realistic aspects of this mechanism were necessary to show the effect of fat on the system (4)-(6). The simple fat differential equation includes Λ, the rate of fat production and p, the rate of fat degradation. This simpler model includes the effects of fat accumulation in the liver, on liver sensitivity, as well as β-cell sensitivity to glucose. The model is given by equations (4)-(6) where $S_I(F)$ represents the insulin resistance as a function of fat and $S_\beta(F)$ describes the β-cell resistance as a function of fat.

$$\frac{dG}{dt} \;\; = \;\; a - (b + \frac{S_{I0}I}{1 + \tau F})G \tag{9}$$

$$\frac{dI}{dt} \;\; = \;\; \frac{dF(1 - \frac{F}{k})BG^2}{e + G^2} - fI \tag{10}$$

$$\frac{dB}{dt} \;\; = \;\; BG(h - mG) - gB \tag{11}$$

$$\frac{dF}{dt} \;\; = \;\; \Lambda - pF \tag{12}$$

where $S_I(F)$ represents the insulin resistance as a function of fat and $S_\beta(F)$ describes the β-cell resistance as a function of fat.

5.1 Bifurcation Analysis for parameters g, m, and h

Bifurcation parameters were found in g, m, and h where the stability and number of steady-state solutions of glucose changed as the parameters were varied. The long term behavior (or steady state) of an individual depends on the initial conditions of glucose, insulin, β-cell mass, and fat. This analysis considers three separate bifurcation diagrams for β-cell mass growth due to compensation (h), β-cell mass death due to overcompensation, and natural death rate of β-cell mass (g). (See Figure 11 to Figure 13). Note that dashed lines (- - -) represents unstable steady-states and solid lines (—-) represent the stable steady-states. For this analysis we found that bifurcation was found to be similar of those for Topp *et al.*'s model [26]. The long term behavior that the system achieves for a particular an individual depends on the initial conditions of glucose, insulin, β-cell mass, and fat.
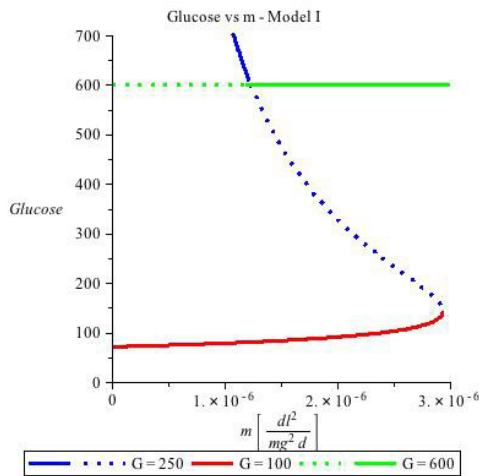
Figure 11: Bifurcation Diagram where the fixed points of glucose are plotted as a function of the rate at which β-cells mass decreases due to overcompensation and *m*, which is glucose tolerance. For Region 1, there only exists two stable equilibria points. This means that in this region for levels of G below 600 the long term G level will be approximately 75. In Region I, when G > 600 there solutions go to the stable equilibrium point with high levels of glucose. Again, in Region II, there exists 2 stable equilibria points. If glucose levels are above G_2^*, then they would continue to rise and a pathological equilibrium is reached. However, if glucose levels are below G_2^* for a given value of *m*, glucose tolerance, then the β-cells can compensate without dying since in this region glucose remains low. Region III has only one equilibrium point, G_3^* which is stable. In this region, the rate at which the β-cell mass loss is very high and pathological.
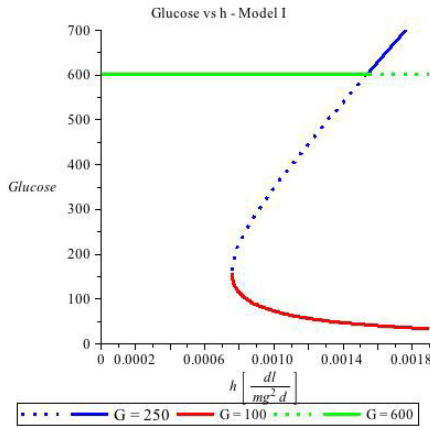
Figure 12: Bifurcation diagram of fixed points of glucose as a function of the rate at which β-cell mass increases due to compensation, h. The solid line represents the stable equilibria of the glucose level and unstable saddle point is represented by the dashed line. In Region I the development of the disease is inevitable since all initial conditions of glucose lead to a pathological fixed point corresponding to $G^* = 600$. For Region II there are two stable equilibria. In Region III, the model is outside of its feasibility range because h cannot be larger than 0.0015 since β-cell mass will grow to an unrealistic level. As h increases, the greater the β-cell mass will expand due to compensation in the presence of excess glucose.
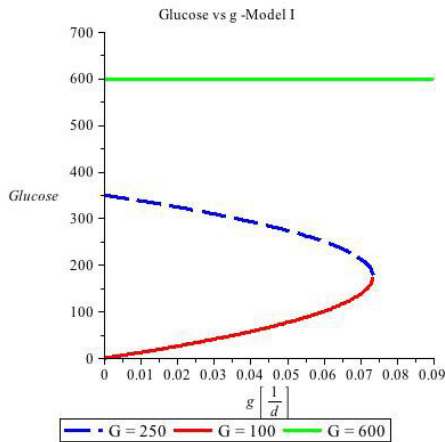
Figure 13: Analysis of glucose and parameter g, which represents β-cell natural death rate at zero glucose. For all positive rates of cellular death glucose will converge to either a physiological stable ($G = 100$) steady-state or a pathological stable ($G = 600$) steady-state. Hence, the outcome will depend on the initial conditions of glucose, insulin, fat, and β-cell sensitivity.

In Figure 11, blood glucose levels may rise or decrease in order to reach normoglycemia depending on the initial amount of glucose and a given value of m, where m represents the β-cell glucose tolerance range. Glucose is reduced in response to the amount of insulin secreted by the β-cells. At low values of glucose tolerance, m, the amount of β-cell mass decreased because the compensation in this case would be small. At high values of glucose tolerance, m, the amount of β-cell mass loss due to compensation is higher. Consider the regions: I, II, and III.

Region I When the rate of β-cell mass loss due to compensation is relatively small, the individual's blood glucose level will reach either a physiologically stable blood glucose Level at $G_1^*$ or a pathologically stable blood glucose G_2^* depending on the amount of initial glucose present. If an individual has a glucose level below G^* their glucose level will converge to G^*. If their glucose level is above G_3^* then the individual will converge to the pathologically stable insulin level G_2^*. Individuals with a blood glucose $< 100 \frac{mg}{dl}$ are considered healthy. Individuals with a physiologically stable glucose level at G_1^* would be non-diabetic and are likely to have normal glucose-insulin regulation with little to no need of β-cell compensation. Individuals with a pathologically stable glucose level at G_2^* would have an extremely large amount of glucose present which could lead them to hyperglycemic shock. Sustaining this glucose level would be nearly impossible because this would most likely lead to death if hyperglycemia is maintained in the long-term.

Region II When the rate of β-cell mass loss due to compensation is slightly higher, the blood glucose levels will reach a physiologically stable blood glucose level at G_1^* or a pathologically stable blood glucose G_3^* depending on the amount of initial glucose. If an individual has glucose level below G_2^*, their glucose level will converge to G_1^*. If their glucose level is above G_2^* then the individual will likely converge to the pathologically stable glucose level G_3^*.

Individuals with a physiologically stable glucose level at G_1^* would be borderline diabetic. These individuals may be experiencing some β-cell dysfunction since their glucose tolerance value, m, is higher. This may contribute to a slight rise in their blood glucose level. The increase in glucose could also be due to a decrease in β-cell sensitivity or due to a rise in fat accumulation in the liver, which would decrease the livers ability to absorb excess glucose. Individuals with a pathologically stable glucose level at G_3^* would have an extremely large amount of glucose present which could lead them to hyperglycemic shock. An individual who converges to this stable glucose level would be unable to sustain this glucose level for very long. Sustaining this glucose level would be nearly impossible be- cause this would most likely lead to death. This would be a pathologically stable glucose level due to a larger amount of β-cell loss.

Region III When the rate of β-cell mass loss due to compensation is relatively high, the individual's blood glucose level, can converge to the pathologically stable blood glucose $G_3^* = 600$.

Now, we consider parameter, h, in Figure 12.

Region I When the rate at which β-cell mass increases due to compensation is small there is only one pathologically stable glucose level, G_3^*. The β-cells in all individuals in this region would be unable to compensate for the increase in glucose. In this case, individuals reach a pathological stable point, $G_3^* = 600$, independent of initial conditions. Individuals in this region would already be considered diabetic for their inability to compensate for the excess glucose. When h is low this could be the result of long term β-cell exhaustion.

Region II When the rate of β-cell mass increases due to compensation is in this region the individuals blood glucose level will converge to either a physiologically stable blood glucose level at G_1^* or a pathologically stable blood glucose G_3^* depending

on the amount of initial glucose present.

Individuals with a physiologically stable glucose level at G_1^* would be healthy individuals with β-cells able to compensate in response to excess glucose. Pre-diabetic individuals who converge to G_1^* would be able to maintain a normal blood glucose level over time.

Individuals with a pathologically stable glucose level at G_3^* would have an extremely large amount of glucose present even though β-cells are increasing in mass to compensate. This would mean that even though the β-cells are expanding and secreting more insulin, the amount of glucose present is too high to obtain a homeostatic state. Having a G_3^* blood glucose level could lead an individual into hyperglycemic shock. Sustaining this glucose level would be nearly impossible because this would most likely lead to death. As before, this would be a pathologically stable glucose level due to the extreme amount of β-cell loss.

Region III: When the rate of β-cell mass increases due to compensation is in a high range the individuals blood glucose levels will converge to either a physiologically stable blood glucose level at G_1^* or a pathologically stable blood glucose G_3^* depending on the amount of initial glucose present. However given the value of the glucose levels for G_1^* and G_3^* in this region these are not realistic and therefore this region is not representative of reality or sustainable. If an individual has a glucose level below G_2^* the glucose level will converge to G_1^*. If the glucose level is above G_2^* then the individual will converge to the pathologically stable glucose level G_3^*.

Individuals with a physiologically stable glucose level at G_1^* would be considered to have a normal or low blood glucose level as long as the glucose level did not reach 0. Individuals whose β-cells are able to expand and compensate at a higher rate may end up having a lower blood glucose level which would result in hypoglycemia in the long-term. The over compensation would lead to too much insulin being secreted and a lower glu- cose level. If h, β-cell mass growth due to compensation, increases too much this may be biologically impossible because β-cell mass would need to increase as a response to the presence of high amounts of glucose.

Lastly, the fixed points of glucose are plotted as a function of the rate at which β-cells die naturally, g Figure 13. The saddle point is represented by the dashed line and the stable fixed points are represented by the solid lines. There is a saddle-node bifurcation when $g = 0.0735$. In Region I there are two stable equilibria. In Region II there is only the pathological fixed point.

Region I When the rate of β-cell natural death is low, blood glucose level will converge to either a physiologically stable blood glucose level at G_1^* or a pathologically stable blood glucose G_3^* depending on the amount of initial glucose present. If an individual has a glucose level below G_2^* then glucose level will converge to G_1^*. If glucose level is above G_2^* then the individual will likely converge to the pathologically stable insulin level G_3^*.

Individuals with a blood glucose level at G_1^* have more β-cells available to respond to the amount of glucose and therefore blood glucose levels are low or normal. As the value of g increases, so does the amount of glucose present since there is less β-cell mass are available to secrete insulin. As g increases the individual will go from healthy or pre-diabetic to diabetic, and severe diabetic for $g > 0.0735$.

The stable glucose level G_3^* would mean there is a large amount of glucose present. An individual who converges to this stable glucose level would be unable to sustain this glucose level for very long even if they had little to no natural β-cell death. Sustaining this glucose level would be nearly impossible because the amount of glucose present would be too high to regulate.

      Region II: When the rate of β-cell natural death is larger than 0.0735 the blood glucose level will always converge to the pathologically stable blood glucose G_3^*. In this case an individual would be losing a large amount of β-cells and it would be impossible to reach a normal blood glucose level.

      In conclusion, the bifurcation diagram with g, m, and h led to similar results for that of the Topp model. However, this analysis did not lead to any conclusions about fat change. Hence, in the next analysis we consider varying parameters introduced in the differential equation of fat.

5.2   Analysis with parameters p and j

The parameters j and p represent the constant rate of fat accumulation and fat degradation, respectively. Since bifurcations were not found with parameters j and p. A steady-state analysis was conducted for β-cell mass. Simulations were implemented for varied initial conditions of β-cells mass and also, modified cases of high and low j and p. In Figure 5.2 and Figure 5.2 we consider the long-term qualitative behavior of high and low β-cell mass (2 cases) with low fat degradation and high fat degradation, respectively.
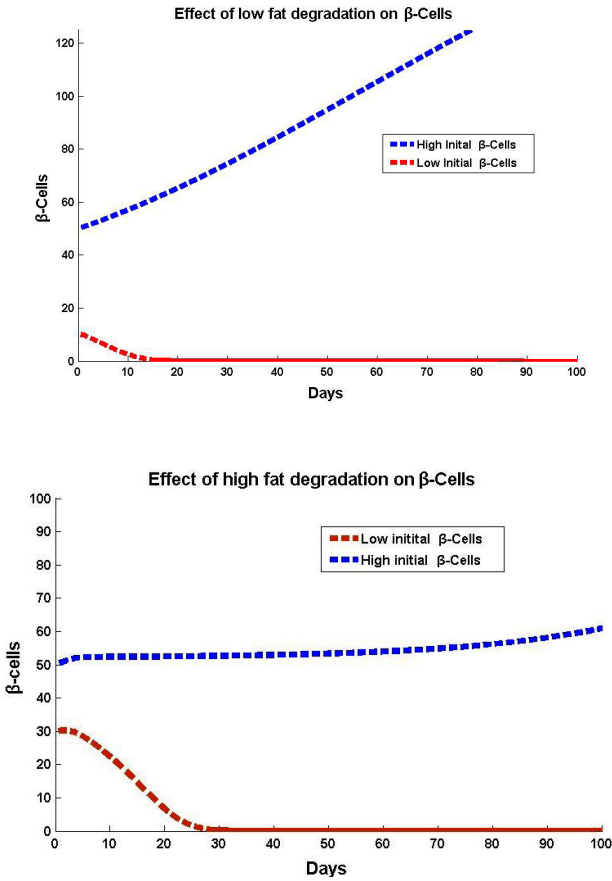
Figure 14: The rate of fat degradation, **p**, is varied for two sets of initial conditions of *β*-cell mass. For either a low (left) or high **p** (right) may lead to a physiological (i.e. healthy) steady-state depending on your initial *β*-cell mass.

6   Future Work: Model 3 on Free Fatty Acids effect on Insulin Sensitivity

This second model attempts to show the effect of free fatty acids (FFA) in the development of diabetes.

$$\frac{dG}{dt} = a - (b + \frac{S_{I0}I}{1 + \tau FFA})G \tag{13}$$

$$\frac{dI}{dt} = \frac{dFFA(1 - \frac{FFA}{k})BG^2}{e + G^2} - fI \tag{14}$$

$$\frac{dB}{dt} = BG(h - mG) - gB \tag{15}$$

$$\frac{dFFA}{dt} = \frac{Gj}{1 + \Lambda I} - pFFA \tag{16}$$

The accumulation of FFA in the blood stream is dependent of glucose and insulin [34] [36]. Insulin has the effect of preventing the accumulation of FFA [34]. Although insulin has opposite effects on FFA and TG, these two have similar effects on liver sensitivity [34]. FFA are being degraded at a rate p that depends on the amount of FFAs that are already in the bloodstream.

7   Conclusion

In this paper we present an extension of the model by Topp. *et al*. Our model incorporates the dynamics of liver fat, F, into their model of glucose, insulin, and β-cell mass to explore the role of liver sensitivity to insulin and the mechanism of β-cell overcompensation. As liver fat increases, the liver's sensitivity to insulin decreases. For small increases in liver fat our model assumes insulin will increase initially, via β-cell function mimicking the compensation phase. However, after a threshold value k/2 of increased liver fat, β-cells begin to dysfunction and will eventually die. We explored three different formulations for fat accumulation: a linear case where liver fat increases and degrades independent of insulin and glucose; and two nonlinear cases where it increases and degrades dependent on insulin and glucose.

There were two stable equilibria for the linear model for the parameter values in Table 1 ($B = 0, I = 0, G = 100, and F = .4$) for the pathological point, which implies that over time an individual's diabetes progresses into a severely unhealthy state and for the physiological case ($B = 871.29, I = 11.6, G = 100, F = .4$), which implies that a person is at a biologically healthy state. For a healthy individual, the normal amount of β-cell mass in the pancreas is estimated to be around 850 mg.

The aim of the nonlinear model was to describe how β-cells adapt to the decrease in liver sensitivity towards glucose over time in response to liver fat. Our model takes into account the effect of β-cell adaptation (compensation), "exhaustion" (dysfunction), and death. By explicitly incorporating the dynamics of fat into this model, we are able to have a more physiologically relevant interpretation for both liver fat and β-cell sensitivity, corresponding to more physiologically accurate glucose and insulin dynamics in diabetic and non-diabetic individuals. We also consider the dynamics of liver fat accumulation in response to a decrease in insulin sensitivity. It is important to observe this process in particular on diabetic and pre-diabetic individuals to observe its role in the progression of T2D.

The nonlinear model displayed a stable equilibrium of $B^* = 0$, $I^* = 0$, $G^* = 600$, $F^* = 1.2$ for the pathological fixed point and $B = 853.29$, $I = 11.637$, $G = 100$, $F = 0.4$ for the physiological fixed point which is more accurate in measuring β-cell mass for a healthy individual at 853.29 *mg*. This model gives more accurate fixed points while incorporating physiologically relevant fat dynamics at the pathological equilibrium point. Liver fat for an obese individual is considered to be between 1.7 to 90 *mg/ml* [26]. The steady state value for the physiological equilibrium point corresponding to fat is .4 *mg/ml* which is below the typical range for an obese person. Our pathological equilibrium point is within the ranges for obese diabetic individuals. Figure 7, indicates that β-cell mass will decrease to zero for a wide range of p, the rate for fat degradation. The figure β *cells versus* p shows that when the initial β-cell mass is beneath the unstable manifold, β-cell mass will decrease.

Now by investigating liver fat accumulation, j, instead of the degradation, Figure 8, indicates that β-cell mass will decrease to zero for a wide range of j. The figure β *cells versus* j shows that when the initial β-cell mass is beneath the unstable manifold, β-cell mass will decrease regardless if j is small. If β-cell mass gets this low enough then they cannot recuperate and go back to normal, β-cells will eventually die and we call this the point of no return. This shows that the most important aspect in recovery in our model depends on β-cell adaptation driven by both insulin resistance and β-cell sensitivity, which in turn are driven by fat accumulation in the liver. However, it is not clear whether Type 2 Diabetes is still reversible if severe β-cell dysfunction was developed (e.g. passing the threshold point) in response to significant weight loss. Further research is needed on fat accumulation and fat degradation in both the liver and pancreas and how it impacts β-cell adaptation.

A better understanding of the role of fat mass in β-cell dynamics could offer insight into alternative treatment or intervention strategies. More specifically, diet interventions for the pre-diabetic and diabetic, and also the borderline overweight and obese. Connections between muscle mass and diabetes, potentially also correlated with obesity, have also been made in recent research [38] Our findings will possibly give insight into targeted prevention strategies to more susceptible populations.

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8   Appendix

8.1   Analytical Work on Fixed Points when $B = 0$ and $B \ne 0$

$$\frac{dG}{dt} = a - (b + \frac{S_{I0}I}{1 + \tau F})G \tag{17}$$

$$\frac{dI}{dt} = \frac{dFBG^2}{e + G^2} - fI \tag{18}$$

$$\frac{dB}{dt} = BG(h - mG) - gB \tag{19}$$

$$\frac{dF}{dt} = \Lambda - pF \tag{20}$$

To find the equilibrium of the system above, we set the left hand side equal to zero. Equation 14 becomes

$$\beta^*(G^*(h - mG^*) - g) = 0$$
$$\text{If } B^* = 0 \text{ then } G^* = \frac{a}{b}$$
$$G^*(h - mG^*) - g = 0$$
$$G^*(h - mG^{*2}) - g = 0$$
$$-mG^{*2} + G^*h - g$$

Next we apply the quadratic formula

$$G^*_{1,2} = \frac{-hpm\sqrt{h^2 - 4(-g)(-m)}}{-2m}$$
$$= \frac{h \pm \sqrt{h^2 - 4(g)(m)}}{2m}$$

Thus, there are two positive real solutions for glucose, G, if $h^2 - 4gm \geq$, 1 real positive solution if $h^2 = 4gm$, and no real solutions otherwise. For the latter case, $\beta \equiv 0$ in order to satisfy equation (14) $= 0$. If $B = 0$, then $G = \frac{a}{b}$. Thus, there are three potential equilbrium points for glucose, G^*, where

$$G^*_1 = \frac{a}{b}$$

(when $B^* = 0$), a constant depending on a $\ne$ b and

$$G^*_{2,3} = \frac{h}{2m} \pm \frac{\sqrt{h^2 - 4gm}}{2m}$$

when $(B^* \neq 0)$

We have two equilibria if $h^2 - 4gm \geq 0$

$$\Rightarrow \frac{a}{b} = \frac{h}{2m} + \frac{\sqrt{h^2 - 4gm}}{2m}$$

$$2m\frac{a}{b} = h + \sqrt{h^2 - 4gm}$$

$$(2m\frac{a}{b})^2 = (\sqrt{h^2 - 4gm})^2$$

$$4m^2\frac{a^2}{b^2} - 4\frac{hma}{b} + h^2 = h^2 - 4gm$$

$$\frac{ma^2}{b^2} - \frac{ha}{b} = -g$$

$$G^* = \frac{a}{b}(\frac{ma}{b} - h) + g$$

2. Now using the characteristic polynomial and setting $\lambda = 0$, we vary h. Next let the original $h = h1$. This is obtained when setting $\lambda = 0$ where $h = $ constant for equilibria at

$$G^* = \frac{h}{2m} \pm \frac{\sqrt{h^2 - 4gm}}{2m}$$

This is obtained when setting $\lambda = 0$ where h=constant for equilibria at

$$G^* = \frac{h}{2m} \pm \frac{\sqrt{h^2 - 4gm}}{2m}$$

1. For

$$G_2^* = \frac{h}{2m} + \frac{\sqrt{h^2 - 4gm}}{2m}$$

we get $h = h1, h = h2$ where $h1 = 0.00154$, and $h2 = 0.0007589$

2. For

$$G_3^* = \frac{h}{2m} - \frac{\sqrt{h^2 - 4gm}}{2m}$$

we get $h = h2$.

9   Table of Parameters

Table 1: Table of parameters

Parameter	Value	Units	Biological Interpretation	Reference
a	864	$\frac{mg}{dl \cdot d}$	Glucose production rate by the liver when G=0	[26]
b	1.44	$\frac{1}{d}$	Glucose clearance rate independent of insulin	[26]
S_{I0}	0.72	$\frac{ml}{\mu U dmg}$	Initial Insulin Sensitivity $\frac{ml}{\mu U d}$ (S_{I0})	[26]
c	0.72	$\frac{1}{mg}$	Conversion factor	Estimated
τ	vary	$\frac{1}{mg}$	Conversion factor	Estimated
$\hat{d}$	43.2	$\frac{\mu U}{d \cdot ml \cdot mg^2}$	Conversion factor	[26]
d	43.2	$\frac{\mu U}{mgd}$	Conversion factor	Estimated
e	20,000	$\frac{ml^2}{dl^2}$	Determines the inflection point of the sigmoidal function	[26]
f	432	$\frac{1}{d}$	Insulin clearing rate for muscle, liver, and kidney	[26]
g	0.06	$\frac{1}{d}$	β cell natural death rate at zero glucose	[26]
h	$0.84 X 10^- 3$	$\frac{dl}{mg \cdot d}$	Determines β cell glucose tolerance range	[26]
m	$0.24 X 10^- 5$	$\frac{dl^2}{mg^2 \cdot d}$	Determines β cell glucose tolerance range	[26]
j	0.1	$\frac{1}{d}$	Constant rate of fat accumulation	Estimated
k	270	$\frac{mg}{ml}$	Conversion factor	Estimated
p	50	$\frac{1}{d}$	Constant rate of fat degradation	Estimated
Λ	0.09	$\frac{ml}{mu}$	Conversion factor	Estimated
t	1	$\frac{dl}{mg}$	Conversion factor	Estimated

Production Techniques in Children's Television Commercials: An Investigation of Gender Stereotypes

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Abstract

Considerable research has documented that gender role stereotypes are reflected in the advertisements found TV programming. The various production techniques used in media production are considered to have psychological significance. . The purpose of this study is to investigate production techniques used in TV commercials geared toward children and to examine whether these techniques reflect gender-role stereotypes. Ten boy-oriented and ten girl-oriented advertisements were used for this study. Advertisements came from television programs aired on Tuesday through Friday from 3:30 to 5:30 in the afternoon and on Saturday from 7:00 in the morning to 12:00 noon. Chi-square test revealed that color of the product differed significantly by gender ($\chi^2(3, N = 20) = 15.20, p <.05$) as did the voice-over ($\chi^2(1, N = 20) = 16.36, p <.001$). Low camera angles also differed significantly by gender ($\chi^2(1, N = 20) = 8.57, p <.01$) as did pacing of ads ($\chi^2(1, N = 20) = 5.05, p <.05$). The results of this study found that there are differences in the techniques used to produce TV commercials for boys and girls and that these techniques appear to be gender role stereotyped. The findings of this study should be of concern to parents and educators as the consequences of these messages for girls can have real-life impact as gender stereotypes have the power to limit girls to their own potential.

Considerable research has documented that gender role stereotypes are reflected in the advertisements found in child-oriented TV programming. This research has mainly focused on the content of ads, analyzing boy-oriented versus girl-oriented ads as to types of products advertised and presence of gender stereotypes (Messaris, 1997). The production techniques used to create children's advertisements, however, have been infrequently studied with only a few studies investigating the effects of gender on such techniques as camera angles, edit pacing, and voice-overs. These techniques are important to study as they are considered to contribute to the viewer's perception and evaluation of product.

Camera angle, an important production film technique, refers to the level and height of the camera in relation to the subject being captured. Subjects can be shot at low angles, high angles, tilted angles, or at eye level. High camera angles are defined as angles that capture the subject from a high angle such that the subject would look smaller than at eye level and low camera angles are defined as angles that capture the subject from a low angle such that the subject would look larger than at eye level (Borwell & Thompson, 2009). Tilted angles are defined as angles that make the subject appear "to be on a slanted surface" (Phillips, 2009, p. 89). Often, film-makers use a high camera angle to film a person to suggest that the person is weak, submissive, and passive and use a low camera angle to portray the person to be dominant and powerful (Borwell & Thompson, 2009; Corrigan & White, 2009). Camera angles appear to have an effect on the viewer's emotional response. Meyers-Levy and Peracchio (1992) studied camera angles and the effects on viewers' perception and concluded that objects and people are seen as more favorable from a low camera angle than from an eye level or a high camera angle. In another study, Tiemens (1970) investigated the difference in viewers' perceptions of subjects filmed in high angles and in low angles. Subjects filmed at low camera angles were perceived by the audience as larger and more powerful whereas subjects filmed at high camera angles were perceived by the audience smaller and weaker. Kraft (1987) also investigated the effects of different camera angles on the viewers' perception of the subject. It was found that the viewers' perception was affected by different camera angles. Changes in camera angles, from high camera angle to low camera angle, resulted in the subject being perceived as taller, aggressive, and powerful, whereas changing from a low camera angle to a high camera angle resulted in the subject being perceived as shorter, passive, and weak.

Color, another variable manipulated in media production, is also considered to have emotional significance to the viewer. Color can be divided into warm colors and cool colors, with warm colors considered to be dangerous, lively, and assertive and cool colors thought be calming and relaxing (Phillips, 2009). Wilson (1965) investigated the emotional arousal people experience under different color conditions and found that warm colors such as red, orange, yellow produced more physiological arousal than cool colors such as blue and green. Levy (1984) also found that different colors elicited different emotional responses. Warm colors such as yellow, red, or orange elicit active and aggressive emotional responses while cool colors such as blue and purple elicit passive and calm emotional responses

Camera shots and editing pace are also thought to have a psychological significance in media production. A camera shot is defined by the camera distance "which determines the scale of the shot, signals point of view, and contributes a great deal to how we understand or feel about what is being shown" (Corrigan & White, 2009, p. 109). Long shots are camera shots that capture the subject's entire body and its surroundings, medium shots are defined as camera shots that capture half of the subject's body, and close-ups are

defined as camera shots that focus only on the subject's face. Long shots are often used to focus on a person's activities rather than the actual person, whereas close-ups which reveal a person's emotional expression and are often used by film-makers for dramatic emphasis (Barsam & Monahan, 2009; Phillips, 2009). Pacing, another media production technique, is measured by the amount of time each shot takes with a shot defined as a filmed sequence without transitional interruptions (Chandler & Griffiths, 2000). Shorter shots mean faster pace, while longer shots mean slower pace (Barsam & Monahan, 2009). Lang and colleagues in a series of studies found that that people reported positive emotion with faster-paced messages (Lang, Chung, Lee, Schwartz, & Shin, 2000; Lang, Zhou, Schwartz, Bolls, & Potter, 2005) and also had greater physiological arousal while watching fast-paced media (Lang, Bolls, Potter, & Kawahara, 1999).

A voice-over is an off-screen narrator who speaks text essential to the camera shot and is used to provide additional information in a scene that cannot be demonstrated through other production techniques (Corrigan & White, 2009; Dick, 2010). According to vicarious learning theory, children are more likely to pay attention to people who are similar to them (Chance, 2006). Therefore, commercials with female voice-overs are thought to be more appealing to girls and commercials with male voice-overs are thought to be more appealing to boys. In a study of adult viewers, Peirce (2001) investigated whether the gender of the speaker-character influenced viewers' evaluation of the product. Peirce found that a male speaker-character was perceived as appropriate for male-oriented products, but a female speaker-character was inappropriate for male-oriented products.

The production techniques used to create children's commercials have received very little research attention. Only a few studies have examined techniques used in boy-oriented versus girl-oriented commercials. In a study conducted over 30 years ago, Welch, Huston-Stein, Wright, and Plehal (1979) examined 60 US TV commercials aimed at boys and girls and analyzed levels of activity within the commercial, pacing of commercial, camera techniques, and auditory features within the commercials. They found that boy-oriented commercials had a faster pace than girl-oriented commercials, cuts were used more in boy-oriented commercials, and male voice-overs were more pre-dominant in boy-oriented commercials and neutral commercials. Chandler and Griffiths (2000) conducting a similar study in the United Kingdom twenty years later found similar results. These researchers found that low camera angles, long shots, and faster paced commercials were used more in boy-oriented commercials whereas girl-oriented commercials contained more high camera angles, more close-ups, and the slower paced commercials.

Given that different production techniques are used to create boy-oriented versus girl-oriented commercials, one important question concerns whether children are even able to detect these techniques. In one study (Greer, Potts, Wright, & Huston as cited in Calvert, 2008), preschool children paid greater attention to TV commercials that had fast pace and rapid cuts. In another study, Huston, Greer, Wright, Welch, and Ross (1984) investigated whether children were able to distinguish between production techniques used in boy-oriented commercials and girl-oriented commercials. Following exposure to boy-oriented and girl-oriented commercials, children did detect the gender difference in production techniques used in boy-oriented commercials and girl-oriented commercials. They were able to detect that production features used for commercials oriented for boys included fast pace, rapid cuts, and exclusive male voice-overs and that production features used for commercials oriented for girls included slower pace, dissolving transitions, and predominantly female voice-overs.

The purpose of this study is to investigate production techniques used in TV commercials geared toward children and to examine whether these techniques reflect gender-role stereotypes. It is hypothesized that boy-oriented commercials will be faster paced, have more low camera angles, more long shots, use warm colors on products, and have male voice-overs, whereas girl-oriented commercials will be slower paced, have more high camera angles, more close-ups, use cool colors on products, and have female voice-overs.

Method

Sample

Ten boy-oriented and ten girl-oriented advertisements were collected and coded. Advertisements came from television programs aired on Tuesday through Friday from 3:30 to 5:30 in the afternoon and on Saturday from 7:00 in the morning to 12:00 noon. Television programs were recorded for one week, from June 21, 2011 to July 9, 2011. Advertisements were randomly selected from four television networks: Nickelodeon, Cartoon Network, ABC, CBS, and Hub. Boy-oriented advertisements were defined as having a product designed to appeal to primarily boys and girl-oriented advertisements were defined as having a product designed to appeal to primarily girls. Products were categorized as either boy-oriented or girl-oriented if the product ad featured mostly boys or girls interacting with the product or if the product was listed in Campenni's (1999) classification of gender oriented play toys.

Materials & Procedure

TV programs were recorded on a DVD recorder, uploaded to a computer, and then edited for commercials using Pinnacle Studio software. A coding sheet was devised to investigate five production techniques: camera angles, camera shots, color, voice-over, and pacing.

Camera angles were categorized as high camera angles, low camera angles, and tilted camera angles and camera shots were categorized as long shots, medium shots, and close-ups. Both camera angles and camera shots were tallied shot by shot.

Color of product was categorized into warm colors and cool colors. Warm colors are defined as red, orange, and yellow and cool colors are defined as blue, green, purple (Phillips, 2009). Products were classified as having mixed colors if there were both warm and cool colors on the product. Voice-overs were categorized as either male or female.

Pacing was measured by dividing the duration of an ad by the number of shots in the ad. Each ad was slowed to count the number of shots. The number of shots was tallied and the duration of the ad was divided by the number of shots. A chi square was used to determine whether there were significant differences between boy-oriented products and girl-oriented products in television commercial production techniques.

Results

There was a significant relationship between gender-oriented products and several of the variables (Table 1). Chi-square test revealed that color of the product differed significantly by gender ($\chi^2(3, N = 20) = 15.20$, $p < .05$) as did the voice-over ($\chi^2(1, N = 20) = 16.36$, $p < .001$). The majority of the girl-oriented products were featured in cool colors and none of the girl-oriented products were warm colors, whereas boy-oriented products featured warm colors or a mixture of warm and cool colors. All of the boy-oriented commercials had male voice-overs whereas almost all of the girl-oriented commercials had a female voice-over. There were no female voice-overs in any of the boy-oriented ads. Low camera angles also differed significantly by gender ($\chi^2(1, N = 20)$

= 8.57, $p <.01$) as did pacing of ads ($\chi^2(1, N = 20) = 5.05$, $p <.05$). None of the girl-oriented ads had low camera angles, whereas over half of the boy-oriented commercials had more than the average number of low camera angles. The majority of boy-oriented commercials were below the average pacing of commercials, while the majority of the girl-oriented commercials were above the average pacing of commercials. Tilted angles were not significant as to gender but did approach significance for boy-oriented products ($p <.06$). All other variables were not significant.

Discussion

The results of this study found that there are differences in the techniques used to produce TV commercials for boys and girls and that these techniques appear to be gender role stereotyped. Boy-oriented commercials were faster paced, used more low camera angles, had products designed with at least one warm color, and had all male voice-overs, all of which suggest dominance, excitement and power. Girl-oriented commercials, by contrast, were slower paced, used no low camera angles, had all products designed with only cool colors, and had a majority of female voice-overs, all of which suggest weakness, passivity, inferiority. That these ads differed based on gender is not surprising given that studies of the content of TV programming for children shows similar gender divisions with boys portrayed as more active and exciting and girls portrayed as more nurturing and passive. What is surprising is the extent to which the commercials in this study differed.

There were limitations in this study. First, the sample size of 20 commercials was small. Due to the small sample size, statistical techniques for interval data were not available to explore hypotheses. Another limitation was that inter-rater reliability checks were not done for the commercials. As such it is unknown if the coding of the data was valid. The length of time given to collect the sample for this study was insufficient. As it took approximately one week to collect five girl-oriented commercials and ten boy-oriented commercials and ten to twenty minutes to code each commercial with each variable, the 8 weeks provided to complete this study did not permit more data collection.

As noted above, children do detect the different production techniques used to produce commercials for boys versus girls. Hence, the message that it is more exciting to be a boy and play with boy-oriented products and less exciting to be a girl and play with girl-oriented products is being communicated. The findings of this study should be of concern to parents and educators as the consequences of these messages for girls can have real-life impact as gender stereotypes have the power to limit girls to their own potential.

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Table 1

	Boy and Girl *M* (N/s)	Boy and Girl *SD*	Boy *M* (N/s)	Boy *SD*	Girl *M* (N/s)	Girl *SD*
Production Techniques in Girl-Oriented and Boy-Oriented TV Commercials						
Pacing*	1.62	0.49	1.46	0.39	1.79	0.54
High Camera Angle	0.04	0.08	0.05	0.08	0.03	0.08
Low Camera Angle**	0.03	0.06	0.60	0.07	0.00	0.00
Tilted Angle	0.01	0.02	0.01	0.02	0.00	0.00
Long Shot	0.04	0.12	0.02	0.04	0.07	0.15
Medium Shot	0.07	0.08	0.60	0.06	0.08	0.09
Close-up	0.06	0.14	0.02	0.04	0.11	0.19

Note. Color and voice-over variables are not included. These variables are at nominal level.

   * *p* <.05. ** *p* <.01

Everything is Bigger in Texas, Including Educational Inequalities

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INTRODUCTION

One of the most popular slogans has been "Everything is Bigger in Texas," and for the purpose of this research, it seems appropriate to refer to the inequalities in educational attainment and economic power as a part of Texas' attributes. Previous landmark decisions have established that access to education is a fundamental constitutional right and identified where constituents' rights were violated due to inequitable funding provided by their State of residence.[1] Although the responsibility for funding education in Texas has been shared among Federal, State, and local governments, most of this responsibility was split among local district government with supplemental funding from the State of Texas. Local districts in Texas generate revenue through property taxes, in which part of this revenue is allocated toward public education in those districts. The main issue with this type of tax is that the amount of revenue generated will vary in the State because property values differ across locations. As a way to ameliorate the inequalities created by this tax, the State of Texas must provide supplemental educational funding to bring low income districts to a level that is closer to the wealthier district's average revenue. Although these efforts have improved the educational sphere in Texas, there is still a desperate need for improvement in the amounts of educational funding and quality of education given to Texan students.

As a result of the U.S. recession that began in 2008, Texas and others states are dealing with deficits that have placed additional burdens on state funding requirements, especially in the educational and health sectors. However, there are ways in which the states could improve their economic conditions and one of these is through improvements in the educational sector. Even though it is important to assess the quality of education and curricula offered in public schools, this would not be possible before analyzing the financial circumstances which enable schools to offer appropriate education. This research focuses on the financial implications of the current Texas school finance law and the effects on the southern Texas region, specifically the three counties that constitute the Texas Rio Grande Valley—Cameron, Hidalgo, and Starr counties.

The Rio Grande Valley is composed of four counties in which three of these counties, Cameron, Hidalgo, and Starr, are adjacent to the Mexico border and, often, referred to as "The Valley" counties.[2] Some of the demographics of The Valley region include a concentration of many poor districts, low levels of educational attainment, low educational funding, and a population made up of more than 90% Hispanic. The combination of these variables have left this region at a competitive disadvantage that is deeply entrenched by historical, economic, and political influences which demand attention because they have a significant impact on the development and progress of this region. The evidence of low performance in school districts that have a majority of minority groups and lower incomes seem to send a message of discrimination and preferential services to those who speak English and have higher earnings. The differences in concentrations of minority groups around the country, especially in Texas and the southern region, demand that current education finance laws are modified to account for the districts limited taxable property whose minority populations require higher funding than the schools who do not have to deal with the issues surrounding minority groups and poverty. And, as Amartya Sen wrote:

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1   See Case *Serrano Vs. Priest in California* (1971) which established that education was a fundamental constitutional right. And, case *Robinson Vs. Cahill* (1973) which determined that the states, rather than the localities, have ultimate responsibility for ensuring students receive a thorough and efficient education.

2   The fourth county is Willacy, however, it will not be included as part of this analysis.

There are good reasons for seeing poverty as a deprivation of basic capabilities, rather than merely as low income. Deprivation of elementary capabilities can be reflected in premature mortality, significant undernourishment (especially of children), persistent morbidity, widespread illiteracy and other failures.[3]

Even though it is hard to accept that many of these areas suffer the effects of poverty, it is the first step in recognizing that there is a growing minority population that requires more help than others. This may seem "unfair" to those who have grown up speaking English and only one language, yet the state's refusal to prepare students who are expected to compete in the state and national market at an equitable level to students in more affluent communities can cripple students' development and participation in the political processes which enable an individual to make their voices heard.

In the United States we have come to accept that a democracy is a system which allows individuals to shape their future based on their political participation and equality of opportunities. Equality of opportunities begins with access to education and developing the capacity to be an agent of change. An agent of change can be defined as

someone who acts and brings about change, and whose achievements can be judged in terms of her own values and objectives…as well as the agency role of the individual as a member of the public and a participant in economic, social and political actions (varying from taking part in the market to being involved, directly or indirectly, in individual or joint activities in political and other spheres).[4]

Education is the foundation of life that helps us obtain the knowledge necessary to live a healthy and informed experience, and leads to better opportunities for a good life. Substantial research has found that there is a correlation between an individual's level of education and life opportunities and the inequalities in quality of education and completion levels translate into major differences in lifetime earnings and quality of life.[5]

One of the patterns found in American education is that its emphasis on educating individuals to be 'free' shifted towards educating individuals on how to be productive in order to make a living in our economy. In 1971, David K. Cohen and Marvin Lazerson wrote a book titled *Education and the Corporate Order* in which they wrote:

In our view the main developments in education since the late nineteenth century involve the school's adaptation to industrialism and the conflicts this engendered. The period's dominant motif was infusing the schools with the values of industrialism and reorganizing them in ways thought to be consistent with the new economic order. The aims of education were closely tied to production--- schooling was justified as a way of increasing wealth, improving industrial output, and making management more effective. [6]

Analyzing the shift in the structure of education deserves attention because our economy has shown that we live in a society that has thought education is necessary to improve living conditions. However, many students are dropping out of schools, while many others who remain in school are not provided with the necessary funding to derive effective gains from the kind of educational experience attained. The Intercultural Development Research association conducts extensive research on educational improvements in which the effectiveness of a school is dependent on: "quality teaching, curriculum quality and

3   Amartya Sen, *Development as Freedom* (New York: Anchor Books, 2000), 20
4   Ibid. pp. 19
5   *The cost of Inequity in Education: A Review of the Policy-related Research*. (IDRA, 2010).
6   Richard C. Edwards, Michael Reich, and Thomas E. Weisskopf, *The Capitalist System: A Radical Analysis of American Society* (Englewood Cliffs: Prentice-Hall, Inc, 1972), pg 184. This phrase was an excerpt from a revised version of "Education and the Corporate Order" by David K. Cohen and Marvin Lazerson. From *Socialist Revolution* 2, No. 3(May/June, 1971).

access, student engagement, and parent and community engagement."[7] It is reasonable to assume that this is the kind of education that we all wish for everyone and that it comes at a cost. And, the state of Texas has established a program for funding that has been described before as "The basic structural components that made up the Foundation Program— State funding subsidized by local taxes and an emphasis on local control— [which] have consistently defined education-finance reform in Texas.[8]

According to the Texas Association of School Business Officials, Texas ranks 43rd in the nation for investment in education with an approximate $8,350 total per-pupil expenditures.[9] This number, however, tends to vary among the state of Texas because districts possess different amounts of taxable property wealth. According to recent data provided by the Intercultural Development Research Association, the 100 poorest school districts have an average of $5,524 per student funding to $6,974 in the richest 100 school districts.[10] These differences amount to a gap of $1,450 per student in how much will be available for investment in education. The inequalities that exist among districts in Texas has allowed wealthy districts to attract better teachers and fine arts instructors, invest on technology and improve their databases, as well as invest in nicer facilities.[11] Research has also shown that districts that have higher per pupil revenues also have lower dropout rate, and lowered drop out rates have been found to improve economic prosperity in local communities.[12] A study conducted by the College of Business Administration, University of Texas at El Paso used simulation results to determine the potential income gains in border counties when dropout rates were decreased and these resulted in higher per capita income and significant contributions to this region.[13] It is for these reasons that investing in the educational development and attainment of students is a fundamental necessity.

However, before analyzing the dimensions in which the Texas public finance system has affected the poorest districts in Texas, it is useful to have a basic understanding of the historical decisions which have improved educational funding and how the system is designed to generate funding for public schools, and how they impacted quality of school funding in the three counties being analyzed. From this foundation we can then examine what has transpired over the last 6 years that has resulted in the current school funding crisis that now challenge the state of Texas, and how those changes have impacted/will impact local school systems in the Rio Grande Valley Counties. Finally, this paper will offer some recommendations on how the current challenges to school funding inequities could be addressed, given current political and economic realities.

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7   IDRA. The Status of School Equity. pp.4

8   The Edgewood Drama. Pp. 614

9   Public Education Demographics and performance for Texas relative to the U.S., Texas Association of School Business Officials (TASBO), 2011.

10   IDRA, May 2011, figures based on average projected revenue per weighted student for 2011-2012.

11   IDRA. The Status of School Equity. 2009, pp 5.

12   Murdock, Staeve H. and Michael E. Cline. A More Slowly Growing But Diversifying America, And a Rapidly Growing and Diversifying Texas.Section: Implications of Demographic change for Texas and the United States . Article in Texas CEO Magazine titled: May 2011.

13   Econometric Evidence Regarding Education and Border Income Performance, 2006. pp 11.

HISTORICAL DECISIONS THAT SHAPED TEXAS PUBLIC EDUCATION FINANCE LAWS

Around the 1970's, new suits and cases demanding equitable funding surged as a result of the incompetent service by the states. During the spring of 1968, in the state of Texas, Demetrio Rodriguez and other parents that were residents of the Edgewood District in San Antonio filed a suit against San Antonio Independent School district. These parents argued that their children afforded inadequate education "because they resided in the very poor and heavily Mexican-American (90 percent) Edgewood District in San Antonio."[14] The research conducted for this case revealed that Edgewood Independent School District did not have a tax base per pupil that generated enough educational funding. The residents of this area were paying higher taxes for a small property base, and even with minimum funding from the State of Texas' Foundation program[15] to provide a more even distribution of funding, additionally this area could not generate supplemental revenue from local enrichment.[16] The Analyses that followed the suit revealed that per pupil spending in Texas differed in low-income districts from wealthier districts with "an average of three times as much per pupil as the four poorest districts, even with the funds provided under the state's "equalizing" formula."[17] Part of the decisions that followed were the result of the strategy adopted by the plaintiffs, in which they argued that under the equal-protection clause the Texas finance system worked to the disadvantage of poor children and interfered with the exercise of fundamental rights and liberties explicitly or implicitly protected by the Constitution.[18]

Analysis
Texas Demographics

Data from the U.S. Census Bureau shows that from 2000 to 2010, there was a 20.6 percent increase in Texas population numbers compared to a 9.7 percent population growth for the nation as a whole. In 2010, foreign born individuals accounted for 15.8 percent of the Texas population while 33.6 percent of families in Texas speak languages other than English at home; in both categories Texas exceeds the national percentages. In addition, per capita income in the past 12 months (2009 dollars) and median household income in Texas was below the U.S. average per capita income and household median income in 2009, while the percentage of persons living below the poverty level were higher for Texas than the nation's average.[19]

According to the data released by Steve Murdock, from 1970 to 1990, there was a 25.5 percent increase in elementary and secondary enrollment and 241.9 percent in college enrollment which he attributes to "the fact that the 1970's and 1980's were periods in which the "baby bust" generation was affecting elementary and secondary schools but the baby boom generation was affecting colleges and universities in Texas."[20] For both

14   Texas School Finance Reform. Ch. 2 Rodriguez v. San Antonio, pp. 37.
15   This is the Texas Public School Education Program administered by the Texas Education Agency to provide funding for public schools. Responsibility for generation and distribution of funds is divided among the state of Texas and local school districts.
16   Texas School Finance Reform. Ch. 2 *Rodriguez v. San Antonio ISD* IDRA.
17   Savage Inequalities. Ch. The Dream Deferred, Again, in San Antonio. Pp. 215
18   The Edgewood Drama: An Epic Quest for Education Equity. Pp.622
19   Data obtained from the U.S. Census Bureau 2010. Texas Statistics. These were the results: Per capita money income in the past 12 months (2009 dollars) 2005-2009: Texas: $24,318 U.S.: $27,041 Median Household Income (2009): Texas:$48, 286 U.S.: $50, 221 Persons below poverty level, percent, 2009: Texas: 17.1%   U.S.: 14.3%
20   Steve Murdock. *The Texas Challenge: Population Change and the Future of Texas*, 135.

levels of education, the percentage increases in educational enrollment in Texas were larger than those experienced by the nation in which the number of elementary and secondary students decreased by 10.1 percents and the number of college students increased by 69.1 percent from 1970 to 1990, to which he noted that "a faster rate of population growth and a younger age distribution are largely responsible for the faster growth in Texas school enrollment."[21] This situation changed in 2010 when the percentage of persons over 25 years old who have a high school diploma or higher in the United States increased to 84.6 percent and 79.3 percent in Texas. In contrast, the percentage of persons over 25 years old who hold a bachelor degree or higher was 27.5 percent for the United States and 25.4 percent of the Texas population.

Table 1

General Demographics

	United States	Texas	Hidalgo	Cameron	Starr
Population 2010	308745538	25145561	774769	406220	60968
percent2000-2010	9.7	20.6	36.1	21.2	13.8
Hispanic Population	16.3	37.6	90.6	88.1	95.7
foreign born persons	12.4	15.8	28.6	24.4	30.0
lang other than Eng	19.6	33.6	83.3	72.8	96.0
persons under 18	24.3	27.8	36.5	35.0	37.4
25 and over with H.S.	84.6	79.3	59.5	62.4	46.5
	27.5	25.4	15.2	14.9	8.2
per capita income (2009)	$27,041	$24,318	$13,130	$13,474	$9,717
median household	$50,221	$48,286	$30,360	$30,760	$22,418
persons below poverty	14.3	17.1	35.2	34.0	38.5

U.S. Census Bureau 2005-2009 American Community Survey

Lower Rio Grande Valley Region: Hidalgo, Cameron, and Starr Counties

Some of the biggest challenges for the state of Texas are associated with improving the state's current educational conditions and adopting finance reforms that

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21   Steve Murdock. *The Texas Challenge: Population Change and the Future of Texas*, 135-136.

increase educational funding per student and decrease funding inequities among local school districts. From 2000 to 2010, the highest population growth in The Lower Rio Grande Valley (LRGV) region was experienced by Hidalgo County (36.1 percent), Cameron County population growth (21.2 percent) was slightly above the state average, while Starr County's population increased by 13.8 percent which is closer to the national population growth. The data on table 1 shows that Hidalgo, Cameron, and Starr counties share similar demographics that are characterized by concentrations of majority Hispanic populations and, median household incomes and per capita money income fell below the state and national average median household incomes for 2009. In contrast to the state's 15.8 percent of foreign born persons and 33.6 percent of households that spoke a different language at home in the state of Texas, more than one fourth of the average population in the Lower Rio Grande Valley counties was made up of foreign born individuals with a majority of their respective populations speaking a language other than English at home.

Different empirical studies have found that increasing education levels has a positive impact in future earnings; therefore, it is important to consider that some differences in average incomes may be dependent on the improvement of educational attainment. [22] In 2010, the percentage of adults over 25 years old with a high school diploma in the LRGV region was below the state and further below the national attainment percentage. And although the percentage of adults over 25 years old with a bachelor degree or higher in Texas was 2.1 percent below the national percentage, Hidalgo and Cameron counties' percentage were 10.2 and 10.5 percent, respectively, below the state average, while Starr county showed a higher difference of 17.2 percent below the state's percentage of bachelor's degree or higher educational attainment. Since the LRGV region had educational attainment averages below the Texas percentage may be a significant factor influencing the lower personal and household incomes in those counties. In addition to the inequalities in income and educational attainment among the state of Texas and The Lower Lower Rio Grande Valley, the percentage of persons living below the poverty level in Texas is 17.7 percent compared to 35.2 percent in Hidalgo county, 34 percent in Cameron county, and a staggering 38.5 percent of the population in Starr county.

TEXAS PUBLIC SCHOOL EDUCATION FUNDING
Definitions and Variables

The following definitions are useful for understanding how funding is generated per school district and understand why there are many differences in the amount of funding generated.

Basic Allotment

The basic allotment is the basis of funding for most of the allotment making up a districts's Tier I entitlement. The amount of the basic allotment varies depending on a school district's compressed tax rate (DCR). The basic allotment amount and the number of students in **average daily attendance** are used to calculate a district's Tier I entitlement. Additional adjustments to the basic allotment are made based on:

- How much it costs to educated students in that region of the state, through the state's cost of education index (CEI). To adjust for varying economic conditions, the state assigned a cost of education index to each school district in 1991. The CEI was based mainly on the size of the district, the teacher salaries of neighboring districts, and the percentage of low-income students in the district in 1980-1990. The index has not been updated since that time.

22   Christa Almada, *et al. Econometric Evidence Regarding Education and Border Income Performance,* 7.

- Whether the school district is small or mid-sized and thus suffers a hardship be-cause of diseconomies of scale (the cost of educating a single student increases as the number of student in the district decreases).

- The sparsity of the district's population.

Making these adjustments to the basic allotment produces a district's **adjusted allotment (AA).[23]**

DCR (District Compressed Rate)

To provide property-tax-relief, the Texas Legislature established a "compressed" tax rate beginning with the 2006-2007 tax year. Per House Bill 3646 (HB 3646), passed by the 81st Texas Legislature, Regular Session, 2009, for the 2009-2010 tax year and beyond, a district's compressed tax rate (DCR) is its 2005 M&O tax rate multiplied by the state compression percentage, which is 0.6667. If, for example, a district had a 2005 M&O tax rate of $1.50, then its compressed tax rate would be $1.00.

Revenue at the Compressed Tax Rate

A district's revenue at the compressed (tax) rate is based on the state and local M&O revenue a district would have earned had it not lowered its tax rate in 2006. It is the sum of the state share of a district's Tier I entitlement and the revenue from the district's (compressed) M&O tax rate, adjusted for statutory minimum or maximum hold harmless provisions. This tax rate guarantees school districts a set amount of funds per student in weighted average daily attendance through Tier II formulas to compensate for a mandatory reduction in, or compression of, their local maintenance and operations (M&O) tax rates from rates that were adopted in 2005.

Tier IIA/ "Golden Pennies"

Golden Pennies are the first six cents of tax effort a district assesses above its DCR. These pennies are called golden because they are the pennies of tax effort for which a district is able to generate the highest level of supplemental funding in Tier II.

Tier IIB/ "Copper Pennies"

Copper pennies are any cents of tax effort a district assesses above its DCR plus six cents. These pennies are called copper because they generated a lower level of supplemental funding than the golden pennies do in Tier II.

Adopted M&O Tax Rate

To receive funding related to revenue at the compressed tax rate, a district must adopt a tax rate at least equal to its DCR. This is the tax rate that local school districts use to generate local fund assignment revenue. The government uses this number to determine

23   For detailed calculations on Tier I allotments and weights refer to *School Finance 101: Funding of Texas Public Schools, 11-15.*

the attempted revenue generation per penny effort.

Effective M&O Tax Rate

Differs from the adopted M&O Tax rate in that the effective M&O tax rate is the actual rate used to generate funding. For example, if a districts adopts a $1.04 M&O Tax rate, but the effective tax rate is $1.00, the government will use the effective tax rate. This is a disadvantage to districts who have trouble collecting taxes.

LFA (Local Fund Assignment)

The portion of the Tier I entitlement that the district is responsible for is called the local fund assignment. The LFA is the amount of tax collections generated by assessing the DCR or a tax rate of $1.00, whichever is lower, for each $100 of property valuation, using the preceding school year's property values.

The total Tier I entitlement minus the LFA equals the state's share of the Tier I entitlement.

If a district's LFA exceeds its Tier I entitlement, the district is said to be "budget balanced." Before the provisions of HB 3646 went into effect, it was possible for a district to be budget balanced without being subject to the provisions of the TEC, Chapter 41 (subject to having part of its DCR tax collections recaptured). Now, however, a district that is budget balanced will also necessarily be subject to the provisions of the TEC, Chapter 41.[24]

ADA (Average Daily Attendance)

This figure is used to determine the average daily attendance of students receiving regular education. It is the sum of the number of days attended by all students in a six week period (sum of all students' days of attendance) is divided by the number of days taught in the six-week period. The results for all six-week periods in a school year are then summed, divided by six, and rounded to three decimal places. A district's ADA is further adjusted to account for certain significant declines in enrollment and to change any prekindergarten attendance that was reported as full-day attendance to be half-day attendance (with limited exceptions, only half-day prekindergarten is eligible to generate FSP funding).

WADA (Weighted Average Daily Attendance)

Weighted average daily attendance figures reflect the needs of special student populations and are used to determine Tier II calculations. A district's WADA is calculated by first subtracting from a district's Tier I Entitlement any (1) transportation funding the district is due, any (2) funding the district is due for new instructional facilities, the district's TXVSN allotment, the district's high school allotment, and 50 percent of the CEI adjustment. The resulting amount is the divided by the district's basic allotment amount to arrive at a district's WADA.

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24   Charter schools do not have an adjusted allotment, a charter school's Tier I entitlement is calculated using a state average adjusted allotment.

Revenue per WADA (per pupil)

Revenue per WADA is the average funding that can be generated per student in weighted average daily attendance.

Wealth per WADA (total based on penny efforts penny effort)

Wealth per WADA includes the aggregate revenues generated from Tier II penny efforts per students in weighted average daily attendance. (Revenue per WADA* WADA)

Chapter 41 Wealth Equalization

Chapter 41 of the Texas Education Code makes provisions for certain school districts to share their local tax revenue with other school districts. For the purposes of the school finance system in Texas, districts are designated as either property wealthy or property poor. The relative wealth of the school district is measured in terms of the taxable value of property that lies within the school district borders divided by the number of students in weighted average daily attendance (WADA). Chapter 41's provisions are sometimes referred to as the "share the wealth" or "Robin Hood" plan because districts that are deemed to be property wealthy are required to share their wealth with property-poor school districts. The funds that are distributed by the property-wealthy districts are "recaptured" by the school finance system to assist with financing of public education in school districts that are property poor.

Texas Foundation School Program

As explained by the Texas Education Agency, funding for Texas public schools is provided by local school district property taxes, state funds, and federal funds. However, most of this funding comes from a state program called the Foundation School Program (FSP)* that generates revenue through local property taxes, which are collected by school districts, and state funding.[25] The Foundation School Program provides funding for **school district operations** and **school facilities,** each of which is tied to: the tax efforts of school districts, its local district taxable property wealth, its student enrollments, as well as the variations in needs of different student sub-populations; and variations in costs of operations impacted by geographic settings among the major factors considered. Since the school district operations component is the main source of funding for education, more attention will be given to this funding component than the facilities component.

The operations funding component is divided in two tiers of Maintenance and operation (M&O) tax rates that generate different levels of revenue to provide a minimum education for all students. The basic allotment is the main source of funding for most of the allotments making up a district's Tier I entitlement.

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25   * The Foundation School Program is administered by the Texas Education Agency. For more detailed information see Texas Education Agency Website or contact their Office of School Finance. The title of the document is *School Finance 101: Funding of Texas Public Schools,* April 2010.

Tier I

Tier I of the FSP generates funding for various programs including: regular basic education, special education, career and technical education, bilingual/English as a Second Language education, compensatory education, gifted and talented education, Public Education Grants, transportation, and new instructional facilities.

In order to adjust for varying economics conditions, the state assigned a cost of education index (CEI) to each school district in 1991, which was based mainly on the size of the district, the teacher salaries of neighboring districts, and the percentage of low-income students in the district in 1989-1990, and has **not been updated since that time**. Additional adjustments are made until an adjusted allotment (AA) is developed and then multiplied by the district's number of students in average daily attendance (ADA) who are not receiving special education services or career and technical education. After the regular education allotment is determined, the distribution of funds for different programs is created based on a number of weights attached to the number of students enrolled in a specific program.[26] The weighted programs include: Special Education (SE), Career and Technical Education (CTE), Bilingual/English as a Second Language (ESL), and State Compensatory Education (SCE), Military Allotment, and Pregnancy-Related Services (PRS). In addition, a Gifted and Talented (GT) allotment is given to fund 5 percent of the students in ADA, as well as other funding such as the Public Education Grant for students who have transferred to another district due to previous school's failure in state exams or if the student's school was considered academically unacceptable at any time in the past three years. Other programs funded by Tier I include: the New Instructional Facility Allotment (NIFA) which provides support for operational expenses associated with the opening of a new instructional facility and is available to all school districts that build new instructional facilities that meet the requirements of statute and rules, transportation allotments, the Texas Virtual School Network (TxVSN), and the High School allotment.[27]

Tier I entitlements are funded by the State and local districts in which the local fund assignment (LFA) is the school district's share of funding its Tier I entitlements. As provided for in the property-tax-relief law that was passed in 2006 and modified in 2009, the local fund assignment of Tier I requires school districts to adopt a Maintenance and Operations (M&O) tax rate set at the district's compressed tax rate (DCR) to generate state funding.[28] Revenue at the compressed tax rate ensures state funding based on the district's Tier I entitlements and provides an additional guaranteed yield of enrichment per student in weighted average daily attendance determined in Tier II entitlements. Depending on the revenue generated by school districts, the state will match the revenue generated by the school districts in order to provide an average basic allotment of $4,765 per WADA. Based on the Texas Education Code (TEC), Chapter 41 statutes, if a district generates revenues that exceed its local fund assignment, the district is subject to a recapture mechanism that distributes the remaining revenues among local districts in Texas.

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26   For detailed formulations, please consult the Texas Education Agency Office of School Finance. Or their document: *School Finance 101: Funding for Texas Public Schools.*

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28   For more details and computation, *See* (DCR) District Compressed Tax Rate in the definitions section.

<u>Tier II</u>

Since the passage of HB 3646 (2009), there are two levels of guaranteed yield funding on the pennies of tax effort that exceed the local fund assignment (LFA). These two categories of Tier II enrichment are: TIER IIA and TIER IIB. As explained by the Texas Education Agency Office of School Finance, this Tier of funding provides a "guaranteed yield," or guaranteed level of funding, to school districts to supplement the basic funding provided by Tier I. The Guaranteed yield ensures that school districts will generate a specified amount of state and local funds per student in weighted average daily attendance (WADA).

<u>Tier IIA</u>

The first six cents of tax effort a district assesses above its DCR are usually referred to as "golden pennies" because these generate a higher level of guaranteed yield per student than the state funds at the district compressed tax rate. A M&O tax rate up to $1.06 provides 6 cents that generate $59.02[29] per student in WADA. The only caveat is that due to restrictions in the Texas Tax Code, access to the fifth and sixth pennies of enrichment require voter approval.

<u>Tier IIB</u>

Any M&O tax rate above $1.06 up to $1.17 is referred to as "copper pennies" because these tax rates provide a lower level of guaranteed yield per student. Any tax above the DCR plus six cents provides a fixed amount of $31.95 per WADA and any tax effort at this level is subject to a "recapture" mechanism that collects the excess of $319,000 associated with this tax effort. The final determination of whether a school district will be required to make recapture payments is based on the district's tax effort and the extent to which the district's wealth per WADA exceeds the revenues created by the different tiers.

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29   This number changes according to the amount of district tax revenue per WADA per cent of tax effort generated for this level of guaranteed yield funding for the last school year or Austin ISD's property wealth per student. For the 2009-2010 years, this amount was $59.02 per WADA.

Educational Funding in Texas generated through the Foundation State Program
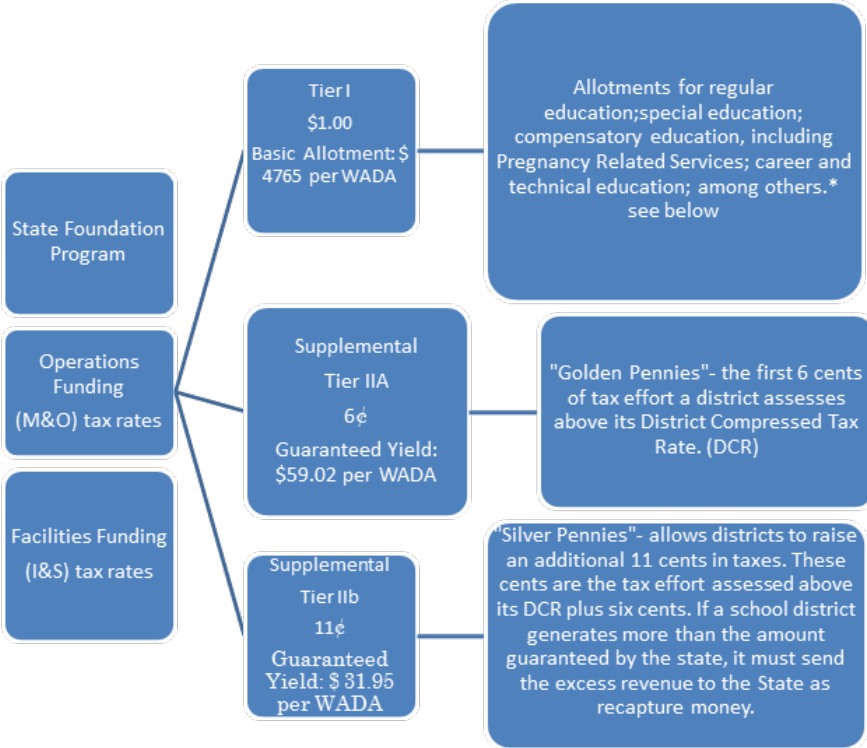
Public School Education Finance in Texas

Adopted Tax Rates 2010-2011

Texas	100 poorest	100 richest	LRGV	Cameron	Hidalgo	Starr
1.064	1.099	1.007	1.070	1.058	1.065	1.126

Table 2

Although the full complexities of the Texas Public School Finance system are not captured in the summary information, it is easier to understa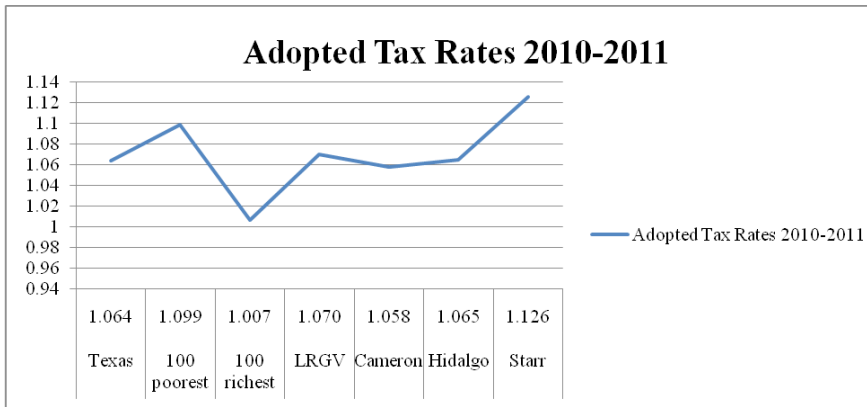nd the effects of the current finance laws through the inequalities in revenue generation per school district in the State. Table 2 shows the average adopted tax rates per selected groups for the 2010-2011 years, wealth per WADA, and WADA information. The State average adopted tax rate is $1.06 and the average wealth per WADA is $348,033 for an average 5,861 WADA; this result implies that most districts are adopting tax rates that yield the highest revenue per WADA of unequalized local enrichment. However, the $1.00 average adopted tax rate in the 100 richest districts can generate an average $1,406,411 million per WADA for an average WADA of 1628, while the $1.10 average adopted tax rate by the poorest districts only generates an average of $74,508 thousand per WADA for an average WADA value of 5249. The 10 cent difference in adopted tax rates between the 100 richest districts and the 100 poorest districts shows that richer districts can adopt lower tax rates and generate higher revenues per WADA in contrast to poor districts that are forced to adopt higher tax rates in order to produce higher revenues.[30] The results also show that there are extreme inequalities in which the 100 richest districts have lower taxes than the State average tax rates and produce four times the State average wealth per WADA compared to the 100 poorest districts average tax rate which was above the State average tax rate and yielded an average revenue of four times below the state average wealth per WADA.

Twenty out of twenty-nine school districts in the lower Rio Grande Valley (LRGV) counties were included in the 100 poorest districts. For this reason, the counties of Cameron, Hidalgo, and Starr, are good examples of the general situations of poor districts in Texas.

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30   The 100 richest and 100 poorest districts were chosen in terms of Wealth per WADA, out of a total of 1024 districts.

Conclusion

The state of Texas has had a history of challenges in the educational sector that have focused on improving the public school education finance laws without much success or progress. Since the Texas Supreme Court's decision in the 2005 *West Orange-Cove* case, minimum standards for public school education funding have contributed to several deficiencies in state average educational levels of attainment and increased inequalities among poor and rich districts in Texas. Based on the results of the 2010 Census Bureau, Texas experienced a higher population growth than the nation's percentage growth where the majority of growth came from Hispanic populations. This research revealed that the majority of poor Texas school districts, especially the districts in the Lower Rio Grande Valley region, have larger percentages of Hispanic populations that necessitate higher levels of funding to cover the expenditures of special student populations. It is very likely that more issues regarding insufficient funding for public school education arise.

As of June 2011, the 82nd Texas Legislature approved new reductions in funding for the years 2011-2012 and 2012-2013. All districts received a 6 percent reduction in funding in the regular program for the year 2011-2012, while second year cuts for the 2012-2013 year were made differently, and included a combination of across the board cuts of 2% for all districts - with the remaining cuts coming from reductions in districts' Target Revenue allocations. These amounts resulted in about 1.5 billion of cuts in the poorest 100 districts and about 6 million dollars are projected to be deducted from the 100 richest school districts for the upcoming 2011-2012 year. The cuts in funding for the second year were made differently and reduce 2% across the board funding for the regular programs, and an extra cut that comes from target revenue and harm holdless provision. The projected impacts show that all school districts will receive cuts that reduce funding beyond current levels. This challenge requires new solutions and alternative sources of funding. Among the options to increase equity is to eliminate all unequalized enrichment - so that all local tax revenue that generates more than what the state equalizes is recaptured and distributed to all districts on an equitable basis using property wealth per WADA as a primary driver. A second option is to eliminate all Target revenue and all related hold harmless features that remain in the funding system, so that all state aid is wealth adjusted for all districts. A third option is to adopt a state property tax and let the state collect property tax revenue for all districts and distribute equally to all districts (this is the ultimate in state recapture) ; districts could be given limited options to raise a small amount of local equalized enrichment to allow for some local discretion in levels of spending - so along as the state equalized the return for each penny of tax effort - this would allow the state system to meet the Edgewood 1 standard of equal return for equal tax effort at the local level. A final option is a state income tax dedicated to support public education - with a tradeoff being some level of reduction in local property taxing authority. I think most of these options are discussed in the 2009 policy update I wrote.

Explaining Peace Duration through Foreign Aid and Civil War Outcome

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Abstract:

This study explores the relationship between foreign aid and civil war outcome and analyzes the impact these factors have towards peace duration in a post-conflict environment. Previous literature has focused on the factors of war duration and civil war outcome (Brandt et al. 2011; Mason et al. 2011), while other scholars have observed the effect that the amount or timing of foreign aid have on political stability (Breuning and Ishiyama 2007). However, previous research has not combined the relationship between civil conflict outcome and sources of foreign aid to observe how the interaction of these factors may affect peace duration in a post-conflict environment. The theory holds that bilateral aid provides biased support when giving aid to recipient countries by supporting one group over another, which may decrease peace duration depending on the civil war outcome. Interaction variables are created to measure the relationship between civil conflict outcome and foreign aid in a post-conflict environment. A logit regression model is then used to test my theory regarding the relationship

between the interaction of foreign aid and civil war outcome with peace duration. Ultimately, it is found that the relationship between the civil war outcomes of government victory and truce and a high bilateral aid ratio have a significant effect on peace duration. Specifically, a high proportion of bilateral aid in a truce civil war outcome has a greater probability of durable peace than in a government victory in a post-conflict environment.

Introduction

Since 1956, Sudan has undergone a long and violent history of ongoing civil conflict. In 2005, the groups signed the Nairobi Comprehensive Peace Agreement, which called for a referendum on the status of the southern aspect of Sudan in six years but allowed the opposing groups to remain armed, which incited conflict in border regions. Recently, on July 9, 2011 after the lingering civil war, the south successfully seceded from the north, creating a new state. The conflict stemmed from ethnic and economic differences between the north and south. Non-Arab (including animist and Christian) groups located in the south held longstanding grievances towards the Sudanese government, which was dominated by a minority group of Arab and Muslim people in the north. The grievances of the groups in the south included political and economic exclusion despite that the mass reserves of crude oil in the country lie in the south. Furthermore, despite the natural resources richness in the region, the south remained underdeveloped and enjoyed a limited infrastructure in comparison to the northern region of Sudan. The case study of Sudan demonstrates how a durable peace may be difficult to achieve in a post-conflict environment while the condition of dual sovereignty continues to exist between the government and the rebel groups. Dual sovereignty arises when the government no longer solely controls the primary means of coercion within the state and a challenge develops for the legitimate sovereignty over the state between the government and groups outside of the government (Tilly 1978). Some main factors that help groups acquire dual sovereignty in the state include military strength and financial sustainability. Thus, weak governance may create government instability and economic frailty. Post-conflict environment countries are in need of international assistance to help sustain the economy and keep state legitimacy, therefore, foreign aid is given to developing countries. Foreign aid assistance is given from a variety of donor incentives; some include international goals, while others include goals that may only benefit the donors. Multilateral aid is given from an international organization which aims to give aid to many recipient countries which are most in need of aid. Bilateral aid donors incorporate policies in exchange for aid, which may support a particular party or political actor and may not be beneficial for the recipient country. As a result, aid donors who do not focus on implementing policies to increase political and economic stability may harm the recipient state and incite tension among belligerents. Therefore, ongoing civil conflict suggests the question, *how does the interaction between different sources of aid and the outcome of the civil conflict affect durable peace?*

Developing countries that have weak governments and slow economic growth are more likely to experience difficulties in preserving peace in a post conflict environment. Collier et al. (2003) argue that the key root cause of conflict is the failure of economic development. Poverty is the one commonality of all countries which experience civil war, and the civil war itself has drastic economic consequences in the post-conflict environment, thus developing a conflict trap. Fearon (2004) argues that the number of civil wars is not an increasing number of new civil wars but rather a number of unresolved wars. Therefore, unresolved wars provide a path to the conflict trap in developing countries (Fearon 2004: Collier et al. 2003).

The concepts of civil war outcome and foreign aid have been analyzed separately by previous scholarship, but none of the previous work has tested the interaction of the factors. Previous studies disagree on the impact of foreign aid in post conflict settings as some scholars argue that foreign aid helps countries adopt practices to further develop their economy (Collier and Hoeffler 2002). However, others argue that foreign aid does not promote economic growth and peace, but rather incites civil conflict (Grossman 1992). On the other hand, it has been argued that the impact of civil conflict outcome: rebel victory, government victory, or negotiated settlements may have a different effect on peace duration (Brandt et al. 2008). Thus far previous studies have not analyzed the impact that different sources of aid may have on post-conflict environments based on the type of civil war outcome.

The objective of this research is to explain how bilateral aid may affect dual sovereignty in accordance to the civil war outcome including government victory, rebel victory, truce, or negotiated settlement. This article will help evaluate if bilateral aid has an effect on dual sovereignty and analyze if previous research overlooked a significant factor that may affect peace duration. This paper will first review previous literature on foreign aid and civil conflict outcome and the rationale to how these scholars come to argue that these factors may affect peace duration in a post-conflict setting. The second section of the article describes my theory regarding the relationship that foreign aid and the civil war outcome have on dual sovereignty and may affect the duration of peace in a post conflict environment. The third section discusses the methodology used to test my theory and the operationalization of my dependent and independent variables. The fourth section of the study analyzes the results of the test and states the implications in relation to the theory. Finally, the fifth section of the article discusses my conclusion of this research and future consideration for areas regarding foreign aid and civil war outcome that are not addressed in this paper.

Literature Review

Previous studies argue that the duration of civil war, rebel incentives, and rebel costs are a few factors that may affect the duration of peace in a post-conflict environment (Mason et al. 2011). Tilly (1978) argues that dual sovereignty (which involves a legitimate group that has power over a state and an opposition

group challenging such power) may lead to conflict due to competing means of obtaining power of the state. He claims that the government has the choice of either satisfying the opposition by allowing them to become part of the polity or maintaining the status quo with the opposition remaining outside of the polity, in which case the opposition may decide to resort to political violence (Tilly 1978). Thus, unresolved wars may increase the opportunity for dual sovereignty because it decreases the government's legitimacy of power. On a similar note, Mason et al. (2011) and Brandt et al. (2008) argue that the peace duration after civil war depends on whether the outcome of the civil war ended in a rebel victory, a government victory, or a negotiated settlement. The outcome of a civil war is an important factor in peace duration because it may lead to dual sovereignty if one group did not gain complete control over the state.

Scholars have analyzed previous civil war outcomes and its impact towards peace duration in a post-conflict environment. Kreutz (2010) argues that if a previous conflict is fought with rebels aiming for total control over government, the risk of conflict recurrence increases. On the other hand, if total government control is not the aim of the rebel group, then government victories or the deployment of peacekeepers should reduce the likelihood of conflict to recur (Kreutz 2010). In addition, other studies argue that rebel victories produce a more stable peace than government victories, but only if the new regime controlled by former rebels survives the first few years after the conflict (Brandt et al. 2008; Quinn et al. 2007).

Tilly (1978) and Walter (2004) argue that a rebel group may try to gain recognition by persuading a sizeable amount of the population that it holds sovereignty, which creates a dual sovereignty between the government and the rebel group. Walter (2004) argues that the people would not join a rebel group if the opportunity costs are high. Opportunity costs may increase if the population does not observe the rebel group to have sovereignty, or if the population does not have a particular objective (such as increasing income or gaining rights) to join the rebel group (Walter 2004). Civil wars typically last longer if there is an unequal distribution of income and a low average income within a state because the opportunity costs for rebellion are low and the government has a low state capacity (Collier et al. 2003). On a similar note, Collier et al. (2003) argue that the key root cause of conflict is the failure of economic development. One possible contribution to economic development in a post conflict setting is foreign aid. Quinn et al. (2007) argue that the international community has policy tools at its disposal to structure intervention strategies that will reduce the probability of civil war recurrence.

Bueno de Mesquita (2010) describes foreign aid as the contribution of money, goods, or services to other governments or to "people" or "communities" in foreign countries. Foreign aid can be given as large subsidized loans, for free or a price below the market price (Bueno de Mesquita 2010). He also argues that increasing aid may help alleviate poverty and therefore help to prevent

civil conflict from recurring, but Grossman (1992), on the other hand, argues that aid increases the chance of civil conflict due to the resource opportunity in foreign aid. Similarly Breuning and Ishiyama (2007) argue that neither the amount nor the timing of foreign aid is related to political stability in the post conflict environment. They suggest that donors should promote political stability in post conflict societies by encouraging political institutions that promote the inclusiveness of political groups.

Theory

Peace duration in a post conflict environment is essential in developing countries because peace may enhance economic growth and government legitimacy. Civil conflict damages infrastructure, and diminishes populations' income and self-confidence, thus the duration of peace helps re-gain what was lost. Recurring civil wars have been proven to be more common than new civil wars in recent research, which implies that post conflict environments are significantly important to analyze in peace duration research (Brandt et al. 2005). Recurring wars may be caused by actors who are politically interested in gaining some if not all political sovereignty from the developing state. Tilly (1978) argues that opposition groups begin civil wars to challenge the governments' power. The rebel groups' ultimate goal is to gain control over the state (Tilly 1978). Thus, dual sovereignty may cause political and economic instability because only one group of belligerents may completely establish such goal.

In a post-conflict environment, the government strives to maintain legitimacy in order to avoid for the reemergence of dual sovereignty. Post-conflict environments are economically devastated and many accept outside sources to sustain peace and to help maintain political and economic stability. Given that developing countries generally endure slow economic growth and many receive foreign aid, outside actors often take advantage of the financial need of developing states to make agreements that may benefit the donor. As a result, different sources of aid may affect the recipient country in terms of the duration of peace in a post-conflict environment.

Bilateral and multilateral aid differ in many regards particularly policies, type of aid, the amount of aid, as well as the incentives of donors. Understanding the differences of the sources of foreign aid will help evaluate if the results of previous research overlooked a significant gap by including bilateral and multilateral aid as a single source. Many recipient states receive aid from numerous bilateral and multilateral donors which vary in policies and conditions. The requirements from donors may vary according to the amount of aid, and donor-recipient relationship with the country. Bilateral aid differs from multilateral aid in that bilateral aid has a stronger donor-recipient relationship between the parties. Bilateral donors typically have preferential treatment with the recipient country and choose to give aid based on factors such as whether the recipient is a colony of donor, shares a language, or has

transitioned to a democracy to name a few. As a consequence, this may provoke competition between the former belligerents in the recipient state particularly if the bilateral donor supports one group over another. Typically the donor gives aid to the recipient's government and not to a rebel group. According to Bueno de Mesquita (2010), foreign aid (bilateral) enriches petty dictators and secures them in office. Thus, bilateral aid may increase the tension between belligerents, which may lead to the recurrence of dual sovereignty.

On the other hand, multilateral aid such as the International Monetary Fund loan agreements, contain formal performance criteria including economic policy targets. Although disagreements between countries arise regarding multilateral agreements before reaching consensus, multilateral aid offers many advantages towards applying policies for more efficient economic growth and political stability in recipient countries. Multilateral aid donors distribute to all the recipient countries which belong to the international organization. Consequently, multilateral aid is more likely to have policies and economic distribution that may benefit a larger percent of the population in the recipient state in comparison to bilateral aid.

Bilateral aid may have a varied effect in a post-conflict setting depending on the civil war outcome. The civil war outcome has a significant effect because it influences the condition of dual sovereignty within the post-civil war environment. A government is typically weak in a post-conflict environment because it is trying to rebuild its legitimacy. Thus, a rebel victory, government victory or negotiated settlement may impact peace duration in a post-conflict environment (Mason et al. 2011). The outcome of the civil war may interact with the factor of bilateral aid ratio on its impact on peace duration.

In a government victory, the inclination for dual sovereignty to reemerge is not as direct as the other outcomes. On one hand, a victory by the government is established, but the supporters of rebels as well as the rebel group itself remain in the country after the civil war. As a result, peace duration may be difficult to predict. Mason et al. (2011) argue that government victories remain stable only because it takes time for rebel groups to regroup and rearm. To follow this concept, in a government victory, the ratio of bilateral aid should be proportionate to multilateral aid to keep rebels from acquiring an incentive for dual sovereignty in a post-conflict environment. Bilateral aid donors implement policies based on self-interest in comparison with multilateral donors who implement policies to benefit the recipient country.

Hypothesis 1: *High ratio of bilateral aid over multilateral aid decreases peace duration in a government victory in post-conflict environments.*

Quinn's et al. (2007) findings reveal that rebel victories are less likely to break down into renewed conflict than government victories. Unlike a government victory in which the rebel group remains in the state, during a rebel victory, the former members of the government are exiled from the country and the rebels solely control the new government. In a rebel victory

the government loses its sovereignty because the rebels become the new government. Consequently, dual sovereignty is less likely to recur in a rebel victory because the former government no longer exists within the country (Mason et al. 2011). Thus, bilateral aid donors are less likely to have an impact on rebel victories because there is a less likelihood for dual sovereignty to recur. On that note, after a rebel victory, donors should maintain long term bilateral aid agreements during the first few years of a post conflict environment until the recipient country attains political stability. Therefore, a high ratio of bilateral aid in a government victory will likely have a positive effect on durable peace in a post-conflict environment.

Hypothesis 2: *High ratio of bilateral aid over multilateral aid increases peace duration in a rebel victory in post-conflict environments.*

Brandt et al. (2008) argue that over time, negotiated settlements are not more fragile in comparison to decisive victories. On the other hand, Mason et al. (2011) argue that negotiated settlements often produce a more fragile peace than government victories. Negotiated settlements represent post-conflict environments where the former belligerents reached some form of "consensus", and are therefore less likely to cause dual sovereignty to recur than government victories. Although both belligerents remain in the post-conflict environment, there may be a chance for durable peace because the belligerents reached a negotiation, and each side gained something from the negotiated settlement. Alternatively, skepticism may arise between the government and opposing group to follow the agreement, which may incite one group to break the contract. As a result, bilateral donors may negatively impact durable peace if donors give a high ratio of aid to a post-conflict environment with a negotiated settlement.

Hypothesis 3: *High ratio of bilateral aid over multilateral aid decreases peace duration in an outcome of negotiated settlement in post-conflict environments.*

Unlike negotiated settlements where the belligerents reached a negotiated settlement, ceasefire only calls for belligerents to put their arms down. Ceasefire may be the outcome of different issues that came up during the conflict including costs. According to Mason et al. (2011), if the rebels do not see a victory soon and are not able to cover the costs for a prolonged war, they are most likely to agree to a ceasefire. During this type of civil war outcome, both the government and rebels continue to operate within the state and remain armed and mobilized. Therefore, dual sovereignty is likely to recur because the rebels do not gain anything from the conflict and if they remain in the state, they are most likely to challenge the government again. On this note, a high ratio of bilateral aid may cause tension between belligerents and trigger dual sovereignty to recur. Since bilateral aid donors are more likely to support one group over another and the aid goes directly to the governments, the rebels (whom are in need of additional funds) observe the government receiving aid from a third party and may challenge the states' power.

Hypothesis 4: High ratio of bilateral aid over multilateral aid decreases peace

duration in an outcome of cease fire in post-conflict environments.

  The policies in aid agreements are significantly important because they help implement the aid to its best advantage for the recipient state. Bilateral donors typically give aid based on their own political gains and may not consider other actors within the country that may need foreign aid. Additionally, they may not consider the effects of the distribution of bilateral aid in a post-conflict environment. This action may cause conflict to recur. Corruption is largely common in forms of foreign aid. This emphasizes the importance of having good policies to avoid corruption from the donor or the recipient. By balancing the ratio of multilateral and bilateral aid in post-conflict environments, this may assist in prolonging peace duration because they will avoid supporting one group over the other, and subsequently recreating the condition of dual sovereignty.

Research Design

  I use Mason's et al. (2011) dataset on peace duration to test my hypotheses concerning civil war outcome and foreign aid. According to Mason et al. (2011), the dataset contains 96 peace attempts, but 48 of the peace spells ended in new civil wars or peace failure. The dataset also includes information on the civil war outcome particularly if the outcome of the civil war was a government victory, rebel victory, negotiated settlement, or truce. The peace duration dataset documents peace duration as the number of years after a civil war has ended, and includes all civil wars that started between 1945 and 2002 (Mason et al. 2011). The *unit of analysis* for this article is peace spells.

  Previous research has focused on the circumstances in which a nation's political and economic institutions encourage dual sovereignty (Mason et al. 2011). This article focuses on how outside factors including sources of foreign aid may destabilize durable peace depending on the fragile stability left from the previous conflict, which may incidentally encourage dual sovereignty. I am interested in analyzing the impact of the foreign aid ratio and the civil war outcome, along with other explanatory variables on peace duration. Given that durable peace is difficult to achieve in post-conflict environments, this paper advances the proposal that international actors that may affect peace duration in developing countries.

  As noted earlier, Sudan underwent an ongoing conflict even after a peace treaty attempt in 2005, and as a result, the ongoing conflict led Sudan to be highly dependent on foreign aid. Therefore, the peace attempts between the belligerents did not eliminate the condition of dual sovereignty, and foreign aid sources may have influenced this by implementing policies that may have excluded some of the former belligerents. Some of these policies made by donors may include keeping an actor or government party in office in the recipient state, which secludes other parties from participating.

  It is also important to take into consideration that some variables have time varying effects and may not have the same number of cases regarding civil

war outcomes, which may lead to biased results. A logistic regression model is used to test the relationship between durable peace and the interaction between foreign aid ratio and the civil war outcome. A logit regression model was the best fit for this study because my dependent variable is dichotomous. The results using a binomial logistic model are provided in Table 1 (pg. 25). In binomial logit models, we can observe whether the coefficients are statistically significant or not. However, the actual coefficients produced by the logit regression are limited in their interpretation. When using a binomial logit model, one cannot interpret the coefficients directly in terms of a change in the dependent variable, y, for a unit change in the independent variable, x (Long 1997). Therefore, I ran four logit models with odds ratios that can be directly interpreted to determine the effect of my independent variables on my dependent variable, peace duration.

Dependent Variable: The dependent variable for this study is peace duration, which is measured in an ordinal scale. Using the dataset in Mason's et al. (2011), a new dichotomous variable was created to simply measure whether the civil conflict ended in durable peace. Peace is measured by the amount of years without civil arm conflict. The dataset also measures peace duration through the concept of dual sovereignty which was previously discussed in Tilly (1978). Peace duration represents the time belligerents engage in peace. A state with durable peace is defined to have within 5 or more years of peace. On that note, a state that does not have durable peace is defined to have 5 years or less of peace.

Peace duration measured by year is not descriptive enough to measure the time it took the rebels to rearm, and recruit to challenge the government, subsequently resuming the condition of dual sovereignty. Apart from political actors acting as obstacles for dual sovereignty, other obstacles may have prevented the rebels from engaging in conflict including costs. Although peace duration does not describe what specific incentive led to the recurrence of civil conflict, it is safe to generalize that the rebels achieved dual sovereignty as a fracture of peace duration.

This article focuses on peace spells for the unit of analysis. A post-conflict year unit of analysis is used preferably than dyads because only governments receive foreign aid, and dyads vary within state borders. Thus, post-conflict year analysis works best for this research.

Independent Variables: Several independent variables are defined to test my hypothesis. First and foremost, the sources of foreign aid are gathered from the OECD dataset (www.oecd.org) which contains data from 1960 to 2009. The dataset contains all donor and recipient amounts from all foreign aid transactions. This research however specifically focuses on the foreign aid that is received from each recipient state. The data is separated by the total amount of foreign aid that is received from each recipient state, and the total amount of multilateral foreign aid. Therefore, total aid was subtracted from multilateral

aid in order to document the amount of bilateral aid that was received by each recipient country. To measure the hypothesis that bilateral aid has a negative impact in peace duration, the variable *ratio* was created to measure the proportion of bilateral aid over multilateral aid. Foreign aid is measured in US dollars and is a continuous variable. A high a ratio is the division of bilateral aid over multilateral aid. Therefore, a high ratio demonstrates a higher proportion of bilateral aid than multilateral aid.

Second, I include a variable representing the civil war outcome from the dataset (Mason et al. 2011), which signifies a government victory, rebel victory, negotiated settlements or truce. Given that previous research has already observed the relationship between civil war outcome and peace duration, I constructed four interaction variables that describe the relationship between ratio and civil war outcome to test its impact on peace duration. The first interaction variable, *interact_reb,* includes the relationship between foreign aid ratio and rebel victory. Rebel victory means that the rebel wins and the government is overthrown. Thus, dual sovereignty no longer takes place because the government is replaced by the opposing group. The second interaction variable, *interact_gov,* includes the relationship between foreign aid ratio and government victory. Government victory means that the government continues to fight and rebel quits, or the government wins and the rebel is defeated. The third interaction variable, *interact_settle,* consists of the relationship between foreign aid ratio and negotiated settlements. A settlement means that both the government and the rebel choose to quit at the same time. The fourth interaction variable, *interact_truce* incorporates the relationship between foreign aid ratio and truce, which means that both the government and the rebel decide to agree to a ceasefire without a formal agreement. The interaction variable between foreign aid ratio and civil war outcome suggests that there is a relationship between ratio and civil war outcome, thus these variables are added to determine if a relationship exists between the interaction variables and peace duration (Marshall and Jaggers 2000).

Control Variables: Several control variables are added that may influence peace duration including democracy, GDP per capita, GDP growth, and total aid given to a recipient country. Polity 2 was included as a measurement of democracy and its effect on peace duration, which was gathered from the Polity IV Political Regime Characteristics and Transitions Dataset, where the scale of democracy is measured from -10 (least democratic) to 10 (most democratic).

GDP per capita and GDP growth of the country measured in US dollars are included as control variables in order to analyze the income necessity that may support previous research regarding opportunity costs Walter (2004). GDP per capita and GDP growth is already included in the Mason et al. (2011) dataset. Opportunity costs may influence enough people to join the rebel groups in order to gain dual sovereignty (Walter 2004). Thus, GDP per capita and GDP

growth are measured as continuous variables.

The total amount of aid is also included as a control variable. The total amount of aid includes bilateral and multilateral aid, which is included as a continuous variable measured in US dollars. The total amount of aid data is gathered from the OECD database (www.oecd.org).

Analysis

Table 1 presents the results from the logit regression tests for the hypotheses. I altered the controls for each model to verify the strength of the relationship between the interaction variables and peace duration. Model 1 contains all the interaction variables along with GDP per capita, GDP growth, total aid, and Polity2. Model 2 results do not have Polity2 as a control variable. Model 3 results do not have total aid as a control variable, and model 4 does not have GDP per capita as a control variable. The results for Model 1, 2, and 4 show that aid ratio along with government victory and truce as civil war outcomes have significant results on peace duration.

In table 1, model 1, 2, 3, and 4 (pg.25) provides the outcome of hypothesis 1, which concerns the interaction variable for *interact_gov* and its impact on peace duration in post-conflict environments. The logit regression model shows a significant relationship between *interact_gov* and *peaceduration* in Model 1, 2, and 4, therefore the null hypothesis was rejected because it demonstrated a small p-value of .05 or less in Models 1, 2, and 4. In addition, the odds ratio model indicates that the odds of peace duration increase by 1.18 as the ratio increases in a government victory outcome. A larger proportion of bilateral aid than multilateral aid given to the recipient country in a post-conflict environment thus decreases the opportunity for dual sovereignty. Bilateral aid is given to the government, many times to a particular party to keep the party in office, thus increasing the sovereignty for the government and decreasing the opportunity for dual sovereignty.

Mason et al. (2011), state that in a government victory, there is a high probability of durable peace in relation to the first few years of peace. Specifically, Mason et al. (2011) argue that there is a high probability of peace frailty in a post-conflict setting after four years in a government victory than in a rebel victory. In addition, Collier et al. (2002; 2003) argue that a large amount of aid provided in the first four years would produce more political instability. Thus, these two variables were not previously combined to analyze a relationship with durable peace. Although, Breuning and Ishiyama (2007) argue that neither the amount nor the timing leads to political stability, they aggregated their variable for foreign aid and did not analyze the sources of foreign aid separately. Consequently, given that government victories in a post-conflict environment provide a high probability of peace duration for the first few years, the results show that a high ratio of bilateral aid also adds to this probability.

Model 1, 2, 3, and 4 on table 1 provide the outcome of hypothesis 3, which demonstrates the relationship between the interaction variable of

intract_truce and peace duration in a post-civil war environment. The logit results demonstrate a statistical significance between *interact_truce* and peace duration. The odds of peace duration increase by 4 as the ratio increases with a truce outcome in a post-conflict environment. Therefore, if bilateral aid ratio increases after a negotiated truce, there is a large probability for peace duration. The results emphasize the finding produced in Mason et al. (2011), which claimed that if rebels do not see a victory soon and are not able to cover the costs for a prolonged war, they are most likely to cease fire. After a negotiated truce, the government and the rebels both put their weapons down; therefore the opportunity for dual sovereignty is high. As previously stated, bilateral aid will give financial assistance to the government thus decreasing dual sovereignty as the government gains more economic power. Based on the results, one explanation is that the government receives bilateral aid, which may cause a higher probability for dual sovereignty to be eliminated for a few years because the ratio of bilateral aid increases.

Moreover, the introduction of a high ratio of bilateral aid after a government victory and negotiated truce may be effective for peace duration considering the action that the government decides to make afterwards. In order to prevent dual sovereignty from recurring, the government may decide to change to a democratic regime.

Model 1, 2, 3, and 4 demonstrate that there is no statistical significance between the relationship of ratio and negotiated settlements, or rebel victory to impact peace duration in a post-conflict environment. In a negotiated settlement, the government and the rebel reach a consensus which may involve sharing or splitting some sources in order to keep from violence which involves costs. Mason et al. (2011) argue that negotiated settlements produce a more fragile peace than government victories, while Brandt et al. (2008) argue that negotiated settlements are not entirely more fragile than decisive victories. Reaffirming both arguments, negotiated settlements differ extensively from contract to contract. Thus, costs may not be a large factor is this situation because in a negotiated settlement outcome, all belligerents do not see victory in the near future and instead aim for settlement to acquire some political gain between belligerents.

A high ratio of bilateral aid in a rebel victory did not indicate to be significant to peace duration in any of the models. Rebel victories are less likely to break down into renewed conflict than government victories (Quinn et al. 2007), and for this reason, a high ratio of bilateral aid in a rebel victory outcome does not have a statistical significance towards peace duration. After a rebel victory, dual sovereignty is eliminated, which means that there is less dependency on bilateral donors because there is no competition for sovereignty.

GDP per capita, total aid, GDP growth, and polity2 had a different effect towards peace duration. Models 1, 2, and 3 indicate that GDP per capita is statistically significant towards peace duration. On the other hand, polity2,

GDP growth, and total aid did not have a statistical significance towards peace duration.

Conclusion

This study aimed to determine whether an interaction between the sources of foreign aid and outcome of a civil war have an effect on the duration of peace. Although domestic affairs have a large impact in peace duration, international actors may also play a role on the condition of dual sovereignty in the recipient countries that experience ongoing conflict. Previous studies have argued that foreign aid does not have an impact in the recipient country in regard to political stability and economic development. Many scholars have included peacekeepers as international actors that may influence peace duration, yet previous studies have not included how different sources of foreign aid may have an influence in peace duration. Thus, this study attempted to explain how foreign aid may influence dual sovereignty depending on the civil war outcome. Given that bilateral aid is more likely to give aid that is biased on personal preferences, and not necessarily to those who need it the most, bilateral aid may shift dual sovereignty. Thus, interaction variables were developed to indicate the relationship between the ratio of bilateral aid over multilateral aid and civil war outcome. A logit regression model was constructed to explain the relationship between the interaction variable of ratio and civil war outcome and the impact these factors have towards peace duration.

Ultimately, it was found that a high ratio of bilateral aid introduced in the outcomes of government victory and negotiated truce may be effective to prolong peace duration. This study emphasizes the findings of previous studies which argue that a method to prolong peace duration includes the elimination of dual sovereignty (Tilly 1978). Dual sovereignty may lead to conflict due to competing means of obtaining power of the state. The results from this research demonstrate support for this theory. A high ratio of bilateral aid given to a recipient country that experienced a negotiated truce or government victory may help decrease the opportunity for dual sovereignty because the government receives the aid, which increases government sovereignty. Thus, if a government is receiving a high ratio of bilateral aid in a post-conflict environment, some of that aid may also serve as military aid, which strengthens the military capacity of the state and may use it against the rebels if they decide to attempt to resume conflict.

The actions a government pursues after regaining sovereignty may also impact peace duration. In order to prevent dual sovereignty from reoccurring, the government may decide to transition toward democracy in order to signal to the former rebels that they are attempting to co-opt the former rebel. Quinn et al. (2007), argue that a negotiated settlement outcome involves the construction of power-sharing institutions that offer belligerents the opportunity to compete peacefully for political office. Democracy requires the redistribution of political and economic power between governments (Quinn et al. 2007). Therefore,

this concept supports the results for having no significant result for having a high ratio of bilateral aid and negotiated settlement outcome impacting durable peace because there is a compromise for redistribution. Thus, bilateral aid may be received by the former belligerents involved the negotiated settlement. Unlike a negotiated settlement, a truce outcome involves belligerents who compromised to put down their weapons, but no formal permanent agreement takes place. Thus, a high bilateral aid ratio decreases dual sovereignty because the government gains sovereignty and may use such aid to its advantage.

Quinn et al. (2007) also argue that military victories, which include government and rebel victories, are less likely to pursue a democratic regime in a post-war environment, because there is no major gain. Rebel victories have a durable peace because the condition of dual sovereignty no longer exists as there are no longer groups that are challenging the state sovereignty. Thus, the results demonstrate that a high ratio of bilateral aid will not have a large impact on peace duration after a rebel victory.

Although there is significant difference for peace duration in a government victory, a high ratio of bilateral aid may only impact peace duration for the first few years. If the rebels continue to live in the same state after conflict, they may rearm and regain dual sovereignty at any point in time. For this reason, a high proportion of bilateral aid in a truce civil war outcome has a greater probability of durable peace than in a government victory in a post-conflict environment.

The data gathered for bilateral aid was calculated based on the information provided from the OECD dataset. The bilateral aid data gathered included loans which may have impacted results; therefore further research should attempt to include bilateral data without loans. Furthermore this research examines interactive factors including sources of foreign aid and civil conflict outcome which have not been analyzed together to measure peace duration. Previous studies have included peacekeepers as an international factor that may influence peace duration in a post-conflict environment, thus this research provides additional international factors that impact peace duration.

Future research should attempt to include non-OECD countries. Non-OECD countries such as Asia tend to give industrial form of foreign aid. Therefore, non-OECD donors may have a different impact towards peace duration than OECD donors considering the different types of foreign aid.

As previously stated, a high ratio of bilateral aid introduced in the civil war outcomes of government victory and truce civil war outcome may be effective for peace duration considering the action that the government decides to make after. Dual sovereignty suggests that in order to challenge the government the rebels have to cover the costs of rebellion to compete with the recruitment and weaponry from the government. Thus, if a government receives a high ratio of bilateral aid in a post-conflict environment, some of the aid may also serve as military aid which decreases the probability for rebels to rapidly

rearm and recruit. In order to further analyze this observation, military aid data from each recipient country would be needed. Nevertheless this study was able to analyze additional factors that contribute to search for peace duration in post-conflict environments.

Table 1: Models 1-4, Odds ratio estimates, whether ratio and civil war outcome leads to peace duration.

Variables	Model 1	Model 2	Model 3	Model 4
Ratio and Truce	4.41 (.01)***	4.37 (.01)***	4.19 (.02)**	5.39(.004)***
Ratio and negotiated settlement	.86 (.17)	.85 (.12)	.84 (.11)	0.91 (.32)
Ratio and rebel victory	.76 (.13)	.74 (.11)	.75 (.13)	0.8 (.15)
Ratio and government victory	1.15 (.05)**	1.16 (.04)**	1.12 (.07)*	1.25 (.005)***
Polity2	.98 (.31)		.98 (.30)	0.99 (.95)
GDP growth	1 (.82)	.99 (.96)	1 (.80)	1(.84)
GDP per capita	1(.000)***	1 (.000)***	1(.000)***	
Total aid	.99 (.30)	.99 (.31)		0.99(.24)
Dependent Variable: Peace Duration *p< .10 ** P<.05 *** p<.01	Number of observations: 632 Log likelihood:	Pseudo R2: 0.0882		

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Race-Based Media Socialization: A Look into Animated Prime-time Sitcoms

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Abstract

Through a secondary analysis of refereed literature, I explored the televised media world of U.S. adolescents (ages 12-19) for insight into the role of television content in their social learning about race and ethnicity. Specifically, I examined ethnic humor found in animated prime-time shows, such as "The Simpsons," "South Park," and "Family Guy" to see how race and ethnicity are presented and what potential effect(s) it has on adolescent viewers. Previous research found that ethnic humor, across a range of mediums, served as a tool for oppression by the dominant racial and ethnic group(s). Given the relevance of television viewing in the lives of adolescents and the established functions of stereotypical ethnic humor, I examined the influence and outcomes of televised ethnic humor for U.S. adolescents. This study applies the social-learning theory and includes recommendations for adolescent television viewing of ethnic humor.

"You laugh at me because I'm different, I laugh at you because you're all the same."
—*Jonathan Davis*

Media socialization is an important and influential aspect of a person's learning. People learn about important topics such as: race and ethnicity through many forms of media, specifically through televised media. Televised media teaches many Americans about a world we are not familiar with; it shows us the life, people, and cultures we have not experienced first-hand by using stereotypes that function as "an aid to social perception". Even though these perceptions may be incorrect and over-exaggerated they serve an important role to the socialization of many people, especially children and adolescents whom are still developing their identities and knowledge of the outside world.

Stereotyping is a social act that has caused racial tensions and discrimination that is evident through U.S. history and reputation of slavery and segregation and continues to be a struggling issue for our nation that seems almost impossible to eliminate no matter if we find evidence to contest such exaggerated perceptions. Stereotypes are a collection of exaggerated beliefs associated with certain characteristics that link to a specific group used to justify our conduct toward the targeted group (Allport, 1954; Gaertner & McLaughlin, 1983). Stereotypes serve as a tool to assist us in making sense of our world by increasing our understanding; but, they can also lead us to judge individuals with a biased mind-set due to the incorrect or exaggerated descriptions found in stereotypes.

Examples of racial stereotypes in relation to Allport's definition in, *The Nature of Prejudice* are found in figure 1. This representation is used to show that racial stereotypes target different aspects of a group and exist on three levels (1) Intelligence/Educational stereotypes, (2) Personality/Character stereotypes, and (3) Physical Appearance stereotypes. Language such as: "stupid", "violent", "lazy", "dirty", and "scary are typically linked to minority groups including, but not limited to Blacks, Chicanas (os), and Native Americans as a means to justify conduct toward these groups or members of these groups by member of the dominant ethnic or racial group(s) and also by other minority groups. Such associations may vary between groups and are used to justify (1) the act of segregating schools, communities, housing and public facilities and (2) minimum wage and low position jobs for members of the targeted groups (Allport 1985; Solorzano, 1997).

Figure 1
Racial Stereotypes as Justification for Conduct towards People of Color

Exaggerated Belief	Associated with a Category	And Its Function Is to Justify Conduct toward that Category
Intelligence/Educational Stereotypes		
"stupid"	Blacks	segregated schools
"dumb"	Chicanas/os	low expectations
"slow"	Native Americans	menial jobs

Personality/Character
Stereotypes

"violent"	Blacks	segregated communities
"lazy"	Chicanas/os	segregated communities
"savage"	Native Americans	Reservations

Physical Appearance
Stereotypes

"unclean"	Blacks	segregated public facilities
"dirty"	Chicanas/os	segregated public facilities
"scary"	Native Americans	segregated housing

(Allport 1985; Solorzano, 1997, p.9)

Once the incorrect and exaggerated group descriptions and associations are planted in our minds, the risk of danger begins by spreading as humor through television shows to adolescent youths or others who have not been exposed to racial awareness and may take these jokes at face value and instill them in their lives by taking action and building prejudices and racist thinking upon these stereotypes (Marx & Sienkiewicz, 2009). By sharing these stereotypical ideas with others as humor it may lead to misunderstandings by its young viewers who may perceive these jokes as acceptance and encouragement of such racial perceptions which may reinforce these stereotypes in their minds. Sharing these stereotypical ideas through humor may also lead to prejudices and encourage racist thinking, especially if the stereotypes deal with present day events. Now in days racial humor on Islam may be taken more seriously by today's youth due to the fact that it is a "real fear" in the United States after the events of 9/11 (Marx and Sienkiewicz, 2009). Although stereotyping can lead to prejudice feelings towards other racial groups and lead to racial tensions, discrimination, and self-hatred by the victims, it has been and continues to be a major factor in creating identities and images of the world we have not experienced first-hand.

To understand the development of racial stereotyping we must first focus on the social construction of race, prejudices, and racism. Just as stereotyping, race and racism have been around for centuries and is used as tools to understand the world we live in and our place in society. Race is usually defined as an ascribed category of people with shared genetic, biological, and physical features, but as time has passed we have come to understand that it is socially constructed and depends highly on physical features (Hudley & Wakefield, 2007). Race plays an important role in society by giving us the means to draw clear boundaries using racial stereotypes which in turn may lead to prejudices which are defined as negative attitudes toward a group or toward individuals of that group (Nelson, 2009). Each of these social constructions is highly dependent on each other to exist and function correctly by building off of each other and are all susceptible to change as they are altered by society.

Prejudice is an important building block in racist thinking because it gives the foundation of negativity toward out-group individuals. When trying to define racism many

may think that by having certain stereotypes of others makes a person racist but they do not consider the fact that the human species uses stereotypes so that we can have a basic understanding of the unknown. In order to understand racism we must realize that there is nothing wrong in relating certain patterns or behaviors with certain groups to be able to relate with others even without first-hand experience but when these stereotypes are used for our advantage then it begins to show signs of racism (Gandy, 1998). For the sole purpose of this study we have defined racism as an act of assigning characteristics that differentiate groups based on their race in order to justify an advantage or the abuse of power in any way, whether it be economically, politically, culturally, or psychologically (Shohat & Stam, 1994). Racism continues though efforts have been made to combat it because it is supported by our individual prejudices and racial stereotypes that may be shared and learned through social interactions and through content consumed from television shows.

Through shows containing ethnic or race-related humor, adolescents are subjected to false perceptions by reinforcing stereotypical images they learned at an early age. Evidence accumulated suggests that stereotypes are well established in children's memories before children develop the cognitive ability and flexibility to question or critically evaluate the stereotype's validity or acceptability (Devine, 1989). Ethnic humor is a type of humor in which fun is made of stereotyped behavior, customs, personality, or any other traits of a group or its any of its members by their specific sociocultural identity (Apte, 1987). Race-related humor, also known as ethnic humor, found in animated sitcoms is an important medium through which racial stereotypical ideals are transmitted to adolescent youth, giving them jokes to share with their friends and family and so the spread of racial stereotypes continues to grow. Humor is and has been a social act that in many cases is expected of us as a gift to each other and expected of us to laugh at the jokes shared with us. In many cases we are looked down upon and seen as people who "can't take a joke" if we get offended by its content (Gandy, 1998). When journalist, Manish Vij, spoke out against racist portrayals of Asian Indians through the character of Apu Nahasapeemapetilon from The Simpsons he received negative comments making him out to be humorless, such as:

> "…Why can't you humourless self righteous zealots tackle racism where it is doing real harm and stop inventing it where it doesn't exist."

> "Jeez have a sense of humour will you?"

> "…You clearly know nothing about racism."

Ethnic humor is highly used in many conversations as a function to make new friends by bringing pleasure to them or may be used to relieve awkward situations. Stereotypes may spread through humor by giving a sense of acceptability and accuracy of such perceptions.

Some people believe that the social learning theory only applies to social interactions but scholar, Van Dijk claims that social learning is not limited to direct personal experience, but it is mediated by means of communication, including mass communication media (1994). With modern technology and the amount of time spent using technological devices it is no doubt that we do a lot of our learning through communication media such as the internet, radio, and especially television.

Today's youth are attached to television and it is an important agent of

socialization. For many adolescents watching many hours of television, the shows they watch are their main mean of education outside of the classroom (Dates, 1980; Hartman & Krugman, 1970). Some youth may reference television to real life more strongly than others and may perceive content found on television to be as close to reality as can be. Just how much of reality they perceive in television content is greatly influenced by factors including but not limited to race, education, hours of exposure to television content, social economic standing, and their parents' education.

<div align="center">

Literature Review
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<u>**Social Constructions: Race, Ethnicity, and Prejudice**</u>

In early times race was believed to be biologically determined and many thought it was nature's way of selecting out the inferior. During the years of 1984-1986, a survey was given which showed that 67 % of university biologists and 50% of physical anthropologists believed and accepted race as being biologically determined (Gandy, 1998). As time has continued, more scholars pushed away from the biological model and have been more inclined to believe that race is socially constructed.

According to W.E.B. Dubois, race is socially constructed and is used as a tool to construct groups that will maintain the status quo and it adapts to our needs as a society depending on it for stability and memory (as cited in Brooks & Hampton, 2005). Race is and has been used through history to create boundaries between groups so that fine lines can be drawn between those who have power and those who are powerless and must concur with the dominant group's ideals. Race helps in forming identities but it may also lead to discrimination of the out-group by the in-group, whether it would be the dominant group discriminating against minority groups or vice versa. Racism is not limited to minority victims, but any individual can be a victim of racism no matter if they are of the dominant group or not (Gandy, 1998).

In *Images of Color, Images of Crime*, Mann and Zatz claim that just as race, racism is also socially constructed and susceptible to change depending on social conditions (1998). Racism has evolved over time as historical context has changed in our nation. Many may think that just by having racial images of out-group individual that makes us racist but the truth is that "racism is all about power" (Mann and Zatz, 1998); therefore, using stereotypes to help us understand our surroundings and those not immediate in our realm of experience does not necessarily make us racist. In fact, Mann and Zatz argue that although we may all have prejudices not all of us have the resources or power to act upon those feelings such as Euro-Americans do because they control major political, economic, and social institutions; therefore, leaving people of color no power or resources to discriminate (1998).

Racism is highly influenced by the concept of racial formation which is the "process by which we attach meaning and importance to racial categories" (Mann and Zatz, 1998, p. 5). We can look at racial formation in two distinct levels: (1) the individual level, in which each individual forms his/her own identity, and (2) the societal level, in which racial formation is structured and influenced by social relations between racial groups (Mann & Zatz, 1998). Racism can be disguised in many forms that seek to form a system of oppression, usually against the minority groups. We can find racism in three specific guises: (1) as personal prejudice, which its sole purpose is to defend racial privileges, (2) ideological, which is used to support the biological model so that they can justify the superior position of Euro-Americans, and (3) institutional, which social institutions use practices to draw a fine line between racial groups (as cited in Mann & Zatz, 1998).

Race, stereotypes, prejudices, and racism are all social constructions altered by each society as relevant to their dominant racial and ethnic group(s)'s beliefs and ideals and are highly susceptible to change as new elements are introduced to society. Their evolution in the United States has been modified due to the history of our new born country and its reliance on slavery and the efforts to combat racist thinking (Gandy, 1998; Clemmitt & Katel, 2007)

Encouraging Racism and Stereotyping

Stereotyping and racism can be found and passed through almost all agents of socialization, such as: family, friends, peers, and the mass media. Many scholars argue that racial stereotypes found in the mass media, specifically in television shows, encourage racist messages that can influence racial prejudices by the shows' young viewers. Although scholars in the fields of Sociology, Justice Studies, Criminal Justice, among others, have established that society plays a great part in the construction of racism, we may also infer that the media plays just as big of a part in its construction by transmitting race-based humor to its viewers and reproducing these racial stereotypes for people to then share with their peers. These social constructions are deeply embedded in society in which everything is connected and these perceptions are spread through all agents of socialization, including social interactions and the mass media. Ethnic humor, also known as race-based humor, may be found in many forms of mass media, including but not limited to television shows which adolescent youth are exposed to at high rates. The functions of humor and viewers' consumption of television content is further explained in the following sections.

In his book, *Communication and Race; A Structural Perspective*, Oscar H. Gandy, Jr. argues that ethnic humor serves as a tool to reinforce accepted ideas that are usually of the dominant group; therefore, amusing people at the expense of individuals belonging to the minority groups. The accepted ideas, values, and goals that are transmitted through ethnic humor would more than likely be those held in high standards by the majority of the population which would usually be the ideals, values, and goals of the dominant group in society. Gandy focuses on ethnic humor's history of oppression of immigrants and black slaves to show how this type of humor has a dark past and continues its struggle for power and superiority and cause of harm to society. His main focus is on the stereotypical and racist messages found through all mediums of communication and how we as a whole reproduce these socially constructed perceptions by using race and ethnic-based humor that spreads and encourages these racial stereotypical perceptions.

Gandy argues that by repeating a race-based joke we heard, seeking a reward for bringing pleasure and laughter to others, then we reinforce the stereotype and it continues to reproduce as it spreads through society (1998). Humor is a part of society and in many occasions or situations we are expected to share the gift of a good joke. This type humor which Gandy may refer to as dark humor from his past research continues to spread to new populations as it is a give and take social act (reciprocal) in which we must respond with a joke when one is shared with us. According to Zijderveld, the quality of the joke, and its success in bringing pleasure to others, depends on who is telling the joke and who it's being shared with (as cited in Gandy, 1998)

Functions of Humor

Principles on humor have existed long since the time of Plato and Aristotle. In their concept of propriety, Plato and Aristotle spoke about how there are good forms of humor and bad ones that should be avoided. Humor serves a great importance to society but when used as ridicule, satire, or any other such form characterized by anger to point the

finger and laugh at someone then the joke is unacceptable and lacks dignity (Gordo, 1998). Humor has many functions in society but when used with bad intentions then it can be a dangerous tool that can deprive its victims of pride and dignity in their race and ethnicity.

Humor serves as a function of both conflict and control and is used by many groups for varying reasons. The function of conflict includes techniques such as humor, satire, irony, and wit that are used to gain an advantage over those of the out-group (Burma, 1946). According to Thomas Hobbes, "humor comes from a conception of superiority in ourselves by comparison with the inferiority of others" (Burma, 1946, p. 710). Humor is also used as a mechanism of defense against racism and racial prejudices. Victims of ethnic jokes have been known to take part in such humor by classifying themselves in order to soften the blow from such prejudices made by those spreading the jokes (Boskin & Dorinson, 1985).

In "Ethnic Humor: Subversion and Survival", Joseph Baskin and Joseph Dorinson look at the history of ethnic humor and the functions it served diverse groups, specifically: African-Americans, Irish, and Jews. Their research was mainly based on a secondary-source analysis on how these particular groups utilized ethnic humor throughout history. Baskin and Dorinson give us an insight to each group's mentality by providing examples of ethnic humor that has been used by these specific groups and their reasons behind it such as jokes reproduced by African-Americans as a defense mechanism including jokes from comedians such as:

Restauranteur: "We don't serve Nigras!"
"That's cool. I don't eat them" (as cited in Boskin and Dorinson, 1985, p. 95).

"It's kinda sad, but my little girl doesn't believe in Santa Claus. She sees that white cat with the whiskers and even at two years old she know damn well that no white man coming to our neighborhood at midnight" (as cited in Boskin and Dorinson, 1985, p. 95).

Baskin and Dorinson reinforce the importance of ethnic humor and its effect on the various groups within the United States by focusing on ethnic humor's function of oppression of unfortunate individuals, such as: slaves, immigrants, and their descendants, etc. They do no just claim that it was used as a form of oppression but that it also served positive functions by the victims of oppression. Baskin and Dorinson allow us to see both sides of ethnic humor by including most if not all parties included in its history. From their analysis they concluded that ethnic humor is not only just for oppression based on previously-set stereotypes, but instead, it is used by various groups, including: African-Americans, Jews, and Irish as a defense mechanism to combat oppression and its effects. They state that reasons for the use of ethnic humor differ between trying to maintain the status quo as well as their position of superiority and as a mechanism for survival and self-acceptance.

In "Conflict and Control Functions of Humor", Richard M. Stephenson focuses on the various function that humor serves in humanity and how different ethnic and race groups have used and are using humor as a form of oppression, hatred, retaliation, and acceptance. Baskin and Dorinson offer examples of ways that slaves used ethnic humor as retaliation and as a way to express their anger without getting punished, examples are as followed:

"I fooled Old Master seven years,

Fooled the overseer three.
Hand me down my banjo,
And I'll tickle your bel-lee" (as cited in Boskin and Dorinson, 1985, p. 91).

Sayings such as these found in African-American tales were used to express anger against the slaves' white master in a way that they could get away with it and not get punished by using code language that only the slaves new its meaning. Stephenson's findings are parallel to Baskin and Dorinson's conclusion that ethnic humor can and is used by most if not all people but the reasons behind it and the effects of it differ. In Stephenson's research time is dedicated to analyze how humor has physical, psychological, and social functions. Although he focuses on all the functions, they focus strongly on the social function that humor has and continues to play in society today.

Baskin, Dorinson, and Stephenson focus on the social functions of ethnic humor; conflict and control. Their findings conclude that as intergroup conflict, humor is used in a sarcastic manner and may withhold aggression and malice (Baskin & Dorinson, 1985; Stephenson, 1951). Intergroup conflict is when humor turns nasty for the victims of the joke because it is used to strengthen the person who is telling the joke and demean the victim of the joke, therefore causing tensions due to superiority and inferiority. The oppressors are not the only ones using ethnic humor as a tactic or weapon, victims of ethnic humor which are usually pertaining to the minority groups use this kind of humor as a tactic to survive their broken self- esteem and self- acceptance due to all the pain and hate forced on them by these demeaning jokes that we see as just a fun time. Ethnic humor may also be used as a mean of social control so that the group may express their approval or disapproval of certain actions and situations, express their views, form group stereotypes, and ease tense and awkward situations (Stephenson, 1951).

Ethnic humor can sometimes be used as a tool to bring in new friends and be accepted by others. Laughter can usually be the deciding factor when trying to be liked and taken in by others. It has been said by Konrad Lorenz that "laughter produces simultaneously a strong fellow-feeling among participants and joint aggressiveness against outsiders….Laughter forms a bond and simultaneously draws a line" (as cited in Lowe, 1986, p.440). Ethnic humor benefits some in that they are able to make new friends but is hurtful to those that are at the other side of the joke. Lowe agrees that Ethnic humor is an important aspect in a group's identity formation (Lowe, 1986).

In a blog of a presentation given for the Asian American Journalists Association, "When Humor Crosses the line in Journalism and Entertainment," Journalist Ray Hanania gives us an insight into ethnic and race-based humor and how it affects him as an Arab American in a post-9/11 America. Just as studies on the functions of ethnic humor, Hanania points out that humor can be used as "a weapon when it is pointed at someone" (Hanania, 2007). Hearing about his life and how he deals with racial prejudices allows us to view the functions that humor has played in his life and how it truly can and is used as a defense mechanism to try and salvage the remains after being branded and laughed at by others. Hanania makes an interesting point by claiming that Americans see one form of racism unacceptable but other forms as "an everyday obligation" (Hanania, 2007). This takes us back to Gandy's definition of ethnic humor and how it incorporates and portrays accepted ideals of the dominant group. When thinking about accepted ideal we must think of who the dominant group is, where this is taking place, time period, and any current events that could alter thoughts and feelings by the dominant group. As Hanania said, we find racism

against African Americans unacceptable because of horrid past with slavery but we see racism against Arab Americans as the American thing to do in defense and loyalty of our country. Hanania shows us how ethnic humor can be a powerful weapon of oppression but also of defense and retaliation. Humor is a part of society that cannot be taken away and affects everyone, whether they are telling the joke, the butt of the joke, or just on the sidelines.

In, "Shock Jocks", Arthur Asa Berger claims that ethnic humor is not just a form of entertainment and it is not just for fun, but instead, he says that it is a dangerous tool that can be used as a weapon to make people from the out-group grow feelings of inferiority and self-hatred. According to Berger, ethnic humor is a part of society that divides us by our differences and draws a line that we would not dare to cross; therefore, not allowing us to ever live together peacefully without the issue of dominant and minority groups and the tensions built up by the stereotypes that we hold deep within. Berger argues that this so called "humor" is nowhere near funny for the victims of the joke who are ridiculed by members of the dominant group. He acknowledges that ethnic humor can serve a good purpose but when humor is pointed at someone to gain some leverage, then it becomes harmful to its victims and to society as a whole (Clemmitt & Katel, 2007).

How important is it in his/her life: Television as an agent of socialization

We have entered a century where we not only take from social interactions, but we are exposed to many teachings from mediums offered by mass communications, including but not limited to television. Since its debut, television has had a significant impact on the lives of many people, especially children and adolescents. In, "Trends in Media Use", Donald F. Roberts and Ulla G. Foehr state that "media exposure begins early, increases until children begin school, drops off briefly, then climbs again to peak at almost eight hours daily among eleven- and twelve-year-olds" (2008, p. 11). According to Parks, "Children look to media for normative behaviors, and when they see or hear something they just go ahead and do it, too" (Clemmitt & Katel, 2007, p. 496).

Studies have shown that television exposure is particularly high among African American youth (Foehr & Roberts, 2008) which in turn can have a greater influence over their perception of reality based off of the stereotypical characters shown on the shows they consume. Foehr and Roberts' study concludes that television wins the ranking of exposure between children eight to eighteen years old and hours of daily exposure is significantly higher in African Americans (4:05 hrs./day) and Hispanics (3:23hrs./day) than in Whites (2:45 hrs./day). Foehr and Roberts' findings conclude that television exposure is influenced by socioeconomic status, ethnicity, and education of the parents. They claim that children whose parents attained no more than a high school diploma had higher exposure rates to television than children whose parents continued higher education after high school (Foehr & Roberts, 2008).

Television exposure is not only high in African Americans but rates of time spent consuming media is particularly high within all adolescents due to the fact that television programs have evolved and been targeted towards the youth market (Foehr & Roberts, 2008). According to Foehr and Roberts, many adolescents have access to many if not all forms of media most of the time. In fact, television penetrated 99% of households with children and most U.S. children and adolescents (eight to eighteen years of age) live in homes containing three television sets among other forms of media (Foehr & Roberts, 2008) Although television content may be high within children before entering school, a study by Foehr and Roberts during the years 1999 and 2004 show that media exposure is

more than twice as much in older children and youth ages eight to eighteen than younger children in age range between zero to six years old in 2004/2005 and close to twice as much from children two to seven years old in 1999. With statistics showing that there are high rates of accessibility to television in the household and in the education system and that exposure rates to television content is quite high, there is no doubt that from repetitive behavior consumed from television, such prejudice behaviors and stereotypical perceptions would most likely be learned by adolescents through social learning (Allport, 1985; Foehr & Roberts, 2008; Nelson, 2009).

Through social learning a person develops certain behaviors, attitudes, feelings about oneself and others, etc. by the experiences and social situations one comes to contact with (Ambrose & Miel, 1958). Although social learning consists of social interaction, it is also influenced by the content which one is exposed to through mediums such as the mass media, specifically television. In fact, the audience may learn specific facts from watching television and they may also gain a general perception of what reality or the real world is like (Williams, 1986). Social learning does not pertain only to children, but we continue to learn social norms throughout life since our social constructions such as race and stereotypes are constantly evolving as new times and events come into play. Adolescents are known to passively take in and learn content they are exposed to through television but their education varies depending on what shows they consume, how often they consume television content, and how they go about interpreting that content (Fisherkeller, 2002).

People at any age continue to learn behaviors, ideals, values, etc. as long as the four fundamental factors of learning are present. To learn, we must have the drive to learn the cues which trigger our behavior, a response to the trigger, and most importantly we must be rewarded in some kind of way for the behavior to be learned, if not, it will be thrown out and forgotten (Dollard and Miller, 1941).

The mass media plays an important role in the development and education of individuals, especially those highly exposed to media such as radio, movies, television, etc. Social interactions are no longer limitations to our social learning due to the fact that the mass media has opened the doors to outside communities that we most likely would never come in contact with in real life but at least we get an idea of how they may be in reality through images portrayed on television content that we are exposed to on a day to day basis.

Television is a form of passive learning that is important in the social development of a person at any age. "It is typically effortless, responsive to animated stimuli, amenable to artificial aid to relaxation, and characterized by an absence of resistance to what is learned, thus opening up possibilities that, depending on one's point of view, one may welcome or deplore" (Krugman & Hartley, 1970, p. 184). We may think that television is not an agent of socialization but then we see children acting out things they saw on television by their favorite characters or just something they happened to come across. People do not have to portray what they have learned right away after watching television but instead, events or situations later in life can trigger what they have learned through the consumption of television (Krugman & Hartley, 1970)

In, "Race, Racial Attitudes and Adolescent Perceptions of Black Television Characters," Jannette Dates explores adolescents' relation to black characters stereotyped in television shows. Dates claims that white youngsters who's main experience of black is through television are more likely to think that blacks are accurately portrayed and that that's how they are in reality (Dates, 1980). By spending various hours consuming

television content, a person's perception of reality can be altered into believing that all that is transmitted by television is an accurate portrayal of what the real world is all about. Studies by Greenberg and his associates conclude that "young television "fans" have strong beliefs in the reality of television" (Dates, 1980, p. 549).

Methods

This research was conducted based on a secondary analysis of previous research on stereotypes, social learning, racism, mass media communications, race relations/racial awareness, and humor. A secondary analysis is a data collection method in which one reviews previous studies and draws from their findings to then form their own conclusion based on the support of past research. I draw from the fields of Sociology, Social Psychology, Education, African American studies, Film and Video, and Communications.

While most of the study is based on twenty-two scholarly publications including articles and books, I have also included a blog based off of a scholarly presentation for the Asian American Journalists Association in my data collection to have a wider variety of information to better evaluate my question and have more valid findings. The studies were used to further understand how stereotypes work and how they are used in humor by multiple groups for differing reasons. Studies in communication, race relations, social learning, and mass media were included in the study to understand how the socially constructed stereotypes could and are passed through mediums such as social interaction as well as mass communications including television.

The demographics for this study are adolescent youth but have also focus a minimal section to children younger than 12 years to see how their development can affect their perception of stereotypes found in animated prime-time television shows. Although many studies use the term 'children' or 'youngsters' for those in the age range of 0-18 years old we have focused on adolescent youth, 12-19 years old. Our time frame for our data collection was from the mid 1900's to the year 2011. This research was focused on stereotypes found in animated prime-time sitcoms, focusing on some of the longest running shows, such as *The Simpsons, South Park, and Family Guy.*

The Simpsons (TV-PG) is the longest-running comedy originally aired on December 17, 1989 on the Fox network and has since then ran for 22 seasons. On average, the duration of each show is 22 minutes long and includes comedy that relates to present day events. The show is based around the life of a white family of five and their two pets; the parents are Homer and Marge Simpson and their children Bart, Lisa, Maggie and their pets, Santa's Little Helper (dog) and Snowball II (cat). Homer Simpson is a devoted husband who usually makes a fool out of himself and does not really take things seriously. His wife is Marge Simpson who is the foundation of the Simpson family and picks up the pace for the lack of Homer's role as the man of the house. Bart is a misunderstood boy who doesn't seem to make the right choices in life. His sister Lisa is the complete opposite of him and homer. She is very intelligent and has high moral standards. The last of the Simpson is Maggie, the baby, she does not contribute much to the show because she cannot talk or walk but she is part of the family from Springfield that we have grown to love.

The Simpsons is filled with various racially stereotyped characters which could easily be taken at face value by many of its young and uneducated viewers. Two of the most frequent racially stereotyped characters are Apu Nahasapeemapetilon and Willie the Groundskeeper. Apu is an Asian Indian who owns a corner shop called Kwik-E-Mart and seems to be working 24 hours a day, seven days a week and parties once every year with his family for a whole five minutes of fun (The Simpsons). Apu is portrayed as

having "fractured English, excess fertility, bizarre religious practices, illegal immigration status, and a penchant for cheating customers" (Vij, 2007). Apu is not the only one who is racially portrayed. Willie the groundskeeper is a Scotsman who is the janitor at Springfield Elementary School where Bart and Lisa attend. Willie is typically portrayed as "a red-haired, bearded, foul-tempered, incompetent, haggis-eating, testosterone-filled boor who spends his private time secretly videotaping couples in their cars" (Reid, 2007).

South Park (TV-MA) is also one of the longest running animated sitcoms and has been known to be one of the most provocative shows out there. It was originally aired on August 13, 1997 on Comedy Central and has run for fifteen seasons. This show is about a group of four friends; Eric Cartman, Stan Marsh, Kyle Broflovski, and Kenny McCormick. Eric is a very rude boy, very self-centered and creates many schemes to try and get some money. Stan and Kyle are the best of friends and when things get rough they are the voice of reason for their town and their group of friends. Kenny is the unfortunate one who is poor in the group and somehow always ends up getting killed one way or another. This group of friends brings attention to present day events in their town and seem to add a provocative type of humor.

South Park does not have constant racially stereotyped characters, instead, this show has specific episodes in which racial stereotypes of various groups are introduced and racist conduct, mainly by Eric Cartman, are shown. Racial episodes from this show follow a similar structure pattern, in which the episode begins with suspicion by Eric Cartman against a minority racial group due to prejudices he holds, he later accuses them of an evil plan to destroy America, it is brought to his attention by his friends that he is racist, and ends with Eric's suspicions as being incorrect. Near the end of the episode we begin to see Eric as being genuinely apologetic but soon after draws back from it and he makes some statement to make racism and prejudices out to be acceptable and is usually what saves the day in some twisted way.

Family Guy was originally (TV-14) aired on January 31, 1999 on Fox network and has run for 9 seasons. It is very similar to The Simpsons in which it is based on the Griffin family (white) which is made up of Peter (father), Lois (mother), and their children Chris, Meg, and Stewie, and their dog Brian. The Griffin family is almost a mere reflection of the Simpsons family in that the characters play almost the exact same roles with a few exceptions. Peter is the man of the house but he's very spontaneous with his decisions and usually makes things worse than their already were. Lois is the stronghold of the Griffin family and the voice of reason. She and Brian share a lot in common because both are the only ones who seem to be sane. Brian is the family dog but unlike in *The Simpsons*, Brian can speak and he has become part of the family and is Peter's best friend and usually the one who bails him out when he makes a mess. Chris is the oldest of the children but not quite the brightest and it is reflective in many if not all of his actions. Meg is their only daughter and she is a quite misunderstood teenage girl. She is embarrassed of her family and her main aspiration is to be popular and just fit in. Stewie is the baby of the family but he is a rather odd baby because he talks and acts as an adult and has a hatred for his mother, Lois and constantly tries to kill her. Stewie believes that the world is against him and his only friend is his gay teddy bear, Rupert. He has been known to show signs of homosexuality in many of the episodes.

Just as in *The Simpsons*, constant minority characters are often racially stereotyped in *Family Guy*. Two of the most racially stereotyped characters are Peter's friend, Cleveland Brown and Tricia Takanawa. Cleveland Brown is a minority black

character whose speech is slow. Cleveland Brown has short, black curly hair, and is dark skinned. Aside from Cleveland, Tricia Takanawa is also highly stereotyped. Tricia Takanawa is a Japanese reporter who seems to often be reporting news relating to sex for Channel 5 news. In other episodes there have been Asians portrayed as horrible drivers, very direct, all about academics, and all seem to have the same thick accent and choppy English.

Throughout this process, I have evaluated various factors influencing ethnic humor in animated prime-time sitcoms and how it may create a thought of racism and prejudices from stereotypes embedded as the central point of the shows. Preliminary findings were based off of our analyses and evaluation of the data collected from previous research in order to understand if the stereotypes found in these shows create thoughts of racism or if it creates racial awareness.

Preliminary Findings

Preliminary findings from a secondary analysis of refereed literature ranging in disciplines, show that animated sitcoms containing ethnic humor can be misguiding and lead to the reproduction of racism and expansion of stereotypical images of other racial groups. The reviewed indings conclude that race, stereotypes, prejudice, and racism are all interconnected and need each other to exist and function correctly. Previous research by Allport, Dubois, Gandy, Mann, Zatz on race, stereotypes, and prejudices has concluded that race is socially constructed as a tool to categorize people into certain groups and stereotypes are ascribed characteristics given to each group to facilitate the grouping process of each race. Prejudice then may form from stereotypes in which negative attitudes will form from these exaggerated beliefs differing racial groups. From then racism comes to existence as long as there is power involved because racism cannot exist without the power to act upon people's prejudices. Studies on stereotypes and racism by Mann, Zatz, and Nelson have also shown that although we may all have prejudices, not all racial groups may have the power to be racist because the dominant group(s) usually control all the main aspects of society.

Humor has been used as a mechanism of defense by victims of ethnic humor as a way to soften the blow of the racial or ethnic joke or also as a form of self-hatred. Although humor has been used as a defense mechanism, history has showed us that humor can be a harmful weapon often used as a tool for oppression. Drawing from Mann and Zatz claim that power is needed to spread racism we can relate that to the dominant racial and ethnic group(s) portrayed in ethnic humor and how they may spread racism even though they are not real people. Findings in Date's study show that television is an important aspect in an adolescent's social learning; therefore, we may infer that they learn racist ideals and racial stereotypes from content consumed from televised media. Looking at the racial focus that animated prime-time sitcoms such as *The Simpsons, South Park, and Family Guy* have we may conclude that they do portray racial stereotypes.

By gathering descriptions of various characters often portrayed in animated prime-time sitcoms such as: *The Simpsons, South Park, and Family* Guy from previous studies, news articles, and website descriptions we may see exactly how minority groups are being portrayed with the use of racial and ethnic stereotypes.

Fox's description of Apu truly shows stereotypically ascribed characteristics to Asian Indian members by portraying him as excessively polite and vulnerable to crime in store robberies; while, at the same time, he is equally aggressive by chasing shoplifters, changing the expiration dates on perishable items to sell at inflated and unfair extremely

high rates (The Simpsons). History shows us how this group has been unfairly painted out to be with stereotypes portraying Asian Indians to work every minute of every day, be the only ones working at corner shops, be sneaky, having a thick accent and being very polite.

South Park has a different structure from other animated prime-time sitcoms. Instead of having constant racially stereotyped characters they devote entire episodes to single racial groups. Two specific episodes showed highly exaggerated stereotypes in relation to Arabs and the Chinese population. An episode that stands out highly is episode 4, season 11 called "The Snuke". In this episode, racist, Eric Cartman suspects the new Muslim student, Bahir Habeem, to be a terrorist attempting to bomb the Hillary Clinton Campaign but in reality it is Russian, Vladimir Stoltsky, using the bombing as a distraction so that "America's real enemy", the British could attack Boston and take power once again. When the teacher introduces Bahir and sits him next to Eric Cartman, he and the teacher have the following conversation:

> Eric: "Has he been checked for bombs?!"
> Teacher: "…Not all Muslim people are terrorists."
> Eric: "No but most of them are and all it takes is most of them."

In this scene Eric has the typical stereotypical perception of Muslims and goes on to accuse Baheem as a terrorist to the C.I.A. After finding out that Baheem was not a terrorist, Eric says the following to Baheem and the rest of his friends:

> "My intolerance of Muslims saved America."
> "Today bigotry and racism saved the day."

After Baheem's parents took him and decided to move away from the United States Eric tells his friends,

> "Okay…Who got rid of the Muslims huh? Yeah that would be me, simple thank you would suffice".

Episode 8 from Season 12 called "Imaginationland" also racially portrays Arabs to be terrorist who are out to destroy America. In "Imaginationland" Eric, Stan, Kenny, Kyle and their friends chase down a leprechaun to settle a bet between Kyle and Eric. Once they find the Leprechaun he states the following:

> "I was sent to warn of a terrorist attack but you boys have made me late, now the terrorists will prevail! The end is near!"

And so the story begins about Arab terrorists attacking and bombing Imaginationland to get to America. At Imaginationland a terrorist runs out yelling out, "ALAH!!!" then opens his jacket and bombs Imaginationland. The Arab terrorists are portrayed in a negative way in which they have guns, their faces are covered, they speak Arab, and attack in the name of Alah. In both of these episodes Arabs are portrayed as terrorists due to the events of 9/11 but with the fear swarming Americans these exaggerated stereotypes of Arabs may lead some to believe that all Arabs are terrorist and form prejudice and racist thought about them which may lead to immoral discrimination.

Family Guy goes back to the similar structure of The Simpsons in which it is a white family living with a diverse group of people whom are constant throughout the show and are racially stereotyped. Japanese reporter, Tricia Takanawa, usually reports on stories related to sex. We may think that it is just a characteristic of Asian women but in fact it is a stereotypical perception that has been influenced by Asian's presence

in the United States. Asian women are typically portrayed as "exotic and submissive" and have been portrayed to work in prostitution when in reality Euro-Americans are the ones seeking opportunites in prostitution (Mann and Zatz, 1998). Through other scenes from Family Guy we are shown an Asian man who is all about his child's academics and future career as a doctor. Asians have been stereotyped to be America's "model minority" because according to these stereotypes, Asians are "hardworking, studious, excelling in math and business" (Mann and Zatz).

The history of stereotypes shows us that Asians are seen as perfect but other minorities such as African Americans are not as perfect in relation to stereotypes ascribed to them. Through the character of Cleveland Brown, blacks are portrayed to be deviant and a danger to society "to keep African Americans second-class citizens" (Mann and Zatz, 1998). In the case of Cleveland's speech, it could be inferred that his speech being slow was purposely done to portay a racial stereotype that has its history with African-Americans. African Americans were seen as being mentally and morally inferior to Anglo-Americans (Mann and Zatz, 1998). In fact, Solorzano's study shows that the term "stupid" has been linked to African Americans in order to justify the 'need for segregation' (1997).

In various episodes such as episode 19 from season 3, "Stuck Together, Torn Apart", Cleveland is attacked by new police technology that is meant to arrest criminals. While trying out this new equipment, Peter gets handcuffed and then let go but when Cleveland tries it the equipment starts yelling, "Minority suspect! Minority Suspect!" and begins hitting him with police batons and later yells "He has a gun" while the equipment is actually placing the gun next to Cleveland to make it seem like he was a threat to police officers. This particular episode portrays minorities to be a threat but also portrays officers to unlawfully beat minorities and plant weapons and evidence against them to justify their actions. Other episodes have also shown signs of racism against Cleveland such as episode 13 in season five "Bill and Peter's Bogus Journey" when a racist sunflower begins to grow in Peter's front yard and when Cleveland walks by, the racist sunflower yells out "Hey boy, don't you come walking by this house!". In this episode the creators personify a sunflower that is growing in Peter's yard and have it yell out racist remarks to Cleveland.

Although these shows vary in age appropriate content ratings, they all share similar racial stereotypes. These animated sitcoms share a similar structure of its characters in which it is usually based on a family or friends and how a town corresponds with one another in relation to the diversity in present day America. The roles of the characters share similar traits in that there is typically always the goofy one, the rude one, the doomed one, and the moral one. The shows are rated for different age groups but yet they all contain the same type of humor and racial stereotypes and prejudices on various minority groups. These shows typically use exaggerated racial portrayal of its characters which could be mistaken to be precise characteristics of such groups. The visible differences are that one show has more vulgar language and is more blunt and outspoken and the other shows (*The Simpsons*) is less blunt and instead has subliminal racial stereotypes. When comparing racial stereotypes between The Simpsons and South Park we see that although both are racially stereotyping minority groups, South Park actually has one of its characters express the racial stereotypes by bluntly confronting the targeted group about how they are portrayed. The Simpsons still racially stereotypes characters such as Apu but they do it in a different way by depicting them with these stereotypes but never actually confronting the targeted group with these racial perceptions of them. These shows may differ in "age appropriate content" but by viewing these shows we can see for ourselves that they have

the effect and portray the same stereotypical images of minority race and ethnic groups.

Preliminary findings of this research show that adolescent youth (ages 12-19) have high exposure rates to television content and are the main target for the televised market. Findings also show that African Americans are consuming televised content more than Hispanics and more than whites and that they are the most affected by consumed content in which they form deeper relations to racially portrayed black characters on television. Since these adolescents are highly consuming ethnic humor and may not be well educated in race relations, the over-exaggerated racial stereotypes may be misunderstood and taken at face value; therefore, encouraging viewers to form their own prejudices against out-group members and possibly begin to acquire racist ideals and discriminatory conduct.

Although there are various scholars in various fields who support the case through their studies that ethnic humor reproduces racism and racial stereotypes, there have been scholars in opposition to such a claim. Hugo Dobson, William Savage Jr., among others, have argued that racism is only spread because the viewers of shows with ethnic humor in its core simply do not "get" the show. They claim that if people understood the meaning of shows such as "The Simpsons" and "South Park" they would realize that the jokes are on us because we are idiotic enough to actually believe these stereotypes and instill them into our lives.

According to the notion of hyper-irony, ethnic humor found in prime-time animated shows such as "South Park" and "Family Guy" is meant to show society that these stereotypical perceptions we as a society hold and spread through our social interactions is in fact a social problem. Carl Matheson defines hyper-irony as occurring when comedy consistently advances "positions only in order to undercut them" (as cited in Marx and Sienkiewicz, 2009, p.8). Marx and Sienkiewicz explain how hyper irony is used in this genre to battle this issue but it may be misunderstood and perceived as a major source for the spread of racial stereotypes and prejudices if the people viewing these shows do not "get" what the show is about and the message it is attempting to transmit to its viewers (2009).

Scholars defending ethnic humor claim that this type of humor is intended to force us to ponder on our own stereotypical ideas and prejudices of others so that it can help us move in the right direction of combating racism and prejudices by educating others through humor. Their main focus of shows including but not limited to: *The Simpsons, South Park, and Family Guy* greatly lies on the characters' absurd stereotypes and prejudices with a mindset that it will trigger something within the viewers, causing them to realize that these characters are a mere image of what Americans are like and the images we hold of each other. Marx and Sienkiewicz with the support of previous scholars, argue that animated sitcoms with ethnic humor in its core is not intended to reproduce or in any way encourage stereotypical and racial prejudices, but instead, these shows are pushing for a social movement against racism by breaking these images that we have of each other and showing us how ridiculous those images can truly be (Hart, 2002; Marx & Sienkiewicz, 2007).

In "South Park, In the tradition of Chaucer and Shakespeare," Melissa Hart claims that when analyzing prime-time animation shows containing ethnic humor the viewers divide into two groups; ones who "get" the show and ones that do not "get it" (those who understand the show's true meaning and those who do not). Hart's theory assumes that the problem is not the ethnic humor, but instead, the real problem is the viewers not understanding the creators' true intentions for the race-based jokes. Hart

argues that racial prejudices and characters in animated sitcoms such as "South Park" are blown way out of proportion they people laugh at its stupidity and ridiculous nature. She also argues that these shows help us cope with the sad things in life that we have no control over by allowing us to laugh and let out some steam to be able to return to our everyday lives with some kind of temporary treatment (2002).

Scholars in defense of ethnic humor found in animated sitcoms make a legitimate argument with Matheson's notion of hyper-irony being used to help combat racism instead of encouraging it. According to these scholars, creators of these animated sitcoms have good intentions when producing these racially stereotyped episodes but the truth of the matter is that the context for this to be a success is just not available in America. In fact, Ray Hanania claims that, "Americans are the most educated people in the world but the least educated about the world" (2007).

Promoting racial awareness

Racism is not a thing of the past, studies have shown that racism exist even in modern times and continues to spread through all agents of socialization and is no longer limited to community and our immediate surroundings. Preliminary findings show that although efforts are being made to combat racism through the use of humor found in animated sitcoms we do not have the foundation for this to successfully work as intended by the shows' creators. Scholars such as Ray Hanania have argued and suggested that "the answer to racism is education". The truth is that Americans do not openly discuss race or racism in fear that by discussing it we are opening the door for the next generation to become racist.

In, "Children, Race and Racism: How Race Awareness Develops", Louise Derman-Sparks, Carol Tanaka Higa, and Bill Sparks examine a study that was conducted on children from Southern California during 1978-80. From the study they were able to come to the conclusion that children are in fact aware of racial differences and some may also be aware of the existence of racism (Derman-Sparks, Higa, & Sparks, 1980). Even though we try to shield the children from a provocative subject such as racism, kids are well aware of social attitudes and stereotypes of the racial differences between groups.

Not educating children on an important subject such as racism and racial identity we are only taking power from them by not allowing them to have knowledge over something that affects them all no matter when and where they are in life. "Racial and ethnic identity is the sense of belonging that an adolescent feels toward a racial or ethnic group as well as the significance and qualitative meaning that the adolescent assigns to that group membership" (Hudley & Wakefield, p. 148). Educating a child or adolescent on race relations is an important aspect that has a strong influence over their development and formation of their identity (Marsh, Mendoza-Denton, & Smith, 2010). They need to know that no race is better than the other so that they may form their identity in a healthy way in which they will love who they are and take pride of where they and others come from.

Many parents make a tremendous mistake with their children in relation to issues on race and prejudices by having this notion that if they do not speak to their children about racism and racial differences then their child will be "color-blind" when it comes to race relations and they will grow up not knowing what racism is and especially not growing up to be racist. Alice Miel claims that when observing white suburban children showed that this group of children learns to be hypocritical about differences at an early stage in their lives. Their society's prejudices stay within them, but it is drilled into them that it is not right to express such feelings (Derman-Sparks, Higa, Sparks). Many think that by making

a child "color-blind" when it comes to race relations then the child will grow to have no prejudices because they will see no difference between groups.

The "color-blind" thesis seems quite spectacular but we must take into consideration that children are not just coming into contact with their families but also with other agents of socialization such as: teachers, neighbors, friends, and most definitely the mass media. Ann Beuf claims that the "color-blind" thesis "implies that only family socialization influences a child's sense of self (Derman-Sparks, Higa, and Sparks, 1980). Derman-Sparks, Higa, and Sparks claim that children will only grow up to be non-racist if and only if they grow up in a non-racist society and therefore children should be guided and educated to take pride on their race and culture, appreciate other racial groups, and lastly teach them to understand how racism works and how to fight it Ann B. Onyekwuluje also claims that children needed to be guided with an education on race relations, racial differences, and racism so that they may grow to be more understanding of racial difference that they are confronted with in the future and have no issue adapting. Onyekwuluje focuses on the adolescent and how open discussion about race relations and tensions helps them better grasp the idea of racial differences to lead them into the world prepared to interact with any group no matter the differences. Onyekwuluje states that adolescents need adult role models to teach them about the differences in histories and socioeconomic conditions, and most importantly to teach them that lack of respect, care and appreciation of other groups is not justified by the distinct differences they observe (Onyekwuluje, 2000).

Future Research

Due to the time constraints and the amount of time needed to get approved by the (IRB) Institutional Review Board, my research was based off of a secondary-analysis of refereed literature but in the future I plan to further expand on this research using original data through interviews with adolescents and analysis of animated sitcoms. To further support my thesis that ethnic humor found in animated prime-time sitcoms reproduces and encourages racism I plan to analyze the shows specified in this research and possibly have a group of participants whom I will interview to be able to better understand their amount of television consumption have them consume some of the content from these shows and give their understanding of what the shows are trying to portray.

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Are You Able to *Leer* This?: Self-Paced Reading Interpretation of Semantic Violations and Code-Switches by Bilingual Speakers

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Abstract

Semantic violations disrupt the flow and meaning of a sentence. When paired with a code-switch, the product sentence can become an ambiguous mess. The present study explored bilingual speakers' abilities to interpret meaning in sentences containing semantic and code-switch violations. The study presented participants with various lists consisting of four sentence categories: normal, semantic violation, code-switch violation, and sentences containing both semantic and code-switch violations. The test was taken at the participant's pace and timed using a button box. Preliminary results showed that violations did not interfere with response times. In fact the mean times of sentences containing language violations were lower than the mean response times of sentences with no language manipulations. Future studies should include a larger population of subjects. Also, by using paragraphs of information instead of single sentences experimenters can better understand how well a bilingual speaker can successfully comprehend overall passage meaning.

Introduction

The ability to convey and interpret meaning seamlessly and proficiently in two languages defines an individual as bilingual. The process may not seem rigorous, but in reality consists of many complex internal mechanisms as well as external cues that allow for smooth language processing. For instance, while reading a passage, the brain must, 1. Take in information through the eyes, 2. Indentify the language being used through recognition and experience, and 3. Make sense of letters, words, syntax, order, presentation, meaning, sound, etc. The process also includes an inhibition mechanism, where the brain inhibits the unused language from interfering with the language currently being used (Costa, Santeseban & Ivanova, 2006). Bilingual individuals can switch back and forth between languages in a phenomenon known as code switching. Code-switching involves an individual using words from two or more languages in a mixture within a single conversation. Previous studies have shown that bilinguals have an advantage and learn new languages much more quickly than monolingual persons. This may be due to experiences with different linguistic styles that are found in different languages. In addition multilingual individuals are less likely to be diagnosed with Alzheimer's disease, show less problematic issues with memory, and also display greater ability to learn novel languages (Kaushanskaya & Marian, 2009; Bialystok, 2011).

Pre-existing knowledge is a key component of language. The sentence, "The boy likes to study before going out to play," makes sense because the brain uses prior knowledge of language to interpret the sentence's meaning and apply that meaning. Now imagine that the sentence reads, "The boy likes to study before going out to toothbrush." The sentence now contains a meaning manipulation and makes less sense. The error in the second sentence is known as a semantic violation. A semantic violation is when one or more words are out of context or do not fit with the meaning of a given situation (i.e., toothbrush). Suppose the sentence now reads, "The boy likes to study before going out to jugar." Another manipulation has occurred, but in this case the manipulation is known as a code-switch; the Spanish word "jugar" is in place of the English word "play". A code-switch occurs when one takes two languages and combines them into one new hybrid sentence. These two types of sentence manipulations have been the target of previous studies of monolingual and bilingual speakers. One study (Kutas & Hillyard, 1980) used EEGs to explore semantic violations on an electrophysiological level utilizing the brain's electrical responses to language stimuli. The study sought to discover how language is interpreted by the brain and how the brain reacts distinctly to anomalistic linguistic stimuli. Results from the EEG suggest that the brain responds to semantic violations within reading samples. This was observed through different neurological spikes that were recorded through electrodes as part of the EEG.

Although the present study focuses on processes involving semantic and code-switch violations many studies have been conducted using other types of language based manipulations, including syntax, phonology, orthography, representation, placement, novelty, and others. For instance, in one study, bilinguals were tested on language acquisition of novel words, paying close attention to phonology (sound) and orthographic (spelling) presentation (Kaushanskaya & Marian, 2009). The study also explored whether a native language can interfere with the acquisition of a novel language. The phonology and orthography of the novel language words were manipulated. Words were presented to participants in several ways. Some participants learned the novel language with the

assistance of two language aids— visual and audible. Other participants were allowed one of the two language aids or none. Results suggest that bilinguals were more accurate in learning novel vocabulary than monolingual participants. Bilinguals outperformed monolinguals on all learning tasks and did better when presented with visual and audible aids. Bilingual participants were better at learning a novel language, with little interference, suggesting that multiple experiences with different languages helps facilitate future language acquisition.

Another study focused on the speech control that occurs in bilingual participants when processing and interpreting language (Costa, Santeseban, & Ivanova, 2006). Control mechanisms allow bilinguals to engage a desired language while inhibiting other acquired languages.

Costa & colleagues (2006) tested the different factors that make up this type of speech control mechanism including, inhibition, switch cost, age, and exposure to different languages. The study included four experiments, each testing different factors in language control. One tested the influence of language similarity and second language age acquisition on a language switching task. The age of second language acquisition did not have a significant effect; the languages (Spanish & English) showed symmetry in switching costs. Another experiment tested trilingual participants who possessed two dominant languages and weak to moderate proficiency in a third language. Participants were asked to switch between their second dominant language (L2) and the less prominent third language (L3). Results showed proportional switching costs between L2 and L3 indicating that participants had overall language control despite the switch from a dominant language to a weaker one. The results suggest that bilingual individuals have a great capacity to control what language they use in given circumstances.

Other studies have explored event related potentials (ERPs) through the use of electroencephalograms (EEGs) to monitor the points at which the brain notes linguistic anomalies (semantic, code-switching, phonology, etc.). For example, if a participant is connected to an EEG machine while reading a book, the EEG records all neural activity associated with the reading period, including instances where participants encounter language errors. Spikes in neural activity are translated into ERPs and are used to interpret incoming neural responses to stimuli. One study explored event related potentials (ERPs) and their correlation to syntactic and semantic irregularities in sentences (Steinhauer, Pancheva, Newman, Gennari & Ullman, 2001). Self-paced reading was utilized to isolate each word and more specifically to record individual response times for non-manipulated and manipulated words. This type of reading method, self-paced reading, uses a button apparatus to allow participants to advance through reading material at their own rate; by pressing the button investigators can document each individual's reading comprehension time. Results suggest that individuals read globally and thus anticipate words in sequence based on prior words to make sense of the entire sentence; language is learned and archived and in situations where meaning is obscured the brain compensates for anomalistic information causing participants to reevaluate and restructure given information to make sense of ambiguous words.

The present study investigates processing of semantic and code-switch violations among bilingual participants. Sentences demonstrating semantic and code-switch violations were expected to take longer to process as opposed to sentences containing no language manipulations. The outcome is hypothesized because without sentence manipulation the participant should be able to read through the sentence with greater ease

and at a faster rate. Also, sentences containing both semantic and code-switch violations were expected to elicit greater processing than sentences exhibiting only one violation. The increase in processing cost was expected because the participant has to sort through two language banks to determine a word's meaning in English or Spanish and then continue to make sense of the word's meaning within a sentence's context (Steinhauer, et al, 2001; Costa, et al, 2006).

Method

Participants

Participants were recruited from the University of Texas at San Antonio main campus by advertisement flyers. The flyers contained information describing requirements for eligibility. The study required participants to be fluent in both English and Spanish as determined by various language proficiency tests for example, the Woodcock Language Proficiency Battery Scale (Woodcock, 1991). The study also required that all participants be right handed. Hand dominance was required because specific language centers for production and interpretation of speech may differ hemispherically among right and left handed individuals (Knecht, Dräger, Deppe, Bobe, Lohmann, Flöel, Ringelstein, & Henningsen, 2000).

Materials

Two sets of one hundred and twenty-eight target words were created by a previous researcher building on past research (Kutas, Moreno, & Wicha, 2009). Each set consisted of sixty-two English and sixty-four Spanish target words (words chosen for manipulation). The target words were incorporated into trial sentences that were then placed into four sentence conditions: normal (without any manipulations; "The cat ate."), semantic violation (with a meaning violation; "The lamp ate."), code-switch (with a switch in language; "The gato ate."), or sentences containing both semantic violations and code-switches (with both stimuli; "The lámpara ate."). The result was 32 trial sentences for each condition. Along with the one hundred and twenty-eight trial sentences, an additional one hundred and twenty-eight context sentences were produced to pair with the trial sentences in order to supply participants with enough information to comprehend sentences containing language manipulations. For example the context sentence, "The man went to the store", is followed by a manipulated sentence, "To buy some agua and milk.")

Procedure

Participants completed a verbal fluency test administered in both English and Spanish. The test required participants to name as many words as possible for six different letters. The English A, B, and C and the Spanish A, B, and C. Instructors recorded all responses. Following the test, participants completed two consent forms; one for the actual study describing the procedure, compensation, risk, and other relevant information and a second consent giving investigators permission to hold participant's information for future use in other lab studies. A language history survey was used to provide information regarding participants' native language, culture, primary language background, and also primary language spoken at school, home, and around different people (parents, friend, grandparents, romantic partner, etc.). The Woodcock Language Battery Scale was administered by the examiner in both an English and Spanish version. Lastly, a code-switch questionnaire to help identify participants as code-switchers or non-code-switchers. The survey asked questions pertaining to personal experience with code switching. Participants'

responses used a scale from 1-7, where "1=never" and "7=always". The participant's responses to the questions determined classification as a code-switcher or non-code-switcher. After preliminary tests were administered, participants were seated in a testing room where they were administered the self-paced reading test utilizing an electronic button box to record participants' response times to stimuli in milliseconds. Black and white slides were presented using EPrime on a Dell computer with a color monitor. Participants were prompted to follow instructions on the screen and were also given brief instructions as to how to maneuver through the test. Participants were told to; "Read all the sentences as quickly as possible, but at a pace that would allow for full sentence comprehension." All slide advancements were recorded by the electronic button box. Although the button box's main purpose was to record stimuli comprehension, it also served to advance the participant through the self-paced reading test (including instructions, break slides, and all other non-stimulus slides). Before each phrase participants were presented with a central fixation point (+). When the subjects were ready they advanced through the sentences at a self selected pace. Each bilingual participant viewed the same number of violations, code-switches, and target word presentations. The only difference was in the order stimuli were presented; some participants received context sentences first, followed by a trial sentence and others received trial sentences followed by context sentences. At random a "True" or "False" sentence would be presented relating to the specific context and trial sentence that a participant was currently on. For example, if the context sentence read, "My hands are dirty" and the trial sentence read, "I washed my hands with soap and water" then, the true or false statement would read, "I wash my hands when they are dirty." At that point the participant would answer whether they believed the statement was true or false in accordance with the context and trial sentence. This ensured that participants were reading and understanding the slides and not just skimming. Once the participant completed the first set of one hundred and twenty-eight context/trial pairings they were directed to take a break. After the test was completed participants were compensated for the time spent in the lab in the amount of ten dollars an hour (includes screening process and self-paced test). The self-paced reading test lasted forty-five minutes to an hour on average, not including the screening process.

Results

Preliminary Findings

Initial data collection yielded a small group of pilot subjects. Although the small sample was inadequate for statistical analyses, descriptive statistics were calculated. Mean response times were calculated for the four trial conditions: normal, semantic violation, code-switch, and sentences containing both semantic violations and code-switches. The mean ($\overline{x}$) response times in milliseconds for each trial condition were as follows: normal=710ms, semantic violation=641ms, code-switch=636ms, and both semantic violations and code switches=704ms. The computed means did not support the prediction that sentences containing semantic violations or code-switch violations would yield a significant delay in process time in relation to the controlled normal condition. Instead sentences containing language manipulations yielded faster response times than sentences containing no language manipulations.

The second hypothesis, that the cost for processing sentences with both a meaning violation and code-switch violation would yield longer response times, was not supported.

Mean response time was lower for sentences containing both semantic violations and code-switch violations than for the normal trial sentence mean response time (See Figure 1). The preliminary data suggest that sentences containing language manipulations do not interfere with individual word processing and overall sentence comprehension, but results are inconclusive due to small sample size.

Figure 1

Mean Response Times
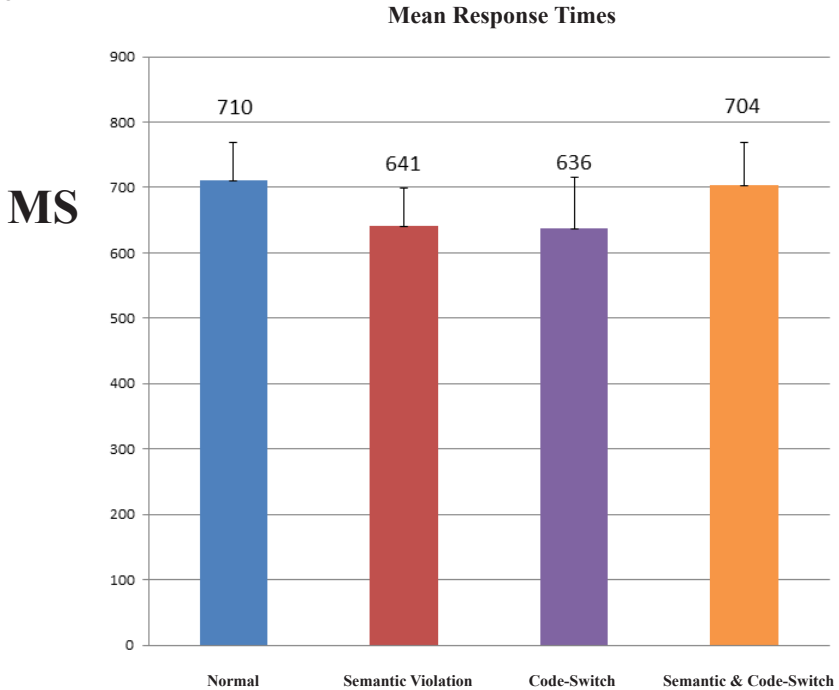
Analyses Plan

A target size of at least 150 participants is desired to allow more rigorous analyses. Upon recruiting the sample a repeated measures ANOVA will compare the mean response times of the manipulated sentence conditions (semantic violation, code-switch, sentences containing both semantic and code-switch violations and the normal trial sentence condition).

Discussion

Preliminary results from the current pilot study suggest that bilingual individuals have the capacity to read sentences containing anomalistic manipulations at a fluent rate. Both semantic and code-switch manipulations dealt with obscuring the meaning or normalcy of a sentence. Previous studies have shown that bilingual individuals have an easier time learning and sorting through novel information (Kaushanskaya et al, 2009; Bialystok, 2011). Also, people fluent in two or more languages show greater ability in anticipating information following erroneous stimuli, thus allowing them to piece together a sentence's

overall meaning, despite possible errors to content. Participants in the current pilot study were able to connect information to comprehend a sentence's meaning regardless of semantic or code-switch violations, a finding similar to the self-paced study conducted by Steinhauer et al, (2001) which suggests that multilingual individual's process information globally, adapting to irregularity when necessary. The current results are also similar to the findings of Kaushanskaya & Marian (2009), which found that bilingual participants were able to learn under most conditions. Thus, being bilingual may be beneficial when learning a new language or interpreting. Essentially the more experience an individual has with different languages the more efficient the individual will be at recalling, sorting, anticipating, and retaining novel or anomalistic language information.

The generalizability of the current findings is very limited due to the small number of participants. Future research must be conducted to increase the likelihood of yielding any statistical significance. In addition the study recorded the response times to semantic and code-switch violations in sentences and was limited to single word alterations. Other variables can be explored in future studies, such as increasing the amount of content that a participant must read. For example, instead of having participants read single sentences with one manipulation, one could increase the amount of reading to a short paragraph with multiple language violations, followed by a context paragraph relating to the manipulated paragraph to assess comprehension. This would test the capacity to effectively process and make sense of large amounts of ambiguous information.

Conclusion

The present study sought to explore how well proficient bilingual individuals could read, process, and comprehend erroneous language content within sentences. It was hypothesized that sentences containing language manipulations would interfere with sentence and language comprehension. What was interesting was that preliminary results showed that bilingual individuals responded faster to sentences containing language violations and slower to sentences demonstrating no language violations. This suggests that bilingual participants are able to take in anomalistic information and somehow process the irregular information so that sentence meaning is met. This shows how the brain works to compensate for falsities that may be encountered in real life settings. Language is an extremely crucial part of everyday life. That is why understanding the processes that drive and produce language are just as important.

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Economic Viability of Photovoltaic Systems in Northern Illinois

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Abstract

A Monte Carlo simulation is carried out to calculate a Levelized Cost of Energy for a residential photovoltaic system in Illinois. The program used was the National Renewable Energy Laboratory-based System Advisor Model in order to take into account engineering and economic factors for analysis. Preliminary results were compiled for the cases including subsidies and not including subsidies. As expected, the utilization of subsidies warrants the investment in such systems whereas no subsidies render the implementation of photovoltaics beyond the means of the average consumer.

Introduction

Photovoltaic (PV) systems are one of the new manifestations of solar energy, along with thermal solar (based on using hydrogen gas to drive a Stirling engine) to become residentially viable. To date there have been studies to determine their viability on the utility scale in the form of photovoltaic power plants via a number known as the Levelized Cost of Energy (LCOE). This quantity takes into account capital costs, risks and returns, capacity factors, and efficiencies, as well as engineering expenses. It can be considered as a benchmark number allowing us to compare power generation systems with very different cost structures. As an example, a PV system may have higher capital costs initially than a nuclear power plant, but the Operation and Maintenance (O&M) of the latter will far outpace the former system over time.

The purpose of the current project is to provide a model that would calculate a LCOE for a residential system in Illinois. Due to the volatility of the political scene, the model assumes standard tax breaks, incentives, and discounts. Limitations are addressed in Appendix A.

Methodology

The course of action in approaching the problem is primarily based on the program, System Advisor Model (SAM) by the Dept. of Energy's (DoE) National Renewable Energy Laboratory (NREL). The software provided also includes the Transient System Simulation Tool (TRYNSYS) as the main compiler for the simulation of weather environmental phenomena affecting a geographical region. The data provided by various government agencies made it possible to produce a model that included hourly data for Illinois, utility rates, in addition to financing. The PV system in question is a rated 4 kW system produced by Sandia Labs along with inverters to match its power output. All state and federal tax incentives included for the model are to be found in the Database for Incentives in Renewables and Efficiency. The inputs and system information are available in Appendix B.

There are many models that seek to ascertain a degree of accuracy regarding the efficiency of an industry within an economy with a deterministic algorithm. However there may be anomalies that arise and cannot be accounted with the model. Hence, the primary motivation of the project is to provide a probabilistic approach to determining a value for the LCOE so there will be more knowledge and of the range of values that can take place given initial conditions and distributions. This approach is described in some detail in [1].

The assumptions in determining the value of the LCOE involve the optimistic possibility of obtaining a sizable portion of incentives and property re-assessments. As mentioned above, there will be some forms of economic or political stipulations that cannot be included which will be noted in Appendix A. Nevertheless, the program was used to provide a Monte Carlo simulation for the nominal LCOE of a residential system by varying the inverter cost, module cost, inflation rate, federal investment tax credit percentage, other incentives, and net salvage value. For the case without subsidies, all federal and state incentives were replaced with a zero or zero percentage. Financing was based on a 30 year mortgage plan.

Results

With Subsidies:

The results for the case with subsidies are optimistic in outlook. Figure 1 below provides histograms of both the LCOE nominal probability distribution function (PDF) and the LCOE cumulative distribution function (CDF).

Figure 1: Histogram of "LCOE Nominal" with subsidies
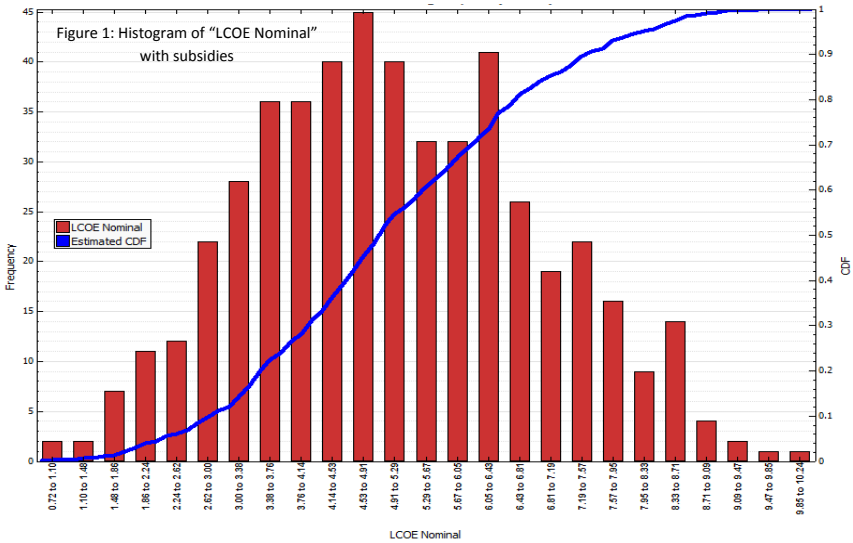
The highest probability for the LCOE occurs between the interval of 3.79¢/kWh and 6.43¢/kWh. Table 1 provides some of the outputs based on the available data, comparing the deterministic model known as "Base" with the Monte Carlo simulation referred to as "Stat. 1" in the table, and also shown in Figure 1 above.

Table 1

Metric	Base	Stat. 1 [mu, sigma]
Net Annual Energy	5,360 kWh	[5360.45, 0]
LCOE Nominal	-6.64 ¢/kWh	[5.10712, 1.74888]
LCOE Real	-5.15 ¢/kWh	[3.95617, 1.33042]
First Year Revenue without System	$ -75.09	[-75.0928, 0]
First Year Revenue with System	$ 89.86	[89.8634, 0]
First Year Net Revenue	$ 164.96	[164.956, 0]
After-tax NPV	$ 5,728.56	[-669.923, 935.628]
Payback Period	0.948696 years	[9.68235, 2.37125]
DC-to-AC Capacity Factor	12.9 %	[12.9484, 0]
First year kWhac/kWdc	1,134	[1134.28, 0]
System Performance Factor	0.79	[0.787543, 0]
Total Land Area	0.02 acres	

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1 The numbers represented in the base case, especially on the payback-period, were found to be an anomaly and may be the result of a coding error in the program.

The mean value for "LCOE Nominal" is determined to be 5.10¢/kWh. An interesting observation is that the LCOE in the base case could be interpreted as being over-compensated for a PV system. To compare with the statistical model, the payoff period is nearly tenfold, meaning that in ten years one would have been able to pay off their debt with the utilization of subsidies. However, some subsidies do have a terminal period usually in 10 years while others have to be annually renewed, among other factors. Nevertheless, it is a comparable number of years in comparison with the analysis without subsidies.

Without Subsidies:

By rendering all subsidy inputs zero and including expenses that were neglected due to property-reassessment (for example), there are significantly different results. Figure 2 and Table 2 show the histogram of the model with no subsidies.
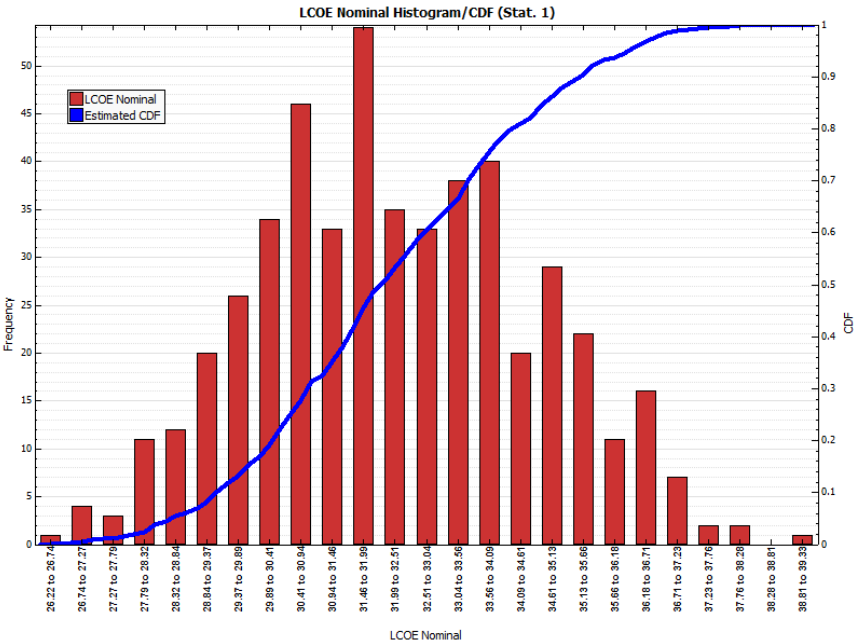
Figure 2: Histogram of LCOE Nominal without subsidies

Table 2

Metric	Base	Stat. 1 [mu, sigma]
Net Annual Energy	5,360 kWh	[5360.45, 0]
LCOE Nominal	36.82 ¢/kWh	[32.2767, 2.29328]
LCOE Real	28.58 ¢/kWh	[25.0516, 1.65132]
First Year Revenue without System	$ -75.09	[-75.0928, 0]
First Year Revenue with System	$ 89.86	[89.8634, 0]
First Year Net Revenue	$ 164.96	[164.956, 0]
After-tax NPV	$ -17,965.80	[-15485, 1159.68]
Payback Period	1e+099 years	[1e+099, 8.98484e+084]
DC-to-AC Capacity Factor	12.9 %	[12.9484, 0]
First year kWhac/kWdc	1,134	[1134.28, 0]
System Performance Factor	0.79	[0.787543, 0]
Total Land Area	0.02 acres	

In comparison with the earlier result, one can see the LCOE is drastically higher, hitting a mean of 32¢/kWh in the statistical model. Perhaps even more disturbing is the payback period. The significance of such an extremely high number (i.e., 99 years) is to say that in a basic financing plan of over thirty years with an income comparable to the state average, it would not be possible to invest in such a system without subsidies.

Conclusions

In order to have a cost-effective LCOE for a residential system, one must have subsidies of the state and federal governments. Although they may have several stipulations depending on the system or its location, for Illinois residents it is possible to attain a system that would be paid off in nearly ten years. Without subsidies, unless one is able to purchase such a system with cash and not depend on financing, it is not possible to be profitable within a time frame of the 30 year financing period.

Future Prospects

The data analyzed and presented are meant to be preliminary and are by no means definitive in the interpretation of the nominal LCOE for residential systems in Illinois. As an ongoing project, more data will be accumulated in order to fine-tune certain parameters. Future analyses may include an examination of the sensitivity of certain variables upon others in order to optimize and provide a possibly more efficient system along with determining parametric relationships in the energy market landscape in Illinois.

Appendix A- Limitations of Model

There are several limitations of the model presented here; these limitations are the reason why it is represented as preliminary. As mentioned above, the volatility of the political environment has the modeler constantly updating variables, including and removing subsidies as soon as they expire, are phased out, newly passed, or repealed. In addition, UofC faculty member Dr. Liz Moyer of the Geophysical Sciences Department has pointed out to me that within Illinois there is a cap on the number of subsidies or their amount one can have at disposal. It will suffice to say that given the flexibility of the program, such constraints may be included to grant greater accuracy for the model. For comparison see Borenstein [2, 3] for an analysis of California's energy market.

Appendix B- Inputs

Presented here are two screen shots of the program and some of the inputs involved for the module and inverter. Calculation of the values is described by the System Advisor Model manual which is available at the website for NREL. The data set for the explicit values for subsidies and financing is available upon request.

PV Module:
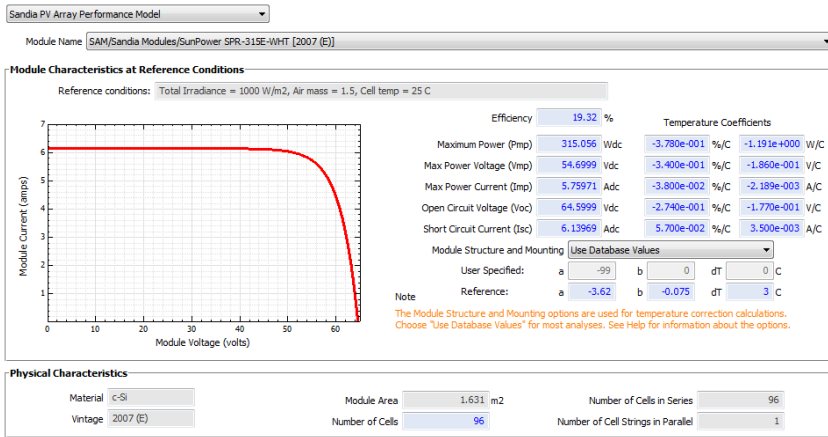
Inverter:
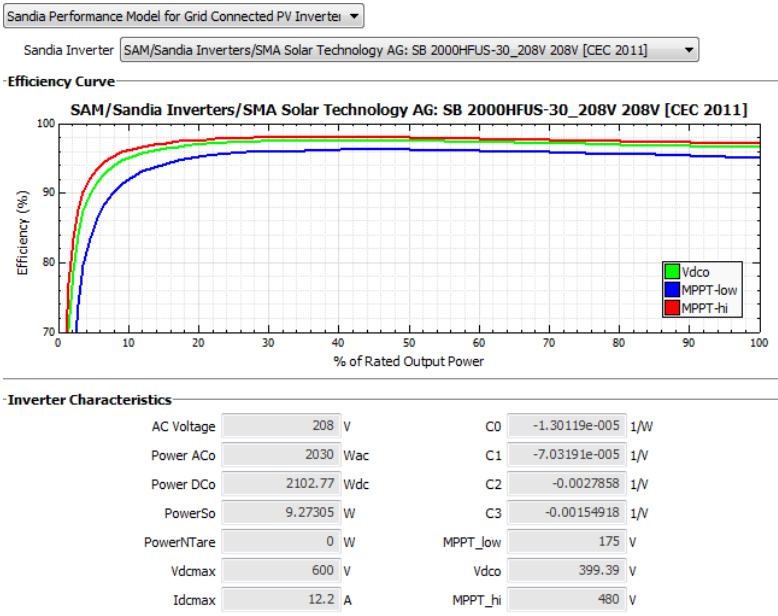
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How do Latinas Compare? A Comparative Study of Latinas in State Legislatures

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Abstract

  This study compares and analyzes Latina state legislators currently serving in two states-- Texas and Arizona. In addition, the Latina public officials were selected based on when they were first elected – during the 1990s or from 2000 to the present. Secondary sources and phone interviews are utilized in this study. This study contributes to the increasing literature on Latina politics by investigating the differences and similarities between the Latinas with regard to their backgrounds and election to public office. In addition, their views on leadership and advocacy positions on immigration and specifically the DREAM Act are explored.

Until recently, scholars have begun to examine the development and contributions of Latina leadership as American political actors. Increasingly, Latinas have managed to move up the political ladder in key political seats. New Mexico Governor, Susana Martinez, elected in 2010, is not only the first Latina to serve as New Mexico's Governor but also the first Latina governor in the history of the United States. In addition, President Obama appointed the first Latina to the U.S. Supreme Court, Sonia Sotomayor. These two Latinas have continued to pave the way for future Latinas to seek higher offices.

In order to contribute to the increasing scholarship on Latina Politics, this study will examine and compare Latina public officials in two states. It will analyze their political background, their election to office, obstacles they faced, their views on leadership styles and advocacy positions on policies using secondary sources and through interviews. The study will consist of Latina public officials in the State House of Representative who are serving in Texas and Arizona. At least two Latinas public officials from each state will be interviewed for this research. The officials have been selected by choosing two from each state legislature. In addition, public officials were selected on the basis if they were recently elected during the 1990s or from 2000 to the present. These two time periods have been chosen to draw comparisons of Latinas public officials. It contributes to the understanding of the differences and similarities from the 1990s to the present time. These Latinas have been identified based on their biographies on the internet.

In the state of Texas, State Representative Jessica Farrar will be interviewed. She is currently in her 8th term for District 148 which represents the city of Houston. She was first elected to the Texas House of Representatives in 1994 at the age of 27, and is the longest serving Hispanic from Houston in the Texas House of Representatives. Also, State Representative Veronica Gonzales will be interviewed. She is serving her third term in the House of Representatives representing District 41 (first elected in 2004). Representative Gonzales is the first Latina elected to represent District 41.

With regard to Arizona, State Representative Anna Tovar will be interviewed. She is a life-long Tolleson and West Valley Resident (Avondale, Buckeye, Goodyear, Litchfield Park and Tolleson, Arizona). She was first elected in 2010. In addition, State Representative Sally Ann Gonzales will be interviewed. She was elected to the Arizona House of Representatives in 1996.

In 2010, according to the National Directory of Latino Elected Officials (NALEO), there were 152 Latina elected officials and 4 are State Representatives. In Texas, out of the 724 Latina elected officials only 10 serve as State Representatives. Therefore, this study will draw comparisons from these two states that share a similar history in regards to the Latino population and share similar concerns since they are Border States. Third, as a native Arizonian and student in Texas, I was especially interested in these states. Therefore, I have a growing interest in both states.

This study will replicate the study and interview instrument used by Garcia et al. (1998) in their book, "Politicas – Latina Public Officials in Texas." However, this study will compare Latinas from two states. Similar to Garcia et. al (1998), interviews and secondary sources are incorporated. In addition, a comparative case study approach will be implemented in order to compare their political background, obstacles they faced, leadership views, and their positions and/or views on advocacy issues of the Latinas elected officials in the State Legislature in Texas and Arizona.

To accomplish this study, phone interviews will be conducted whenever possible, or via e-mail along with follow-up interviews if necessary with each officeholder. The questions focus on each woman's political background, her leadership views, and

her attitudes regarding specific policy issues related to Latinos, such as the DREAM Act, immigration, SB 1070, women's rights.

As mentioned earlier, the case studies were selected on the basis of whether they were recently elected or have served since the 1990s. In the 1990s, we can presume Latinas faced more obstacles since Latina elected officials were very few and many were the first Latinas elected into office. In contrast, in the 21st century Latinas have had more visibility, acceptance and support from non-profit organization and political groups such as NALEO, LULAC, and political parties.

The decision to use a case study approach allows a deeper analysis into the lives of each of our cases. At the end, this study will contribute to the research on Latina politics, and serve as a replication of "Politicas". The overall objective is to draw similarities and/or differences among these women.

Literature Review

The literature on Latina politics explores various facets. Some studies focus on Latinas and campaigns in U.S. electoral politics, or on Latinos in general. For instance, *Politicas* (2008), was in many ways a pioneer of Latinas studies, specifically on Latinas in public officials in the state of Texas. The authors were some of the first to first attempt to address this research question. Their objectives consisted of presenting an overview of Latinas' participation in electoral politics, provide case studies of specific Latina public officials in Texas and contribute to a theoretical frame work on Latina politics (Garcia, et. al 2008). They focused that Latinas in their study would demonstrate a strong cultural identity as well as a focus or emphasis on policies that assist families and Latino communities. "Latinas are more likely to develop policy priorities and direct their activities to the needs of women and families, and their particular ethnic communities" (Garcia, et. al p.10). Their findings consisted of providing a clear evidence of the integral role these Latinas as the first generation in public office. In regards to running for a political office, they found that "some were exposed to political campaigns or political issues early in their lives. Some were raised in politically active families, while others were not political until they ran for office" (Garcia, et. al p.130). Latinas in their studies were not socialized to consider running for office or have political ambitions. The decision to run was first initiated by community representatives, colleagues, friends, and families. As found by the authors, the support of the family and spouse was crucial in deciding to run. In regards to leadership the authors found that "Latina leaders have a propensity for building consensus, inviting participation, and empowering others" (Garcia et. al p. 132). In their last area of inquiry in regards to advocacy roles they found that these women have "demonstrated a propensity to advocate for women and families" (Garcia et. al p.132).

Another article that examines Latina public officials is in an article entitled, "Latinas in Legislatures" by Casellas (2011). It analyzes the circumstances under which Latinas are elected to state legislatures throughout the United States – in states like Arizona, California, Florida, New York, New Jersey, New Mexico, and Texas. His emphasis focuses on the successes of Latina elected officials in these states and investigates possible reasons that contribute to a Latina being elected or appointed to office. Through interviews of Latina legislators, Casellas found that "women talk more about building networks and connections for the community" unlike men who speak more about winning elections and have ambition to move up the political ladder (Casellas, p.176). In his findings, Casellas refers to Reingold (1996) stating that those attitudes of Latinas reflect to a certain

extent their leadership styles: research shows that women legislators tend to behave less hierarchically than men.

Garcia's and Marquez's piece (2001); "Motivational and Attitudinal Factors Amongst Latinas in U.S. Electoral Politics" contributes interesting insight into the motivations of elected Latina officials. They answer the critical questions as to why Latinas get into politics and what do they perceive of their own leadership. The article notes the participants are political elites, with some who have been around for good deal of time while others more are recently involved in the political arena. The authors begin with a look back at how Latinas have had a steady rise into politics as they had assistance through their early organizations and political action committees. Now Latinas are bringing with them their own unique vision into politics. A vision described along the lines of being that, "Chicanas are able to transform traditional networks and resources based on family and culture into political assets and action" (Garcia and Marquez, p. 4). This is made more apparent as we see the top reasons the Latina participants ran for office. Garcia and Marquez list them, "1) to elect particular candidates; 2) to see people like themselves involved in politics; 3) commitment to their community; 4) to give something back to the Chicano/Latino community" (Garcia and Marquez, p. 7). This is in stark contrast with reasons men would have for seeking office. If we are to measure the impact of Latinas in American politics we have to take notice of the shifting motivations our leaders are developing against those from the past. Again and again the article refers back to how these Latina leaders are bringing with them a higher priority in giving back to the community unlike before. It highlights a potential shift away from individual careers and more towards service-oriented legislators. It would be important to ask the representatives in my study if they too held "giving back to the community" as one of their top priorities. My study will further add to the growing trend that Latina leaders are moving away from the traditional reasons why they run for office.

Having studied the motivations of Latina officials, it is worth looking into the perceptions of Latino and Latina officials. Pantoja and Segura (2003) wrote an article entitled, "Does Ethnicity Matter?" They explore the impact of political alienation, especially for Latinos. The authors ask and investigate the question of whether elected officials, who follow in line with descriptive representation, help diminish some of the political alienation Latinos may feel. In other words, would a fellow Latina or Latino representative make the person feel less inclined to think government does not work? As the authors describe, "the belief that government officials are violating longstanding norms or rules in an effort to serve some narrow interest" (Pantoja and Segura, p. 2). Unlike other articles, this one seeks to portray more of the psychological effect Latina and Latino officials would have on their constituents. What they found was that Latino officials actually do help minimize political alienation from appearing within the population. "The result is a constituency more empowered to participate in politics" (Pantoja and Segura, p. 4). This was evident as they compared the result of constituents with Latino representatives and those who did not have Latino representatives. The more representatives a person has belonging to his ethnicity, the less likely he or she will feel alienated. However the authors found that the effects are not as significant as others claim. The authors state, "The total effect of co-ethnic representation, however, is not as large as several other important predictors" (Pantoja and Segura, p. 10). The most influential factor was the political knowledge a person had. The more an individual knew about the political system, the less likely he was to believe in it. These other factors could then in turn absorb what effects Latino officials may have on their key constituents. It brings into light the impact Latino and Latina public

officials have in their communities.

Another article that examines Latina and Latina public officials is the article by Fraga et. al (2009) called, "Gender and Ethnicity: Patterns of Electoral Success and Legislative Advocacy Among Latina and Latino State Officials in Four States." The authors note how this current time is one where women and [people of color] have never been more prevalent in public office than ever before. As a result, they seek to ask the important question of how much have women of color progressed in politics in contrast to their male counterparts? This article examines the gains made by women of color within the select states, specifically for Latinas. The article goes on to make important findings between California, New Mexico, Arizona, and Texas. It delves into the unique behavior between Latinas and Latinos. The article starts by displaying certain distinctions between Latinas and Latinos. "Latino men define politics in the conventional terms of political positions, voting, and elections. Latinas by contrast, view politics in a much broader sense" (Fraga et. al, p. 6). The article also measures the patterns of women versus the patterns of Latinas. What they found was that the successes of women did not necessarily translate towards Latinas. The authors state, "Ethnic representation tends to increase as house and senate districts are comprised by higher percentages of ethnic voters. The concentration of women voters does not occur" (Fraga et. al, p. 10). However, Latinas rising rates in office have sky rocketed compared to that of women. Getting into more of the actual contributions Latinas have to bear, the article progresses further into how Latinas approach politics differently from Latinos. It revealed that Latinas had a different set of important duties to their office; they were committed to multiple groups, and were more willing to compromise. The piece also reflected what other officials thought of the impact from their Latina counterparts highlighting increased coalitions, greater influence on considering minorities, and expanding priorities on the agenda. It is not to say that Latinas and Latinos do not have aspects in common with one another. The article stresses that Latinas enter into office bringing with them the motivation of what to do for the Latino community rather than women issues, similar to the men. However the article also shows that Latinas are building a record of bearing a productive legislature introducing more bills in regards to their priorities and being a part of committees related to their issues of concern. This article provides a good deal of important information, providing a general picture of what Latinas offer to American politics. It will be useful to compare this information to that of the representatives in my study. It might not provide much information beyond that but it helps set a foundation and helps leave room where to possibly build on in terms of areas not as well documented in this article.

Having considered the motivations of Latina officials, their perceptions, and their impact in politics to a degree in the previous articles, Fraga and Navarro (2007) offer two unique views of the evolution of Latinas in politics. The work is called, "Latinas in Latino Politics" and it examines Latinas' role in politics through two categories. The first category is comparing Latinas and Latinos to each other. What they found was that in the public, Latinas are more predisposed in the Democratic while Latinos are more predisposed in the Republican Party. Though when it came to public views, both Latinos and Latinas share similar views on the issues and their level of participation was generally the same though it varied on the source. The one where they drew the line was in relation to women's place in society. In the next category, the authors examine Latinas was through the lenses of what they call the "prescriptive possibilities." They examine feminist writings from Latinas and their growing potential models of leadership. Fraga and Navarro found a

great distinction in Latina writing during the time of the early 60s to the 70s and the more modern age of Latina works. In the earlier writings, they notice the literature of the day consisted of subjects relating to defiance against the discrimination and stereotypes Latinas face in regards to race, class, and gender. "It was a bold move for Latinas to reject the role restriction placed upon them and even stronger step to suggest that the "triple oppression" (Fraga and Navarro, p. 190).   It is the Latina that holds the family together and handles the difficulties that come to the family. In essence these works were a product of the Chicano movement as Fraga and Navarro put it. In later times, Latinas are looking to redefine their own role in society towards one as an active agent within the community. Latinas work to understand their experiences and identity, then afterwards, "taking that understanding and mobilizing it toward creative and revisionary efforts for making social change" (Fraga and Navarro, p. 191). This article is useful in that it provides a sort of historical context of where Latinas come from and where they are today, both by comparison and individual analysis.

Another article that examines Latina and Latina public officials is the article by Matt Barreto (2010), "Assessing the Role of Shared Ethnicity in Latino Political Behavior." The authors attempt to add further research into how Latinos politically behave in response to Latino candidates in office. Despite Latino political dynamics changing greatly over the decades, little has been documented in regards to ethnic identification influencing Latino voter behavior. Barreto brings up the point that earlier attempts to answer this question were theories with little empirical evidence and had not sufficiently incorporated ethnicity to be accounted for in the research. Their answers were that group identification did not necessarily influence the voting behaviors of Latinos the way it is for African Americans. In essence, it said that a Latina/Latino candidate did not give the drive to motivate Latinos to go out to vote in a particular fashion or numbers. However the author mentions that these studies reflect the Latino political landscape back in the days when there were hardly any Latino candidates let alone Latino officials. Because of this, there could not have been much a driving force for the Latino community to adhere to. It is not necessarily so in our time and calls for a more careful consideration into the matter. Barreto takes extensive measures to make sure his research helps isolate the effects of ethnicity and not say partisanship. Building on the current model of Latino political behavior, he offers two improvements. He states they are, "(1) Controlling for the presence of Latino candidates; and (2) accounting for shared ethnicity as a mobilizing factor" (Barreto, p. 6). In the end the author develops two theories throughout his study. The first is that Latino candidates do indeed increase participation among those of similar ethnicity and the second is that Latinos help devote more resources to ethnic communities. As a result, the elections involving Latino candidates become, as the author describes, a "mobilizing force" for Latino political participation. Despite the grand diversity among Latinos, Barreto points out that Latinos share four common traits. He lists them as being Latin American Heritage, immigrant experience, Spanish language, and Spanish colonial influence. Clustered together in cities where nationality matters less and less, Latinos will unite more together as they are faced with discrimination and a desire to be heard. He accumulates good sources for understanding ethnicity as he distributes questionnaires to people with important key questions to help highlight ethnicity's impact. In addition he interviews actual elected officials to see if the results matched with what they saw in their communities. This article can be useful in that it offers a more in-depth analysis into the effects of ethnicity on the population and checking the claims with public officials as well. It offers insight into whether representatives similarly draw out larger turn outs and if they

too have focused their resources on Latinos communities as author stresses a great deal of research is still needed into this subject.

Fraga writes another piece (2005) entitled, "Strategic intersectionality: Gender, Ethnicity, and Political Incorporation." In this article, the author attempts to answer the central question of whether Latinas play a more effective role in being working class advocates than Latinos. Fraga finds that Latinas are better advocates and believes this to be because of what he calls, "strategic intersectionality." This concept is the combination of three areas Latinas are believed to have leverage in the political arena. They are substantive policy focus, multiple identity advantage, and gender inclusive advantage. Substantive policy focus is the reasoning that Latinas focus more on the substance related to policy of interest to the working class. Multiple identity advantage states that as ethnic women, Latinas are better positioned to help build coalitions to attain legislative support. And with gender inclusive advantage, it states that Latinas have more opportunities to "soften their ethnicity" being women and mothers for the community. The author is not trying to say that Latinas are supposedly superior in some sense, but rather to highlight the opportunities they have open to them that other officials would not bear otherwise. In terms of the first reasoning behind Fraga's hypothesis, he found that Latinos and Latinas did not substantially differ when it came focusing on policy substance. Fraga writes, "We find that there are not meaningful differences in the policy priorities of Latina and Latino legislators" (p. 14). Latinas were not that much more successful, and sat the similar committees. As for multiple identity advantage, there did seem to be a certain amount that backed this theory. For certain groups Latinas were sought for advice on matters over their Latino counterparts. "Relative to Latino legislators, Latina legislators are asked for advice from African American male legislators and Asian American female legislators at higher rates that are statistically significant" (Fraga, p. 16). For the last reasoning there was a degree of evidence for gender inclusive advantage. No matter what the shape the constituency, Latinas still held to their gender interests more than Latinos. Fraga writes, "Latino majority and non-Latino majority districts, Latina legislators indicate a propensity to identify with gender more strongly than constituency or ethnicity" (p. 18). The picture that comes out of this is not entirely a clear image but a complex one that shows the behavior and potential Latinas have in politics. This can be a very useful article in that it helps break down and classify what key areas Latinas have a specialty of employing in politics and that can be seen. The article is fairly well balanced and accepts the results coming up short from what his initial hypothesis claimed.

Moving from a general understanding of Latinos, Frederick (2010) writes an article more in line as a case study titled, "Practicing Electoral Politics in The Cracks." Frederick attempts to map out the politics of Latina officials. Being someone who represents three oppressed groups, the political arena places Latina officials, as she describes, between the fault lines of these three identities in terms of race, gender, and class, hence the title. In order to answer this question, she spends four months in observation of a Latina candidate running for city council. During her time there, she notes of how these three identities are critical to understanding the political strategies of Latina officials. She underscores how previous research related to women in politics combined all women together as if they were one unit. Frederick writes, "The feminist political agenda has focused too narrowly on issues that are of greatest concern to white, middle-class women and their families" (p. 4). Scholars have gone in several directions and have done little to account for the actual contributions the identities play in Latinas' behavior. In this research she seeks to see how all three interact with one another. Her reasons for following a campaign are that while

surveys are valuable they do not track what the candidates are doing themselves, which is critical. She decided to follow the campaign of Ana Estrada for Hamilton city council. The author started out by looking at her issue platform and seeing how that differentiated from others. What she found was that the issues Estrada covered focused not just women but a broader constituency. As Frederick writes, "Estrada addressed "woman-friendly" issues, but emphasized her commitment to poor and working-class women, reflecting an intersectional consciousness" (p. 11). A great deal of her focus centered helping to alleviate economic hardship and that touched upon all three areas of her identity. When it came to framing her message to the public she found that Estrada used important images to touch to her base. For example, Frederick writes, "The use of the color pink in the logo, a color that is most closely associated with femininity" (p. 13). Her dialogue revolved around the use of the word family which had an impact on all three groups not just one. It was different compared to the male campaigners. In her last segment, she found that in voter mobilization was not influenced much by these identities. Listening to her political strategists, she incorporated a plan that targeted frequent voters. These voters tended to be white. For a majority of the campaign she focused her resources on white women and men away from the Latino community. This was the result that Latino voters simply did not come out in big numbers. In the Frederick made the point that intersectionality can be emphasized as well as downplayed in Latina politics and that more research is need for this area. This article is useful in that it gives a more live account of how a Latina acted on the political scene versus just from a survey. The only limit here is that this is just one campaign and we can only take the information to mean so much.

Moving on from Frederick's case study, Fraga (2003) explores state differences more in depth in his article, "Gender and Ethnicity: Political Incorporation of Latina and Latino State Legislators." Fraga uses a great deal of his previous research to note the differences between Latinos to Latinos, the gains they've made in public office, as well as their views. What was different about this work was that it delves into differences among the various states. He wrote the history with regards to the individual states which helps us better understand the representatives coming from each district. Moreover, he compares the states against one another, especially California and Texas. He describes them as such, "California is a state that is known for its extremes in politics as it is known for its extremes in lifestyle.... the Texas political context has had few institutional changes since the passage of its current state constitution in 1876" (Fraga, p. 9). In some cases they bore similarities and in others had their differences. As Fraga describes, "Between those serving in California versus those in Texas in the 2001 legislative session. We discovered more similarities than differences" (p. 15). He did not mention Arizona or New Mexico in too much detail unfortunately. However the distinctions and similarities he draws here with the other two states is valuable in breaking down our analysis of Latinas in not just a broad context but in a state by state study as well.

The next article written by Carroll (2004) known as, "Women in State Government: Historical Overviews and Current Trends" depicts the history women have had in state government and their increasing numbers in politics. Sadly however, the increases have begun to stagnate over the years and are no longer rising at the rates they are. As of right now the one good news she mention is the fact in terms of high positions like governor, women are actually doing well. A good portion of her article is dedicated to the past but there is some good insights that may help with our research. In terms of current trends she notices some patterns in regards to women. One example she says, "seven of the states with the largest proportions of women legislative leaders rank among the top ten

states in the proportion of women legislators" (Carroll, p. 5). It would be interesting then to see if Latina leadership functions in similar fashion in our two states of study. One other aspect Carroll touches is the need for women to require more motivation to get into politics than for men. As she says, "Women more often than men seek office only after receiving encouragement from others" (Carroll, p. 6). It may be worth to ask our representatives if they too required extra encouragement and see if that plays into Latina politics or is just for women in general. This article does not offer too much else information as it is rather short and spends most of its pages on the historical numbers of women in office. Beyond that it may best to shift to another article for better substance.

Another work that adds more to our study is Geron's piece (2005) entitled "Latino Political Power." In this article she makes reference to the rest of her book which stresses how Latinos have transitioned from a disenfranchised group to political leaders and how these leaders have built their relationship with their ethnic communities as candidates and officials. She starts out with a history of how Latinos have fared in American politics. Only recently have Latinos been able to make significant ground as the political landscape has changed due to several factors. As Latinos step into office though, they are not all the same. One problem which Geron points out is that there is no one universal agenda set by Latinos. "While they recently became the nation's largest minority group, they are not a homogenous political voting-block" (Geron, p. 12). While there has been a consistent trend of differentiation among Latinos there is a growing Latino politics according to Geron. The author notes of the growing trends among Latinos in greater detail than she had already. There has been significant electoral success for Latinos, especially in areas that have blocked Latinos from participating for various reasons. Geron writes, "Politicians ran historic campaigns for mayor and nearly won their elections in three of America's largest cities and were successful in numerous other cities" (p. 9). Even in important areas around the country Latinos are making good strides in elected offices and holding their ground too. With many Latinos still experiencing poverty across the nation, Geron notes it is not enough to have a symbolic victory but a substantial one as well with these elected officials. Sadly as she writes, among some lines of thought Latino officials have been helpful only recently as they had small numbers and little leadership role in the legislature. In the later part of the article, Geron delves into the multiple methods Latinos have used to gain political power within the system. Geron lists these methods as being, "(1) demand/protest, (2) nonconfrontational political evolution, (3) legal challenges to structural barriers, and (4) coalition politics" (p. 14). Their effects and use have varied to certain degrees in the Latino community depending on the location. She writes, "Latino political incorporation efforts have historically used all of them in small towns, medium sized cities, major urban centers, and state houses of government" (p. 15). Near the end she notes several theories developed out there offering their predictions into what significant change can Latinos in state legislatures make in the future ranging from very influential to none at all. A great deal of the piece leaves the impression this article was more of an introduction to her book rather than its own piece to offer a lot of insight into Latinos in politics. While this article does not widely stretch into unknown territory already explored by previous articles, it still adds onto the previous works with insights into Latino's methods and their gains made in specific areas around the country.

Expectations

This paper will examine the similarities and differences of Latinas elected officials in the states of Texas and Arizona, on their biographical background, leadership views and

their views and or positions on political issues. Thus, the expectations are that the Latinas that are being analyzed and interviewed will have little or no previous political experience and experience similar obstacles in running for office. Secondly, they most likely began their careers by being involved in grassroots organizations focusing on communities and/ or have worked on other individuals campaigns at the local level. They may have views on leadership that are inclusive and have strong ties with their community. Lastly, in regards to advocacy issues they may be sympathetic on issues related to immigration and women rights.

Methodology

Unlike previous literature on Latinas politics, I will rely heavily on interviews to compare the experiences of Latina State Legislators in two states. By using interviews, I will be able to draw a deeper understanding in the personal obstacles they faced when running for office, their leadership views, and positions and/or view on advocacy issues that are affecting their community – some of this information that at times cannot be found using secondary information.

As mentioned earlier, each case study was selected on basis that the Latinas are currently serving in the state legislature in the states of Texas and Arizona. These 4 Latinas were selected because they are currently serving in their respective legislature, and have been serving from either the 1990s or from 2000 - present. The Latinas were initially contacted via fax or via e-mail with an invitation to participate in my research. The interviews were conducted via phone for approximately an hour of length. The questions are drawn primarily from an existing interview instrument from the book by Garcia et al. (1997), "Politicas – Latina Public Officials in Texas". The questions focus on each woman's political biography, leadership style, political socialization, policy issues such as Immigration and the DREAM Act. A secondary analysis of previous work was used in order to obtain unique information from the growing literature on the subject of Latina public officials.

Within my interview with the subjects, I primarily focus on their views on leadership and advocacy positions. The interviews with each Latina will give me the benefit of personally speaking to them and assuring accuracy through instant clarification. I will be able to incorporate their rich background history and further understand if their background/heritage has impacted their leadership in any way.

The two States were chosen for three primary reasons. First, these states have a significant percentage of Latinas and Latinos and most Latino and Latina public officials come from the Southwest. Second, these states are appropriate for understanding the role Latinas legislators play since they are states that have had the longest sustained presence of people of Mexican descent. Lastly, all these states are within close proximity of each other.

The Latina Legislators

It is important to note for purposes of this research paper only State Representative Veronica Gonzales (Texas) and State Representative Sally Ann Gonzales (Arizona) interviews will be incorporated.

State Representative Veronica Gonzales is serving her third term in the House of Representatives representing District 41, which is contained entirely in Hidalgo County and includes portions of McAllen, Edinburg and Mission. According to Representative Gonzales her District has a population of Latinos of approximately 80%. She is the first Latina elected to represent District 41. She currently serves as Chair of the Border and

Intergovernmental Affairs Committee and is serving her second session on the Public Health Committee. Representative Gonzales was raised in San Marcos, Texas. She was the first in her family to go to college. She received her Bachelor of Arts degree in English and Spanish from Texas State University. She earned her Doctorate of Jurisprudence in 1991 from the University of Texas School of Law. In 2008, she was recognized as a Super Lawyer by The Texas Super Lawyers and as an "Extraordinary Woman in Law" by Texas Lawyer (Texas State Legislature).

In her election of 2004, Rep. Gonzales challenged incumbent Roberto Gutierrez (D) and Jim Selman (D) in the primary election. She received 49.46% of the votes in the primaries. In the Democratic Party primary runoff election, she defeated former State Representative Roberto Gutierrez by receiving 70.98% of the total votes. In the general election she ran unchallenged (Texas Secretary of State).

The decision to run for the State Legislative seat, according to Representative Gonzales was "accidental". She was first approached by her partners from the Law firm to encourage her to challenge the incumbent who in her view was "no longer doing his job". "We needed somebody else in that position." Representative Gonzales stated. Surprisingly, Rep. Gonzales faced several obstacles in running for office. Even today, being a woman, especially a Latina has many implications and barriers when running for a public office. She expressed that although she did not have children and was single at the time; she faced other barriers, such as, having a financial toll, since she had to go from a private job to being paid by the State. She stated that for many women it is a question of "Can I afford it?" besides any cultural barriers. However, she confirmed that it is a "very rewarding job though, you learn a lot from so many different areas, meet interesting people, learn how laws are made – you can really make a difference in people's lives". However, once in office, the obstacles do not vanish. "It is still very much a men's world", Representative Gonzales stated. She voiced that it is hard if you are a women, but it is particularly harder if you are a women of color –"there is still stereotypes that women don't belong in political office."

With regards to her views on leadership, she commented how she views her own leadership qualities. "I like people, I think I am easy to approach, I think people know they can come to me to pick my brain and give me their ideas. I work hard…can relate to all kinds of people whether you are black or white, wealthy or poor." Her views on leadership consist of acknowledging that it is significantly hard for women to get involved in leadership roles. Culture plays an important role since women, in some cultures, are still expected to be a housewife and the men are the bread giver. She suggests that a way to move away from these barriers is to get educated because many Latinas lack education; they don't finish school and/or not continue into higher degrees and professional fields. However, she understands that life gets in the way – children, taking care of husband, or "feeling the guilt of leaving parents and/or siblings". "Men are expected to be leaders and get involved- women are not," she stated.

When asked about the issues that Texas and her community are facing, Representative Gonzales responded with education being the top concerned closely followed by Health Care, job creation and immigration. Her legislative district is considered an impoverished area. Eighty percent of the residing people in her district need Medicaid, suffer from obesity and/ or diabetes – to name a few. She believes job creation is important "since there are many individuals in need of jobs". She believes that her district in particular can relate to immigration because they all have relatives, they see Latinos

every day crossing the border which makes them more sustainable in understanding their problems and sympathize with them. "Non-Latinos do not have the same knowledge and emotions", she stated.

In the state of Arizona the individual that I am analyzing is Representative Sally Ann Gonzales. Mrs. Gonzales was born in Brawley, California and raised in the Yaqui community of Guadalupe, Arizona with ten sisters and brothers. She holds a BA in Elementary Education from Arizona State University and a Masters in Multicultural Education from the University of Arizona. She was first elected to the Arizona House of Representatives in 1996. In her Primary Election of 1996, she received the second highest amount of votes with a 29.1%. However, in the General Election she obtained the highest percentage of votes out of the three candidates with a 43.1% of the total votes (Arizona Secretary of State). She represented Legislative District 10, which contained Pima County. During that time she served on the Appropriations Committee and the Government Operations Committee. Sally sponsored and/or co-sponsored legislation to improve the life of women and children through education and health care for all as well as legislation for foreign language instruction, teacher salaries, and maternity benefits.

In the period of 2000-2010 Representative Gonzales did not hold a seat in the State Legislature. However, in 2010 she decided to run for the legislative seat of District 27. This district encompasses downtown Tucson and points west and includes the University of Arizona. Much of western Pima County that is not part of the Tohono O'Odham Nation is part of this district, as are Saguaro National Park (West) and Tucson Mountain Park. In her 2010 Primary Election she ran against eight other candidates and received the majority of votes with a 17.09%. In the General Election she again defeated her opponents by receiving 33.24% of the total votes (Arizona Secretary of State).

Representative Gonzales decision to run for the State Legislative seat, according to her, was through her teaching at a district that ignored the voices and opinions of many. "I noticed we didn't have representation, there weren't listening to us," she commented. Her political career began earlier on. From June 1992-1996 she served in the Tribal Council of her Yaqui tribe, which she is a member of. Her uniqueness of running for State office two completely times, first in 1996 and later on in 2010, bring fresh insights on the obstacles Latinas face when running for a political office. "I had no money, I went into debt when I ran for office," she responded when asked about her obstacles in first running for office. She shared that in her most recent election, although she still faced many obstacles such as being in an environment where there is still a stigma that women do not belong, this time she had grown children who encouraged her along with her husband.

In order to demonstrate that even once in office, obstacles that Latinas faced do not end. "My story as in the way I get treated in the State Legislature. People say that there is no discrimination. That is definitely not true because I get discriminated against every day of my life – because I am a woman, because I am an Indigenous women and Latina. And because the way I look, brown skin and black hair."

On the topic of leadership views, Representative Gonzales shared her own leadership qualities that she sees in herself. "I'm vocal! I bring up issues that people do not want to talk about, I listen, and I speak out on the needs of my community. My priority is my constituents." She continued her discussion on leadership views by stating that cultural beliefs could still play a role since women are expected to be at home and take care of children. "Is it how I look, my outfit? I dress professionally but at times I would wear my Indigenous clothing," she stated in regards to the criteria for being a leader and being a

Latina.

In regards to policy attitudes, Representative Gonzales communicated the pressing issues facing Arizona and her community. Education and Health Care are the top issues in her community, as expressed by her. She stated, "I believe in equal education to everyone, I still don't think it's happening, look what happened with ethnic studies here in Arizona." "Education can give us a healthier way of living." For Representative Gonzales it makes sense that if education is equal and good quality education is accessible to everyone than people would most likely live healthier lifestyles. In relation to immigration, Representative Gonzales thinks that "the U.S. congress needs to do something about immigration and the DREAM Act". Half of her "tribe still resides across the border in Mexico and the ones currently in the U.S. were crossed by the border and were here prior to being part of the U.S.," she exclaimed. She continues her efforts in support of such issues by speaking very vocally about them even in her own Caucus.

Preliminary Findings

Through conducting the interviews with both Representative Veronica Gonzales (Texas) and Representative Sally Ann Gonzales (Arizona), a comparison analysis in regards to their political background, leadership views, and advocacy roles was reached. Although both Latinas, they have a unique difference in their heritage. Unlike Representative Veronica, Representative Sally was raised in the Yaqui Tribe. In her interview she shared how until recently she would not identify as a Latina but rather as an Indigenous Yaqui woman. However, recently it was brought to her attention, that she was in fact also a Latina which she now proudly accepts as one of her identities. Despite both having a different biographical background both women faced similar obstacles when first running to office and once being elected office. In similarities, they both compared in having a financial toll when running to office, they did not have name recognition, and therefore, it was difficult for them to fundraise.

As expected, both women are deeply passionate about serving their communities and fighting to give a voice to their constituents. They demonstrated the leadership skills of a servant of the people and for the people. Part of the motivations to run for office was just that – to serve their people whom they felt were not being represented adequately. They both advice young Latinas wanting to pursue a political career to first begin at a grassroots level, to learn how to fundraise, and to just do it – go for it! They both emphasized that education is the key to obtaining great leadership positions where you can accomplish your dreams. During the course of the interviews it was found that these women have strong ties to their family and community which impacts the way they lead.

Their similarities continued on their views and roles in advocacy issues. They had in common having education as a top concern both for their communities and perspective State. Health Care and immigration closely followed behind.

Another area of inquiry that was addressed was their views on women rights. They both responded very passionately with a strong belief that women should be able to decide their own paths. "The law gives the women the right to choose. We should not decide what they do with their bodies," expressed Representative Sally. "This is why we need more women in office because we don't want men making decisions that deal with our body or say who we can marry," Representative Veronica expressed.

The strong passion they possess to advocate for immigration, shows through the active roles they play on this issue; such as preventing hateful legislation from passing to being a strong voice in speaking out against such legislations.

Conclusion

       It is fascinating to note the difference in the time periods these Latinas first ran for public office, one in the 1990's while the other in more recent time – 2010. Representative Sally had the opportunity to run at those two different times – however, she still faced many of the same obstacles. Another aspect to note is the difference between the Arizona and Texas State Legislature. Unlike, Texas whose legislators work part-time during each session, Arizona legislators work full time each session they serve. These Representatives are leaders within the Latino community and have taken upon them to provide opportunities for young Latinas aspiring to be political leaders.

Appendix A

Interview Instrument

<div align="center">POLITICAL BACKGROUND</div>

1. When were you first elected?
2. As far as you know, were you the first elected Latina in your District?
3. What is the percentage of Latinos in your Legislative District?
4. How did you first become involved in politics (was it a particular event, specific people or groups, specific issues or causes, certain role models)?
5. Why and how did you first decide to run for (the office you currently hold)? What do you remember most when you first ran for (the office you currently hold) and got elected?
6. Running for public office involves various considerations. What kinds of factors did you have to consider in running (for the office you currently hold)?
7. Being elected in _____ would you say there are still barriers facing women, and in particular Latinas, interested in running for public office? If so, what are the three biggest barriers facing Latinas interested in running for public office?
8. Are you a member of any Latina-based organizations? Which ones? If so, did this (these) organization(s) have any influence in your decision to run for (the office you currently hold)?
9. Overall, based on your personal experiences, what is one piece of advice that you would offer to a Latina interested in running for public office?

<div align="center">PERSONAL SUCCESSES</div>

1. We have collected information about your life experiences and from your service in public office (secondary information); are there any other important life experiences or accomplishments that we should know about?
2. What would you say are the top two accomplishments as a public official that you are most proud of?

LEADERSHIP

1. What do you think makes a good leader?
2. Which two people do you consider good leaders?
3. What leadership qualities do you see in yourself?
4. As you know, there are few women political leader and even fewer Latina leaders; why do you suppose that is?
5. Do you think the criteria for being a leader are any different for Latinas than other women, or than Latinos? If so, what is different? Why do you suppose that is?

POLICY ATTITUDES AND IDENTITY

1. Given that there are many pressing issues in Texas, Arizona (discuss the issues in the state that applies to you) and community, which three policy issues do you think are most important for women? For Latinas specifically? For all Latinos? Please explain.
2. Recently, immigration has been on the agenda in the Texas, Arizona Legislature (discuss the issues in the state that applies to you), what are you views and positions regarding immigration? Specifically the DREAM Act?
3. What active role, if any, have you played in regards to this issue?
4. Another issue that impacts Latinas are women's rights, what are your views and/or positions?

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Search and Restore

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Abstract

      In recent years computer networking and the growth of the Internet has provided global communication to personal computers, mobile devices and wireless technology that have various storage capabilities. This is one factor that has put a strain on investigations when it comes to examining digital media in the computer forensics field. Computer forensics is the process of using scientific knowledge to identify, preserve, recover, analyze, and present documentation of computer evidence discovered. For the most part Computer Forensics deals with the recovery and analysis of hidden evidence. Analyses consist of making a computer forensic image copy of the original data without tampering it and conducting various searches, including text string searches. Current forensic search tools use algorithms and/or database technology that give results with improper filtering and no arrangement,which can lead to a large percentage of irrelevant "hits" to the investigation. This research tries to reorder the "hits" so that an analyst can get to relevant information faster.

INTRODUCTION

In recent years computer networking and the growth of the Internet has provided global communication to personal computers, mobile devices and wireless technology that have various storage capabilities. Simultaneously, the people committing crime(s) are getting more advanced and opportunity for electronic crime increases. A digital investigation of an electronic crime can have numerous files and critical data being compromised that can be in large hard drives. When preserving evidence creating a bit-stream image, forensic copy, will assure everything on the disk is saved. Analyzing these large hard drives is time consuming, and this is why with Digital Forensics being an emerging new discipline, improving on current digital investigation process framework is necessary. When applied, the digital forensic science discipline will be a critical need in law enforcement to ensure the reliability during an investigation.

A part of the computer forensics investigation is the analysis phase. This consists of using computer forensic tools along with training to constantly create accurate, repeatable, and unbiased test results. When time is a factor it is vital to use your resources to your advantage. Currently there are commercial license software applications that are specially tailored for the field of computer forensics. They might not allow the user to specialize features to their needs, and certain phases, that the user has no control, might take up to much time.

This research uses an alternative application to conduct research. Using an open source code such as The Sleuth Kit, allows for the researchers to integrate into automated forensics systems by using scripts to tailor a program to their needs and specifications. This software is free for use and modify as long as the user obeys to various licenses (C.Johnansson). The goal is to create a program to reorganize the text string search "hits" to improve investigator efficiency

LITERATURE REVIEW

What is now accepted as true forensic techniques were previously developed mostly for data recovery. There has been research to produce better information retrieval and search engine for web environment and hard disk (Lee, 2008). Previous research has suggested since digital forensic is a new field that it is notably behind in development then other developed fields of sciences (Beebe & Clark). One of the problems for today's forensics is that current research tools produce a high recall of "hits" that is irrelevant to the investigation. Another problem is that as technology improves in storage device, the capacities of these devices increase. When an investigator does analyses on a hard drive, this could take up to days to produce information to be sent into the database for further search procedures.

METHODOLGY

The goal of this research is to create a system that efficiently and effectively provides search results for analysis in computer forensics. Since the rise of Dot-Com boom in the early 1990's there has been great research in improving the quality of an effective search engine. As the digital forensics community evolves, so too does the range of unique problems faced by investigators, and it is with this in mind that digital forensic toolsets need to evolve at the same time and speed.

In the field of Computer Forensics there are two analysis tools used in a legal setting, and they are open source and closed source. Generically, open source refers to a program in which the source code is available to the general public for use and/

or modification from its original design free of charge, i.e., open.   Open source code is typically created as a combined effort in which programmers are permitted to study, change, and improve upon the code and share the changes within the community.   Closed source code/ proprietary software is licensed under legal right of copyright, and is not released to the public.   The proprietor is given the right to use the software under certain conditions, but restricted from other uses, such as modification, further distribution, or reverse engineering.   There has been debate between open source and closed source software, which include the topics of security, reliability, and support.   Each side has its pros and cons with no clear winner to the issue.   For this research we are focusing the open source code, The Sleuth Kit and Terrier.

The Sleuth Kit is a C library and collection of command line files and volume system forensic analysis tools (Carrier).   The Sleuth Kit can access raw partition device and extract files, from a image copy, that would normally be hidden.   For this research project the Sleuth Kit will be used to extract the data from an image file by the first process of the Sleuth Kit which is mmls, it displays the layout of the partitions in a volume system, and includes partitions tables and disk labels.   The mmls organizes partition table entries based on their starting sector and identifies the sectors that are not allocated to a partition.   Depending if the files are allocated or unallocated, the next phase will send appropriate files to either blkls or fls.   If files are unallocated then during this process blkls will list unallocated cluster numbers.   Then after blkls the information is sent to blkcat, which displays the contents of specified clusters, statistics on the image (unit size, file block size, flag and number of fragments).

If the files are allocated then fls will process this information to retrieve the directory contents and list allocated inode numbers.   Fls will also display file names of recently deleted files for the directory using the given inode.   In the next phase the information is passed to icat, the process opens the named image(s) and copies the file with the specified inode number and prints contents of specified inode to standard output. Then it is passed to unar, and unar will decompress/extract and compressed files in any format.   The next phase is readpst and it is a program that can read an Outlook PST (personal folders) file and convert it into an mbox and other formats to readable output.

The next step is Terrier and it receives these files, whether they are allocated or unallocated.   Terrier is use to index the data from The Sleuth Kit to count how many times each term occurs in each document in the image file.   With Terrier we can create filters to help us index strings in a computer forensics disc image (copy of hard drive).   One filter process is applying stop words, which are common words that have no important meaning to the investigation.   English stop words include a, of, it, and, can't, and numerous other words, and once this filter is applied the document being search can shorten the amount of strings (words) significantly.   Then the next search process goes to another filter of using stemming or stem filter.   The tool improves a search by trying to produce a root word by extracting prefix, suffix, and pluralization of a word.   An example would be the word "search".   From this word we can derive to other variations of it such as "searches", "searcher", "searching", "searched" and "searchable".   One document can have these variations of the word search, but once stemming is processed we are left with "search" for that document.   These two processes reduce the word count and produce meaningful words that are relevant to the investigation and reduce the number of "hits" in a search.

Once all this information has been through these processes, we are left with

significantly less but meaningful words that are relevant to the investigation. These words are then sent to a database to be saved and used to conduct text string search.

FINDINGS/ RESULTS

There are several methods and previous works to follow, and this research goal is to create an effective clustering process, and an effective hit ranking algorithm akin to the Google ranking process. Google use their patented PageRank algorithm to determine which pages are most common (Beebe). In order to come up with a Google process for digital forensics there are several tools already available and being used such as: Boolean queries, stemming, fuzzy, and Phonic search. With these tools and an algorithm, an advance analytical text string search system was created to decrease noise levels and reduce the high overhead of information retrieval. Using clusters should help with the text string search by allowing us to weigh and use term frequency on terms. Once these documents have been filtered then they saved into a database where then it could be used in a query as a vector, which is another algorithm. With a trail run clustered search did reduce overhead and there was a slightly increase in search time. With other digital forensic tools, algorithms, and methods there could be a significant improvement in this research then the leading commercial software available.

DISCUSSION

With computer crimes dramatically increasing there needs to be improvement in current computer forensic analysis. Current text string search methods are not suitable and have shown to create problems in large capacity hard drives. Other areas such as information retrieval also need to be developed for computer forensics to assist in the quest to produce an efficient and effective search analysis tool. This research is a step forward into creating an order to present the information in a tailored format so the investigator can get to relevant information pertaining to the crime.

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Being Human: Examining the Tradition of the Healer-Writer

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Abstract

If proper healing is to take place within the confinements of the ivory hospital, the eyes of a physician must see a human—not a disease. Physician-writers, William Carlos Williams and Robert Coles represent an alliance of raw analytical medicine and the delicate patois of the writer. Conversations with practicing physicians, published interviews with Dr. Coles, and correspondence from Dr. Williams obtained from the Harry Ransom Humanities Research Center reveal the restoration of the physician-writer focusing on the human.

Figure 1: Sir Arthur Conan Doyle, author of the Sherlock Holmes mystery stories

"When you follow two separate chains of thought, Watson, you will find some intersection which should approximate to the truth."

--Sherlock Holmes, The Disappearance of Lady Carfax

A poem can defeat distance and time because its written form functions like a time capsule for future generations. A healer tends to the wounded and physically interacts with people in the present. While physicians are bounded by the material world, poetry has no such boundaries. The restrictions of one are the liberations of the other; they are each other's counterparts. ***Restoring the tradition of physician-writer is essential to focus on the human.***

It may seem bizarre to relate the raw science of medicine to the delicate nature of language at first glance. We associate the term *medicine* with images of hospitals, stethoscopes, and a bunch of white coats. In this analytical world we imagine, it seems as though the examining rooms would be a crowded place for a poem, or novel, or even a play. Eras have elapsed and the thread tying medicine and language has been cut. The string is severed to the extent that medicine and language are seen as entirely disparate and contrasting entities. However, healing and language have been in alliance with one another since ancient times.
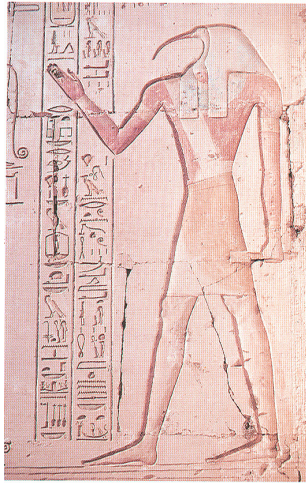
Figure 2: The Egyptian ibis-headed moon god, Thoth

Egyptians and Greeks made language into a science by gifting it the life force of a healer.

Beginning in the sandy dunes of ancient Egypt (3200-2400 BC), medicine was a branch of advanced scribal learning (Gordetsky and O'Brien 2009). The center of medical knowledge commenced in the Houses of Life. These Houses were centers within the temples, placed amongst libraries and archives (Gordetsky and O'Brien 2009; McClellan, Susan 2004). A House of Life is parallel to a contemporary School of Humanities where philosophy, history through poetic form, literature and important religious texts were taught. The medical students in these centers first learned to read, write, and copy manuscripts because "there was an intrinsic power to the written word" (Gordestsky and O'Brien 2009). The correlation between medicine and language was so deep that the Egyptians placed them under the same deity: Thoth, the god of the system of writing and medical science (Jayne 1925). For the Egyptians to have placed medicine and the written word under the same dominion means these two must be linked.

Figure 3: Asclepius, the god of Health and healing leans on a tree trunk lost in meditation grasping a scroll in representation of medical learning, which he received from his father Apollo, master of the sun, poetry, and medicine.

The Egyptians tend to have lots of Greek influences; Thoth is analogous to Apollo, the Greek sun-god of medicine and poetry. Apollo is an interesting case not only because he shares the dual-role identity of healer-writer but he also brings forth illumination by means of the sun. The idea of illumination in the literal sense is powerful because without the education of language, humanity resides in the dark.

Our fact-based modern world has the propensity to disregard the figures of mythology. But these gods were not always just mythology. To the Egyptians, Thoth was a living, breathing individual with superiority beyond the natural world. In Greece, Apollo was the god who started their day. With the rays of his sunshine, he kissed the earth good-morning. From our ancient predecessors, modern man can learn that language is more than just words on a page.

An example most people will recognize of a healer-writer is Sir Arthur Conan Doyle, the author of the Sherlock Holmes mysteries. Dr. Doyle was trained in Scotland at the University of Edinburg obtaining his medical degree and later specializing as an Ophthalmologist (Carr 1945; Stashower 1999).

Receiving his training from the famous holistic diagnostician, Dr. Joseph Bell, Sir Conan Doyle employed this holistic approach as a means for his detective-hero, Sherlock Holmes, to solve even the most difficult of crimes (Carr 1945; Stashower 1999). This was in part because solving a crime and diagnosing a patient require a close understanding of the whole human being. Although Sir Conan Doyle eventually abandoned medicine for writing, his detective stories display the tradition of healer-writer by keeping the narrative of the clients a crucial part of his investigations.

In the mystery, *The Red-Headed League,* Sherlock Holmes sets out to discover

why this league of red-headed men has suddenly vanished, leaving behind, Jabez Wilson, Holmes's future client, unemployed. Wilson comes to Holmes with hopes of reuniting with his well-paying employers. As the mystery unfolds and the back-story to each character is being exposed, one story in particular becomes crucial to Sherlock Holmes—the narrative of Wilson's assistant, Victor Spaulding. Holmes recognized the suspicion of Spaulding's spontaneous arrival in town just a month before the ambiguous affair began. With this knowledge, Holmes concluded there was a correlation between the Red-Headed League and Wilson's assistant, Spaulding. As always, the clever detective was en point; the Red-Headed League and the shady assistant, Victor Spaulding, were nothing but a con. Sir Conan Doyle employs the example of Spaulding as a paragon to relate how the least suspected person is most likely guilty. This example also depicts the implicit value of the writer to the healer because much like Sherlock Holmes, a diagnostician must investigate the culprit of the ailment; and as illustrated in The Red-Headed League, the simplest thing reveals the whole picture.

In 1883, American poet William Carlos Williams was born; adding to the long line of other healer-writers. Dr. Williams practiced medicine in the ghettos of New Jersey among the poor and continued both his medical practice and writing throughout his life. Being reticent about confessing the dependence his both professions had on one another was never an issue for Williams (Halioua and Ziskind 2005; Jones 1997). Analyzing William Carlos Williams's personal correspondence with a dear friend, it is seen that he enjoyed the literary half of his life, but his patients were his inspiration (Interviews with Williams 1976; Williams 1948; Letter to Simpson 1947):

> "Everyone thinks doctors are good people because they help people who are sick. But if you ask me, the people who are sick are helping us all the time…a kid is telling me what happened, and where it hurts, and what he does to make the pain better, or what he's tried to do. Some of those kids, they're playwrights, they're storytellers!...Their story, yours, mine—it's what we all carry with us on this trip we take, and we owe it to each other to respect our stories and learn from them."

In these personal letters, obtained from the Harry Ransom Humanities Research Center at the University of Texas at Austin, it is implicit that Dr. Williams sometimes uses writing as a means of an escape from the tense hospital setting; this displayed the dependence that writing had on his personal life as seen in a letter dated October 24, 1947 (emphasis contained with the original document):

> "I've been saddled with additional hospital work as I grow older and "more responsible" as the saying goes. All at the hospital find me "unobjectionable", no compliment in view of the need for objectionableness in anyone at the head of our present disorganized institution…But, I WANT TO WRITE! TO WRITE!! and under present circumstances I am drowned out by other work. But I'll get there for I never cease pressing the moment for everything good for me there is in it."

During this time when this correspondence was occurring, Dr. Williams was in the process of writing the second volume to Paterson, his five volume set of poetry where the main character is a man in search for peace within himself. This series meant a great deal to Williams, and he originally envisioned it in the 1920s. So, the emphasis he places on the word "WRITE" reveals two important things: the amount of stress he was feeling within the hospital setting and his dependence on writing to relieve some of that stress. These two

implications can be supported by a heart attack he experienced a year later. The concept of dependence is deeply rooted in the tradition of the healer-writer and therefore can be witnessed in Williams's work. The poem shown in **Panel 1** illustrates Williams work as a poet-healer: originally published in 1923 in an anthology of mixed poetry and prose titled, *Spring and All,* Williams relates the concept of dependence to the reader in the form of a red wheelbarrow.

Examining a piece of text is analogous to examining a patient; the subject of the text and the language are analyzed, but the writer and the situation in which the text is created are equally important. The relationship between the text and its readers is also considered. Taking a closer look at the subject of the poem, the red wheelbarrow, it is recognized as a tool—or something that is depended upon as the first line introduces this concept.

Panel 1: The Red WheelBarrow by William Carlos Williams

The Red Wheelbarrow

so much depends
upon

a red wheel
barrow

glazed with rain
water
beside the white
chickens.

Figure 4: Healer-writer, William Carlos Williams (1883-1963)

As a pioneer to the Imagist movement in poetry, Dr. Williams was devoted to depicting the simplicity of life, a trait that evolved from working with common people as a physician (Interview with Williams 1976; Williams 1948).

The function of poetry is to allow the reader to focus the mind on imagery and create new avenues of vision and thought. Williams's concentrated attention on the red wheelbarrow "glazed with rain water" leads to the image of an agricultural setting with "white chickens." From this mental snap-shot, the reader strings together the red wheelbarrow as a gardening tool used for various purposes. The simplicity of the language Williams uses, makes it difficult to misunderstand that the red wheelbarrow, an object signature to an ordinary lifestyle, is depended upon to carry out the agrarian lifestyle of the owner.

The strings tying together the red wheelbarrow as a tool also integrate Williams's medical work. To diagnose a patient, the healer relies on the narrative of the patient and their holistic knowledge of biology, chemistry, physics and even mathematics plays a crucial role, especially when deciding on the amount of prescription to provide a patient.[1] As humans, we are dependent of everything: the earth, its resources, and each other. During the time this poem was written, Dr. Williams lived in his home of Rutherford, New Jersey directly engaging with his patients as a general practitioner; acknowledging this supports the implication that his poetry was indeed affected by his medical work (Williams 1948).

> "Vintage Williams: the busy, street-smart doctor and the hard-working writer *merged* into the friendly but tough teacher who wanted his young listener to treasure not only the explicit, but the implicit, all subtleties and nuances of language as it is used, of language as it is heard. He found moments of liveliness in statements of his patients..."
> –Coles 1989 (emphasis is mine)

These words are written by Williams' close pupil, Dr. Robert Coles, Professor of Psychiatry and Medical Humanities at Harvard University. The concept of dependence once again plays an essential position, represented both by the "explicit" and the "implicit" Williams describes. The "explicit" Williams relates to his young scholar is the reliance every ailing human has to a healer. Meanwhile, the "implicit" is the narrative of the patient and the tools needed to piece together a sound diagnosis, as in the art of language. All healer-writers must appreciate the implicit values of language such as poetry and literature in order to understand the human condition.

As an undergraduate English and History major at Harvard University, Dr. Coles wrote his senior thesis on William Carlos Williams (Letter to Simpson 1947). Encouraged by his professor to meet with Williams, Coles met with the great man and followed his example by attending medical school while also working on his writing. The relationship between Williams and Coles can be seen both in their clinical work and writing (Woodruff 1992). "Like the Williams of the *Life along the Passaic* stories, Coles writes about 'plain, ordinary people…whose knack of survival he [cannot] help regarding with a mixture of admiration, sadness, and bitterness," (Woodruff 1992).
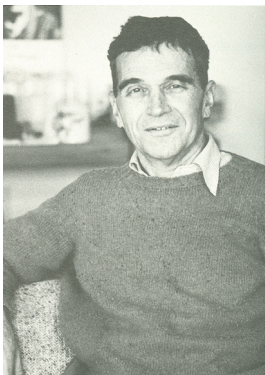
Panel 2: Dr. Robert Coles on life as a healer-writer

"The people that mean most to me are the people like George Orwell, James Agee, and Simone Weil—writers who have gone out and tried to understand others different from themselves."

Figure 6: Healer-writer, Robert Coles, professor of Psychiatry and Medical Humanities at Harvard University

Why then, is society so insistent on keeping the writer separate from the healer? There is much to be gained from restoring the tradition of the healer-writer. Reintegrating the written word as part of medical training as it was in the times of antiquity, would yield not necessarily a plethora of Pulitzer Prize winning healer-writers, as in the case of Dr. Coles and Dr. Williams, but instead, a hybrid individual aware of the dependence of science and language. Conversations with a current healer Dr. Sabas Abuabara, general surgeon and chief of staff at the Baptist Medical Center in San Antonio, Texas, reveal insights about the importance of understanding the close bond between language and healing.

> "We used to say that 'if you just know medicine, you don't even know medicine!' The patients and the physicians are not isolated. They are part of a community that is in total—humanity—and you have to consider every aspect of the individual."—Abuabara 2011

Dr. Abuabara demonstrates the rare occurrence of a healer-writer naked without the garment of poetry, novels, or dramas. His writing focuses strictly on the reality of the patient jotted down on medical pads as notes.

> "I write down the history of the patient: I try to get to know the social aspect of the person: where the person is in his or her life, what the situation is, for instance, does the person have support for the situation they are going through, can they rely on someone else to help them."—Abuabara 2011

These words echo William Carlos Williams's. Sitting there in his office listening to his Colombian accent, I could not help but think how phenomenal it was that such an esteemed individual with no prior knowledge of Dr. Williams was so open to learn about him. What may have also been bewildering is that as we engaged further in conversation about the importance of the humanities while Dr. Abuabara was still wearing his freshly starched white coat—usually a symbol of the distant separation between the layman and physician. By conversing with Dr. Abuabara, I suddenly had a glance of how the tradition of healer-writer is still active presently. Of course, Dr. Coles and Dr. Williams represent modern examples, but both of these individuals were very much appreciated for their work as Medical Humanists. Witnessing a healer without the influences of awards or writing outside the hospital, allows for hope that there are more healer-writers thriving in places where it is least expected.

In examining the tradition of the healer-writer, I have "tried to understand others different from [myself]:" when the healer is left bare without the integration of the writer, a human violation occurs because no longer is the healer, a healer—but instead, an icy clone (Woodruff 1992).

> "Knowing only science or medicine—people like that, they become technicians—mechanics—losing all sense of feeling. You need to understand the human condition in order to heal, or cure the patient; we depend on the Humanities to come into play for that."—Abuabara 2011

Illustrated earlier in Dr. Williams *The Red Wheelbarrow*, is the resounding importance of dependence. Ancient civilizations have forged this glorious tradition, but to continue this speculation of examining the healer-writer, my next question would focus on *why?* It is evident that the writer is essential to the healer, as proved by the works of Sir Arthur Conan Doyle, Dr. William Carlos Williams, Dr. Robert Coles, and Dr. Sabas Abuabara. But why? Why has man from primitive time seen them as a single figure?

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Photograph: **Figure 3**: *Asclepius son of Apollo.* Photograph. *New Larousse Encyclopedia of Mythology.* London: Hamlyn, 1959. Print.

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Justification Closure and Dogmatism

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Abstract

If I have an experience of seeing a red wall in front of me, do I know with certainty that there actually is a red wall in front of me? Without further information about the circumstances of that experience, very few people would say yes. There might be a white wall in front of me with a red light shining on it; or I may be dreaming of standing before a red wall; or I might be a brain in the vat of some 24th century advanced biology summer project. Such skeptical doubts have been floating in the philosophical atmosphere for centuries. But even if I can't be absolutely certain of the existence of a red wall in front of me, should my experience at least count as some evidence toward that knowledge? The radical skeptic would say that it my experience does not. In this paper I will explore Pryor's account of the conflict between such skepticism and what Pryor believes to be the appropriate response to this theory, Dogmatism, a theory that believes that perceptual experiences can give us justified beliefs about the world around us. Then, I will explore whether one of the critiques against the Dogmatist reveals that he is susceptible to an epistemic paradox.

If I have an experience of seeing a red wall in front of me, do I know with certainty that there actually is a red wall in front of me? Without further information about the circumstances of that experience, very few people would say yes. There might be a white wall in front of me with a red light shining on it; or I may be dreaming of standing before a red wall; or I might be a brain in the vat of some 24th century advanced biology summer project. Such skeptical doubts have been floating in the philosophical atmosphere for centuries. But even if I can't be absolutely certain of the existence of a red wall in front of me, should my experience at least count as some evidence toward that knowledge?

James Pryor proposed a new version of the traditional skeptical argument, a version that challenged even the modest claim that a person's experience can form a basis for justified belief. In this paper I will explore Pryor's account of the conflict between such skepticism and what Pryor believes to be the appropriate response to this theory, Dogmatism, a theory that believes that perceptual experiences *can* give us justified beliefs about the world around us. Then, I will explore whether one of the critiques against the Dogmatist reveals that he is susceptible to an epistemic paradox.

The Skeptic believes that perception gives us no certain knowledge about our surroundings. One might experience a red wall but cannot ever be certain that the wall is really red; one could be hallucinating or there might be tricky lighting in the room. The Skeptic also believes that it is possible for us to have all the experiences we are having right now even if they are false. Imagine someone named Luis, who sees his fellow work-study sitting in a room watching Netflix on her computer. It is entirely possible for him to experience his fellow work-study watching Netflix, experience himself sitting in a chair, typing on his keyboard, watching the letters appear magically on the word processing document, and for those experiences to be false. Luis could very well be a Brain in a Vat. Although he thinks he had all those experiences, Luis is actually not in a work-study office but instead he is only a brain in a laboratory and his brain is being influenced in such a way as to make the him believe that he is having the experiences that the scientists in charge of the brain want the him to have.

James Pryor's skeptic goes even further, he argues in favor of the much more radical conclusion that our perceptual experiences can't give us any knowledge or even justification for believing that our surroundings are one way rather than another. If this skeptic had the experience of seeing a black dog, he would say that he does not even have the slightest reason to believe that there really is a dog there. Most contemporary presentations of the skeptic's reasoning are posed as challenges to the possibility of knowledge, not as challenges to the possibility of justified belief. Pryor (Pryor, 2000), however, believes that there are compelling skeptical arguments against justified beliefs and sets out to formulate such an argument.

Pryor's Skeptic appeals to the Skeptical Principle about Justification:

- "If you're to have justification for believing p on the basis of certain experiences or grounds E, then for every q which is "bad" relative to E and p, you have to have antecedent justification for believing q to be false–justification which doesn't rest on or presuppose any E-based justification you may have for believing p." (Pryor, 2000)

Pryor describes a bad alternative to an experience as an alternative that is incompatible

with what we seem to be justified in believing, based on our experiences, but is at the same time allowed by our experiences. Suppose that you are in the zoo and have an experience of a zebra in an exhibit. You might say that you are justified in believing that there is a zebra in an exhibit. One 'bad' alternative would be that there is actually not a zebra in the exhibit but a mule that is painted like a zebra. This possibility is allowed by our experiences but is at the same time incompatible with what you would originally believe. In a similar fashion, the alternative case in which 'your experiences are all false appearances as presented to you by an evil demon' is incompatible with the belief 'there is a zebra in the exhibit' while still being allowed by our experiences.

The skeptic, for example, would ask that in order for you to have justification for believing *anything* about the external world, you would have to have antecedent justification for believing every 'bad' alternative to the proposition 'there is an external world for which I can attain perceptual justification.' In this instance, 'antecedent' does not mean 'that which came before' in a temporal context. Instead, it means "your reasons for believing p1 cannot beg the question whether P2" (Pryor, 2000). For example, imagine that you are in charge of an investigation of a murder. You suspect that the butler committed a murder. If this suspicion rests on the assumption that the murderer was left-handed, then you cannot defend the assumption that the murderer is left-handed simply because the butler is left-handed. Such reasoning would be begging the question. Similarly, I cannot say that I am not a brain in a vat because I am having an experience of the external world, such as seeing my own hands in front of me. Such an example would beg the question as to whether or not I really am or am not a brain in a vat.

In terms of perceptual justification, a Dogmatist is someone who accepts James Pryor's epistemological theory of perception known as Dogmatism, which is based on one of G.E. Moore's anti-skeptical ideas that one can know some propositions to be true without being able to "prove them" or have any non-question-begging arguments to offer in their support. The model of experience that the Dogmatist uses says that experiences themselves represent the world as being a certain way, and the way they represent the world is their propositional content. Let's say you have an experience of looking at a dog. The experience may be expressed by the following propositions: 'the dog is black,' 'the dog is sitting down,' etc. These propositions will capture the content of your experiences regardless of what you were thinking at the time or whatever attitude about your perceptual faculties you might have at the time of the experience (Pryor, 2000).

The Dogmatist argues that the kind of justification that one gets from perception is one that does not presuppose or rest on any sort of independent justification. Think about the previous example of looking at a dog. One of the propositions naturally arising from the experience of looking at a dog is *p,* 'the dog is black.' The Dogmatist will say that you are justified in believing in that proposition because "To have this justification for believing *p* you only need to have an experience that represents *p* as being the case." (Pryor, 2000) One does not need any other arguments in favor of the proposition, 'the dog is black,' such as, 'the color detector says the dog's fur is black,' or, 'my friend says that the dog is black.' Pryor calls this "immediate justification." Immediate justification is neither infallible nor self-evident. It is instead *prima facie* justification that "in the absence of any… defeating evidence, prima facie justification for believing *p* will constitute all things considered justification for believing *p*." (Pryor, 2000)

Pyor makes the point "that only ordinary evidence of the sort employed by the man in the street and by the working scientist counts as defeating your prima facie justification" (Pryor, 2000) So if you had an experience of seeing a stick you would have *prima facie* justification for believing that there is a stick in front of you. The kind of defeating evidence for your justification would be a biologist telling you that it is not a stick but rather it is a bug that looks like a stick.

The skeptical argument that says that you are brain in a vat, however, would not count as defeating evidence for your *prima facie* justification. Instead, what skeptical arguments aim to do is show that we cannot have any justification, not even *prima facie* justification. Suppose you had an experience as of a zebra, you would then have prima facie justification for believing that there is a zebra in front of you. However, a skeptic went over to you and told you "everything you see is not real. It is a clever illusion. You are in the matrix." If the skeptic made a sound argument in favor of the proposition 'you are in the matrix' then what he did is prove that you didn't have *any* justification. What he did not do is undermine or defeat your justification for believing that there is.

Another important assumption that Dogmatism makes is that one will not always have justification for believing that their belief will be justified. "What makes you justified in believing p is one thing; what makes you justified in believing you have justification for believing p is something else…" (Pryor, 2000) James Pryor gives an account of the former and argues that Dogmatism is not an account of what makes you justified in believing the following three propositions:
- You have justification for believing that there is a hand
- Your experiences give you justification for believing that there is a hand.
- That your perceptual faculties are generally reliable or trustworthy

Pryor believes that these things are more sophisticated but are not necessary for Dogmatism.

The Dogmatist also assumes that one will not always be able to defend why he is justified in believing *p*. There is a difference between being the status justified and being able to defend the claim that you are justified. According to Pryor " It can be reasonable for you to believe something even if you're not able to show that it's reasonable or explain what makes it reasonable" (Pryor, 2000) one can be justified in believing that there is a hand in front of me even if he cannot defend that claim.

The last major point is that one's experiences do not give one justification for believing skeptical scenarios. Dogmatism says that whenever one has an experience as of *p* he is *prima facie* justified in believing *p*. One's experiences, however, do not give you prima facie justification for believing that any skeptical hypothesis obtain. One can have *prima facie* justification for believing that there is a hand in front of him because he had an experience of a hand in front of him. One can never really have an experience as of being a brain in a vat, or being deceived by an evil demon, therefore your experiences cannot give you *prima facie* justification for believing that he is a brain in a vat or being deceived by an evil demon.

Suppose that the Dogmatist had the experience of a red card. Having no evidence to the contrary, the Dogmatist would be justified in believing that the card in front of him is red. The same Dogmatist then has another experience; this time of a blue card. Again, having no evidence to the contrary, the Dogmatist is justified in believing that the card is blue. Suppose a large number of similar experiences keep on happening to this Dogmatist. Is it possible, then, to say that each of these experiences counts as inductive evidence toward the conclusion that his senses are reliable? Stewart Cohen (Cohen, 2002) believes

this to be the case. He call this process Bootstrapping.

Imagine you are part of the jury in a trial and you wonder whether the testimony of the witness is reliable. If you relied on the testimony itself to prove that the testimony is reliable then you would be guilty of epistemic circularity. Bootstrapping works the same way here. First, the Dogmatist wonders if his senses are reliable. The Dogmastist then says, "that table , looks red and it is red, the wall looks blue and it is blue. Surely, based on this inductive evidence, my senses must be reliable."

In rejecting Dogmatism because of bootstrapping, Cohen appeals to what Michael Bergmann calls *"The No Self-support principle* (NSS)" which states that "One cannot obtain justified or warranted belief that a belief source S is trustworthy by relying even in part on source S." (Bergmann, 2000) Because Dogmatism is guilty of bootstrapping, which violates the NSS, Dogmatism faces problems that make the theory as it is unacceptable.

Roger White further developed the bootstrapping argument because he felt that the development of Cohen's critique was too quick. (White, 2006) White first distinguishes between two color vision tests. In both of them, the Dogmatist is shown a series of cards. In the first test, which we can call the independent confirmation test, the conductor of the test calls out the color of the cards. The conductor of the test calling out the color of the cards serves as a sort of independent justification. In the second test, called the bootstrapping color vision test, the Dogmatist is only shown the color of cards. The Dogmatist then says "this card looks blue and it is blue so my color vision worked correctly that time; this card looks red and it is red so my color vision worked correctly again,…" and so on until he believes that there is enough inductive evidence to confirm the hypothesis that his sense are reliable. The second step lends itself to bootstrapping because the Dogmatist is forced to conclude that his senses are reliable based on evidence given to him by his own senses

White then examines Pryor's initial response to Cohen's bootstrapping critique. In his response, Pryor says that, in the bootstrapping color vision test, each instance of the Dogmatist's color vision working correctly will not serve as inductive evidence toward the confirmation of the hypothesis that his color vision is reliable because there is no way for the results to disconfirm the hypothesis. No matter what the colors of the cards are, the Dogmatist will report that the colors of the cards are the same as they appear. According to White, Pryor argues that the bootstrapping color vision test violates the principle of Disconfirmability which states

Disconfirmability: If we know that a certain test cannot yield disconfirmation of our hypothesis, then no result of the test can confirm the hypothesis either. (White, 2006)

For the color vision test to actually prove the hypothesis that the Dogmatist's color vision is reliable, the color vision test must be like the independent confirmation test. Because the bootstrapping color vision test cannot prove the Dogmatist's hypothesis that his senses are reliable, according to Pryor, Dogmatism is not guilty of epistemic circularity.

When examining the bootstrapping color vision test, White argues that the fact that the Dogmatist failed to discover an instance in which he misjudged the color of a card can be explained without appealing to his reliable color vision. White says that it is impossible to discover that appearances do not match reality when the only guide to reality is the appearances themselves. Instead, White argues that after looking at all the cards in the bootstrapping color vision test, the Dogmatist concludes what he calls Track Record.

Track Record: This card appears to be C in color and it is C, this one appears C' and it is C'... and these are all the cards that I have viewed. (White, 2006)

From the Track Record Proposition, No Errors is entailed

No Errors: My color experiences have matched the actual color of each of the many cards that .

I have viewed (White, 2006)

According to the Dogmatism, the Dogmatist is justified in believing in Track Record. From Track Record, No Errors is entailed. From No Errors, the Dogmatist is forced into the inevitable conclusion that his senses are reliable.

Reliability: My senses are reliable (White, 2006)

As far as Disconfirmability goes, White makes the case that disconfirmability actually works against Dogmatism. As it was just shown, one goes from Track Record to the reliability of one's senses through Dogmatism. But, according Disconfirmability, one cannot get to No Errors. According to Dogmatism, one can. Dogmatism, then, does something that Disconfirmability say no one can do, putting the two at odds with each other. In the end, as white argues, that Dogmatism is both guilty of epistemic circularity and at odds with Disconfirmability. (White, 2006)

Suppose you were justified in believing that card 1 is blue and you are also justified in believing that card 2 is red, does that mean that you are justified in believing that card 1 is blue and that card 2 red? According to Justification Closure (JC), you are. JC applies the principles of logic to those propositions for which you have justified belief. In the above example, we used JC to allow us to conjoin two independent propositions using the logical principle of conjunction introduction (CI). JC also works with other logical principles such as *modus ponens*. For example, if you are justified in believing p and you are justified in believing if p then q then, by *modus ponens,* you are justified in believing q. For our purposes, I will focus on using CI with JC because that is the principle that Track Record uses.

I propose an intermediary step between Track Record and No Errors that I believe better connects those two propositions.

Track Record 2: I'm justified in believing that my color experiences of card 1 have matched the actual color of card 1 is the color it appears to me AND my color experiences of card 2 have matched the actual color or card 2… and these are all the cards that I have viewed.

This formulation is motivated by following analysis of Track Record. After the Dogmatist is shown the first card, he reasons in the following way:

1. Card 1 looks C in color
2. I am justified in believing that Card 1 is C in color
3. Therefore, I am justified in believing that my color experiences have matched the actual color of Card 1.

After repeating the first step with Card 2 he reasons in this way:

4. Card 2 looks to be C' in color
5. I am justified in believing that Card 2 is C' in color
6. Therefore, I am justified in believing that my color experiences have matched the actual color of Card.

The process is repeated until the test is completed. At the end of the test, the Dogmatist has the independent propositions that are like the following.

3. I am justified in believing that Card 1 is the color it appears to me

6. I am justified in believing that Card 2 is the color it appears to me

According to JC and CI, the Dogmatist is then forced to make the step from 3, 6, and all of the propositions like them to Track Record 2. From Track Record 2 the Dogmatist concludes No Errors and then concludes Reliability.

I believe that this isn't the only instance in which the Dogmatist uses JC, in fact I believe that under the Dogmatist framework, JC is an integral part of how we learn things about the world. As Pryor says, our senses give us perceptually basic propositions. Our senses do not tell us that there is a police man ahead. Instead, what they tell us is I am justified in believing that there is a figure wearing a uniform, I am justified in believing that the uniform is blue, I am justified in believing that there is badge in the uniform. We then use CI, allowed by JC, to conclude that we are justified in believing that there is a figure ahead wearing a blue uniform with a badge on it. Then, using our back ground knowledge we say that we are justified in believing that if someone is wearing a blue uniform with a badge on it, then that someone is a police officer. Therefore, by JC and *modus ponens*, we are justified in believing that the person in front of me is a police officer.

Since JC is used often in everyday life, does that mean that JC always leads you to the correct conclusion? Not necessarily. Suppose you entered a fair lottery in which only one ticket will win and in which the probability of each ticket winning is .00001%(or low enough for one to be justified in believing that an individual ticket will lose). You will be justified in believing that ticket 1 will lose. You will also be justified in believing that ticket 2 will lose and so on. Then by JC, you will be justified in believing that ticket 1 will lose AND ticket 2 will lose and so on. Finally, you conclude that you are justified in believing that no ticket will win. So you know that one ticket will win but also conclude that no ticket will win. This is known as the lottery paradox. Here are the steps in a more clear form:

L1: you know that one ticket will win

L2: You are justified in believing that Ticket 1 will lose and you are justified in believing that ticket 2 will lose…

L3. You are justified in believing that ticket 1 will lose AND ticket 2 will lose…

L4: you are justified in believing that no ticket will win.

Gregory Wheeler (Wheeler, 2007) explains

> "The lottery paradox was designed to demonstrate that three attractive principles governing *rational acceptance* lead to contradiction, namely that
>
> 1. It is rational to accept a proposition that is very likely true,
> 2. It is not rational to accept a proposition that you are aware is inconsistent, and
> 3. If it is rational to accept a proposition *A* and it is rational to accept another proposition *A'*, then it is rational to accept *A& A'*,
>
> are jointly inconsistent.

I take rational acceptance to be same thing as justified belief. I also believe that 1 and 2 are two principles that can be taken for granted. It is 3 that is problematic in this case. 3 is an instance of CI allowed by JC. We have already shown that these two principles

work in conjunction in the Dogmatist scheme. So if it has been shown that CI and JC lead to contradictions, does it mean that, as rule, these principles cannot be used by the Dogmatist? If CI and JC cannot be used by the Dogmatist then the Dogmatist could not be allowed to make any inferences about his experiences beyond simple sense data. At first, it might seem as though the problems of the lottery paradox might apply to Dogmatism, especially when it comes to Track Record. In Track Record we went from

> I am justified in believing that card 1 is the color it appears to me
> I am justified in believing that card 2 is the color it appears to me

To

> Track Record 2: I am justified in believing that card 1 is the color it appears to me AND card 2   is the color it appears to me AND…

Meanwhile, in the lottery paradox, we went from

> I am justified in believing that Ticket 1 will lose
> I am justified in believing that Ticket 2 will lsoe

To

> I am justified in believing that Ticket 1 will lose AND Ticket 2 will lose
AND…

Then from Track Record 2 we got No Errors

> **No Errors**: My color experiences have matched the actual color of each of the many cards that I have viewed

Meanwhile in the lottery paradox we got

> I am justified in believing that no ticket will win.

At this point, the last step of the lottery paradox contradicts the first one: one ticket will win. This is to show us that JC is susceptible to contradictions. So does this mean that making the step to Track Record is wrong?

I think the solution lies in differentiating between different kinds of justified belief. In the case of the lottery paradox and the Dogmatist, we must differentiate between statistically justified belief and what pryor calls *prima facie* justified perceptual beliefs. The lottery paradox does a good job at showing problems with statistical probabilities and justified belief but not so much with *prima facie justified* belief. The main difference is that the lottery paradox shows problems with JC with statistical justification when all the evidence is considered. In the lottery paradox the subject knew the probability of each ticket winning, how many tickets were going to win and how many there were in total. Because the subject had access to all of the evidence, the statistical justification is set.

Meanwhile the Dogmatist doesn't have access to all of the evidence, meaning that what's justified at one point can change. His *prima facie* justification is defeasible and variable. If the Dogmatist discovered that No Errors was in contradiction with the conductor of the test saying, "one card will not be the color it appears to you," the Dogmatist would not have a contradiction or an instance of JC failing. Instead, the Dogmatist would discover that he is not justified in believing No Errors. Of course, the Dogmatist would reason the way that White explained but Dogmatism allows for justification to be defeasible and change if new evidence is introduced.

Dogmatism, at first, might seem to be susceptible to the lottery paradox. It does rely on JC in the Track Record step of the bootstrapping procedure in a way that is very

similar to the lottery paradox. However, the kind of justification that Dogmatism employs allows for the theory to not fall into the traps that statistical justification, according to the lottery paradox, falls into. While the bootstrapping issue was not resolved in this paper, Dogmatism was shielded from the pitfalls and contradictions of the lottery paradox

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Importance of Position 425 to Substrate Specificity of Aromatic Amino Acid Hydroxylases and Evolution of Critical Enzyme Activities

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Abstract

  Aromatic amino acid hydroxylases catalyze hydroxylations in the liver and the nervous system. Tyrosine hydroxylase, the enzyme that catalyzes DOPA from tyrosine, is a significant enzyme in the pathway that makes the catecholamines dopamine, epinephrine and norepinephrine, important hormones in the sympathetic fight or flight response. Tyrosine hydroxylase has evolved from an ancient phenylalanine hydroxylase and has maintained 75% similarity to phenylalanine hydroxylase in its amino acid sequence, although their substrate specificities are different –phenylalanine hydroxylase is unable to catalyze the reaction with tyrosine to make DOPA. This specificity may be accredited to one specific amino acid in the sequence at position 425 which is an aspartate in tyrosine hydroxylase, and a valine in phenylalanine hydroxylase. Through site-directed

mutagenesis, this particular amino acid was replaced with the amino acids methionine, glycine, and cysteine in tyrosine hydroxylase in separate experiments. The result of several assays show that none of the mutants can produce the amount of DOPA that wild type tyrosine hydroxylase is capable of producing. They all showed high K_m values and low activity. D425G was the least effective mutant, while D425C was the most effective mutant, although all three produced amounts of DOPA several orders of magnitude less than that of wild type tyrosine hydroxylase. The project demonstrates the importance of the amino acid sequence of an enzyme in relation to substrate specificity. Evolutionarily speaking, tyrosine hydroxylase is most advantageous when it has an aspartate in position 425.

INTRODUCTION

Tyrosine hydroxylase (TyrH), phenylalanine hydroxylase (PheH), and tryptophan hydroxylase 1 and 2 (TrpH 1 and 2), compose the family of aromatic amino acid hydroxylases (AAAH). They are tetrahydrobiopterin (BH_4) –dependent enzymes (1). Figure 1 shows the different reactions catalyzed by the AAAH family. Figure 2 shows the use of molecular oxygen from tetrahydrobiopterin during the reactions. PheH catalyzes the formation of tyrosine from phenylalanine by adding a hydroxyl group to its aromatic ring in the para-position (2). A deficiency or mutation of PheH can lead to phenylketonuria, in which there is an overabundance of phenylalanine in the body (3). TrpH catalyzes the formation of 5-hydroxytryptophan, the first step in the pathway that synthesizes the neurotransmitter serotonin (2). TyrH catalyzes the formation of L-dihydroxyphenylalanine (L-DOPA) by adding a hydroxyl group in the meta-position of the benzylic ring of the R-group of the amino acid. DOPA is the precursor for the catecholamine neurotransmitter dopamine. The reaction catalyzed by TyrH constitutes the first step in the pathway that makes dopamine, epinephrine, and norepinephrine. These neurotransmitters play roles in maintaining brain functions such as attention, cognition, memory, and emotion (4). A deficiency or abnormality in the levels of any of these catecholamines leads to neural disorders such as Parkinson's disease, bipolar disorder, hypertension, and schizophrenia (5). TyrH is the rate-limiting enzyme in the pathway and is therefore the enzyme of interest for this particular project.
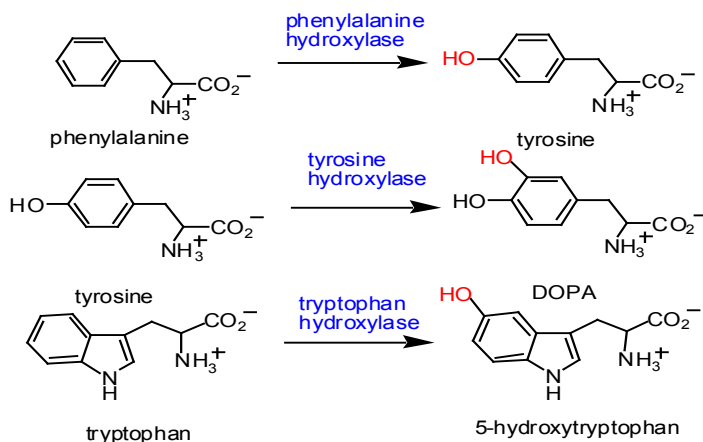

Figure 1. Reactions of AAAH
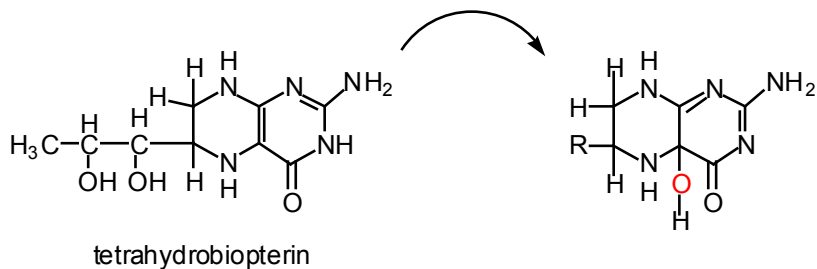
tetrahydrobiopterin

Figure 2. The use of tetrahydrobiopterin

Each AAAH consists of an N-terminal regulatory domain, a central catalytic domain, and a C-terminal domain that utilizes a non-heme iron held in place by two histidines and a glutamate at its binding site (2). The length of the N-terminal regulatory domains for each enzyme is specific for that enzyme and display little similarity in sequence and in length (6). The C-terminal region is highly conserved among them in which there is 75% identity in amino acid sequence between TyrH and PheH, and 60% identity among all three enzymes (7). Their identical features are due to their evolution from a single ancestor, bacterial PheH (1). This bacterial PheH evolved and gave rise to TyrH approximately 750 million years ago, and eventually TrpH approximately 600 million years ago (3). This sequence of events was probably a factor in the rise of the ancient nervous system (1).
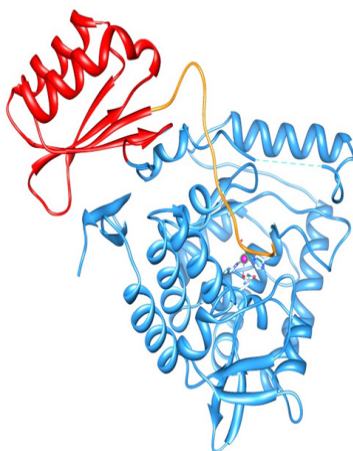

Figure 3. 3D structure of PheH

TyrH is a tetramer in which its regulatory domain acts as a flap that opens and closes to allow a substrate into the catalytic domain and helps to hold it in place. One example of this kind of flap is shown in Figure 3 in the 3D structure of PheH. TyrH has several flaps in the catalytic domain that also help to hold the substrate in place, and at the tip of one of these loops there is an aspartate at position 425 (D425) in the amino acid sequence (3). The homologous position in PheH is 379, but PheH has a valine there. This small change in the amino acid sequence is critical in the determination of the enzyme specificities (3). PheH

has substrate specificity for phenylalanine hydroxylation and is unable to hydroxylate tyrosine to make DOPA (3). TyrH does not have this same limited specificity and is able to hydroxylate phenylalanine with approximately 66% of the V_{max} value of tyrosine (3). Nevertheless, this is a wasteful reaction in which more tetrahydropterin is consumed than tyrosine produced (7). In previous studies, the D425 in TyrH was replaced by mutagenesis with a valine, which increased its affinity for phenylalanine over tyrosine by approximately 50,000-fold (8). This substitution made TyrH D425V almost completely incapable of hydroxylating tyrosine, yet it was able to hydroxylate phenylalanine effectively (8). This same experiment was conducted with PheH in which its valine at position 379 was changed through mutagenesis to an aspartate, but was still unable to hydroxylate tyrosine, and only showed a small decrease in its affinity towards phenylalanine (8). PheH was shown to have more than one factor that influences its substrate specificity.

There are many different forms of TyrH. In fact, humans have 4 different TyrH in which all the differences lie in the N-terminus where several insertion events have occurred (2). All four perform the same catalysis, utilize the same mechanism, and have the same D425 loop. The occurrence of 4 different forms of TyrH in the human body is yet to be understood by the scientific community.

One specific evolutionary event in which one base change occurred from GTC (valine) to GAC (aspartate) could possibly be the necessary cause of the entire metabolic pathway for emerging life forms. Recent studies by Brandt et al. (2009) and Yep and McLeish (2009) show that a single point mutation has the ability to either cause activation or inactivation to an enzyme, which may be the case with PheH and TyrH.

This project will attempt to examine the amount of DOPA produced after the mutagenesis of TyrH at position 425 in *E. coli* so that the significance of its particular evolution in the development of the nervous system can be better understood. The aspartate will be replaced with the amino acids methionine, glycine, and cysteine in separate experiments in order to see if another amino acid could have had the same effect as D425 on TyrH's ability to produce DOPA, and therefore, the emergence of the nervous system.

EXPERIMENTAL PROCEDURES

Mutagenesis. Site-directed mutagenesis was performed as described by the Quick=Change protocol of Stratagene Inc. Mutagenic oligonucleotides were designed separately for each mutant (D425G, D425C, and D425M) and ordered from the Advanced Nucleic Acids Core Facility at the UTHSCS Facility, Department of Microbiology. Each oligonucleotide was purified separately and then diluted to get a final concentration of 15 μM.

Transformation of Possible Mutants. 8 μL of each mutagenesis reaction was used to transform competent *E coli (strain XL10-Gold, Stratagene)*. Ten colonies were chosen from the resulting bacterial plates from the reaction with the least amount of template DNA to increase the possibility of harvesting a successfully transformed mutant. Each colony was picked into 4 mL LB-amp and incubated at 37 °C overnight. DNA mini-preps were performed using a Qiagen Kit. The resulting DNA was digested with restriction enzymes and run on a 1.5% agarose gel. Cut sites were used to determine successful mutagenesis. The plasmids from the 4 mL growths that showed successful expression were grown in 30 mL LB-amp. DNA MidiPrep were performed using a Qiagen Kit.

Bacterial Cell Growth for enzyme isolation. Mutated plasmids were used

to transform competent *E coli* (strain BL21DE). Bacteria were grown in LB medium containing 100 μg/mL ampicillin and 50 μg/mL chloramphenicol (LB-amp-chlor). One isolated colony of BL21DEplysS containing the plasmid of interest was picked from LB-agar plates (plates contained ampicillin and chloramphenicol) no longer than 1 week after transformation. One colony was used to inoculate 70 mL of LB-amp-chlor, and the culture was incubated for approximately 5 hours. The cultures were used to inoculate 1 L cultures of LB-amp-chlor at a ratio of 10 mL/L for 37 °C growth. Six liters of culture were grown for each enzyme preparation. When the A_{600} value of the culture reached 0.4, isopropyl β-D-thioglucanopyranoside was added to a final concentration of 0.5 mM. After induction, bacterial growth was carried out at 18 °C for D425G, D425M, and D425C, and incubation continued overnight. Cells were harvested by centrifugation at 5000 *g* for 30 min and stored at -80 °C overnight.

Protein Purification. All protein isolation steps were performed at 4 °C. Samples at every step were analyzed by activity assay and denaturing polyacrylamide gel electrophoresis. The cell pellet was suspended in an 8-fold excess (with respect to initial weight of cells) of 50 mM HEPES, 10% glycerol, 75 μM DTPA, 1 μM leupeptin, 1 μM pepstatin, and 100 μg/mL phenylmethanesulfonyl fluoride, pH 7.1. The suspension was passed through a 16 gauge needle 3 times and sonicated with 6 bursts of 1 min with 1 min intervals at 45 W. The resulting solution was centrifuged at 15000 *g* for 30 min. The resulting supernatant was brought to 1% concentration of streptomycin sulfate (SS) by the addition of 30% SS, stirred for 20 min, and centrifuged at 15000 *g* for 30 min. The SS supernatant was treated with ammonium sulfate; proteins precipitating at 45% saturation were collected and dissolved in an 8-fold volume (with respect to the initial weight of the cells) of 50 mM HEPES, 10% glycerol, 75 μM DTPA, 1 μM leupeptin, and 1 μM pepstatin, pH 7. The sample was applied to a heparine-Sepharose column (1.5 cm X 10 cm) equilibrated with 50 mM HEPES, 10% glycerol and 75 μM DTPA. After loading, the resin was washed with the same buffer until the A_{280} value of the filtrate was 0.01 or less. The enzyme was eluted with a gradient from 0 to 0.8 M NaCl in 50 mM HEPES, 75 μM DTPA, 10% glycerol, 1 μM leupeptin, and 1 μM pepstatin, pH 7.1, with a total volume of 125 mL. The enzyme eluted at approximately 0.40 M NaCl. The fractions collected were checked for their A_{280} value. Fractions displaying approximately equal specific activities across the peak were pooled. The pool was treated with 65% ammonium sulfate, stirred for 20 min, and centrifuged at 15000 *g* for 30 min. The resulting pellets were resuspended in 50 mM HEPES and 75 μM DTPA, 10% glycerol. The A_{280} values were used to calculated protein concentration.

Assays. Three assays were used to assess the effectiveness of the purified mutants. A colorimetric assay was used to measure the amount of DOPA formed through the hydroxylation of tyrosine. This was carried out in 80 mM HEPES –NaOH, 60 μg/mL catalase, pH 7.1, at 25 °C. After the enzyme reaction was quenched with HCl the mixture was reacted with sodium nitrite and sodium molybdate so the DOPA formed by the enzyme could be quantified by its pink color (11).

Tyrosine formation from phenylalanine was measured by monitoring absorbance changes at 275 nm due to the production of tyrosine. The assays contained 5-800 μM phenylalanine and 10-400 μM 6-methyltetrahydropterin in 80 mM HEPES –NaOH, 5 mM DTT, and 60 μg/mL catalase, pH 7.1, at 25 °C.

Rates of tetrahydropterin oxidation were determined using a coupled assay with dihydropterin reductase, monitoring the decrease in absorbance at 340 nm due to NADH

oxidation. The assays contained 5-800 μM phenylalanine or 1-300 μM tyrosine in addition to 150 μM 6-methyltetrahydropterin, 80 mM HEPE-NaOH, 60 μg/mL catalase, 200 μM NADH, and 0.05 unit/mL sheep dihydropterin reductase, pH 7.1, at 25 °C. Steady-state kinetic data were fit directly to eq 1 using the program Kaleidagraph.

$$v = VS/(K_M + S) \tag{1}$$

RESULTS

D425G. The chromatography eluates were pooled based on the protein gel shown in Figure 4 and their absorbencies at 280 nm. Tubes 7-17 contained enzyme with concentrations between 0.220 and 1.96 mg/mL, with tubes 8 and 9 (shown below) having the greater concentrations of purified protein. Tubes 7-17 were pooled together and purified further. After purification, the absorbance of the final product was taken at 280 nm, and the resulting absorbance was used to calculate a final concentration for the purified protein of 30.1 μM.

Figure 4. D425G Eluate Gel. Wild type TyrH is the thick band to the far left side. The following bands are the eluate tubes 7-17.

D425C. The chromatography eluates were pooled using tubes 12-24 based on their absorbencies at 280 nm and the protein gel shown in Figure 5. Tubes 12-24 contained enzymes of concentrations between 0.662 and 2.38 mg/mL. The final post-purification product had a concentration of 44.6 μM.

Figure 5. D425C Eluate Gel. Wild type TyrH is the thick band on the far left side. The following bands are the eluate tubes 12-24.

d on their absor-
tained enzymes

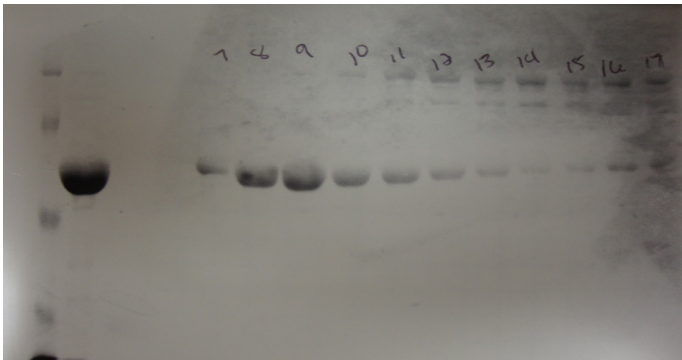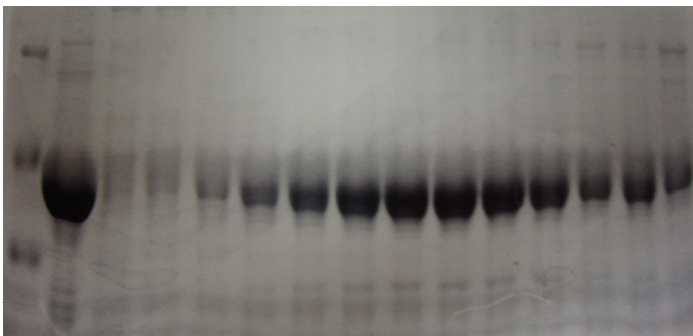of concentrations between 0.351 and 0.812 mg/mL. The final post-purification product had a concentration of 24.1 μM.
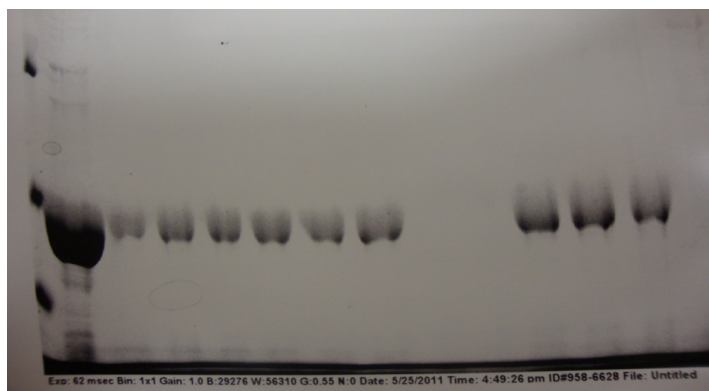
Figure 6. D425M Eluate Gel. Wilde type TyrH is the thick band on the far left side. The following bands are the eluate tubes 9-17.

DOPA Assays. The nmol DOPA produced by each enzyme in an assay were calculated by taking the A_{490} value of each assay sample and using the equation from the DOPA curve. Graph 1 shows the average values for nmol DOPA/min/nmol enzyme for wild type TyrH and the mutants D425G, C, and M. As shown, D425C was able to produce more DOPA than mutants G and M. D425C made an average of 0.407±0.003 nmol DOPA/min/nmol enzyme. D425G made an average of 0.209±0.060 nmol DOPA/min/nmol enzyme. D425M was the worst of the three enzymes and made an average of 0.159±0.023 nmol DOPA/min/nmol enzyme.
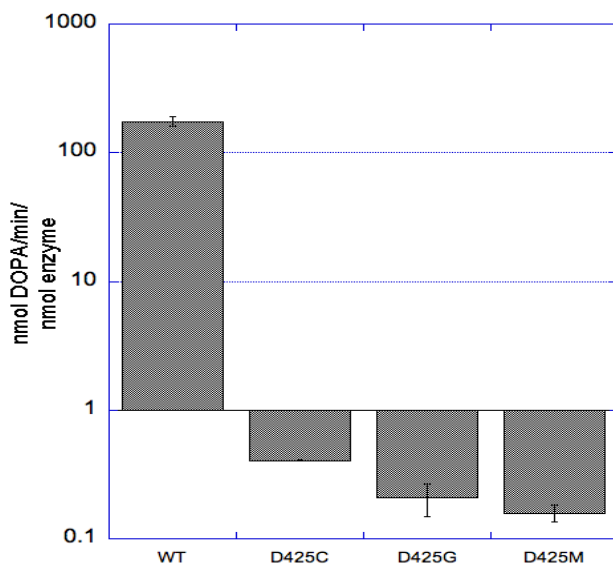
Graph 1. DOPA Assays. Each bar shows the nmol DOPA produced by each enzyme on a log scale. The value reported for wild type TyrH is the literature value (3,7).

Pterin and Tyrosine Assays. The pterin and tyrosine assays displayed typical Michaelis-Menten curve behavior. The K_m and V_{max} values for each assay were calculated using Kaleidagraph and used to calculate the substrate specificities.

Table 1 shows the calculated V_{max} and K_m values from the DOPA assays and the pterin assays using tyrosine as the substrate. The pterin assay for D425M had to be done several times due to inconclusive data. The concentration of enzyme had to be diluted 5-fold in order to obtain sufficient data. The K_m value for each of the three mutants was high in comparison to wild type TyrH.

Enzyme	V_{max} for DOPA formation (min⁻¹)	K_{Tyr} for pterin oxidation (µM)	V/K (µM⁻¹ min⁻¹)
*Wild Type TyrH	150±14	16±3	9.37±2.0
D425G	0.209±0.06	47.5±10	0.0044±0.0016
D425C	0.407±0.0034	42.7±15	0.0095±0.0033
D425M	0.159±0.23	11.3±4.7	0.014±0.021

Table 1. Steady-State Kinetic Parameters for DOPA Formation and Pterin Oxidation. The first column shows the V_{max} values from the DOPA assays. The second column shows the K_m values from the pterin assays using tyrosine as the substrate. *The wild type values reported are the literature values (3).

Table 2 shows the calculated V_{max} and K_m values for the tyrosine assays using phenylalanine as the substrate. Mutants D425G and M both had V/K values larger than that of wild type TyrH due to larger V_{max} values and smaller K_m values. This indicates that the mutants would be better PheH's rather than TyrH's because of their superior ability to hydroxylate phenylalanine. Mutant D425C was the only one that had a V/K value similar to that of wild type TyrH, which was 99.2% similar.

Enzyme	V_{max} for Tyr formation (min⁻¹)	K_{Phe} for Tyr formation (µM)	V/K (µM⁻¹ min⁻¹)
*Wild Type TyrH	96±12	100±15	0.96±0.018
D425G	97.3±2.4	2.0±0.31	48.4±0.18
D425C	63.1±5.6	66.3±14	0.952±0.017
D425M	202±9.9	45.8±5.8	4.41±0.027

Table 2. Steady-State Kinetic Parameters for Tyrosine Formation. The results of the tyrosine assay are shown in the form of V_{max} and K_m with phenylalanine as the substrate. *The wild type vales reported are the literature values (3).

Graph 2 shows the $(V/K_{tyr})/(V/K_{phe})$ values for all three mutants which is an indicator of enzyme specificity. D425C showed the most substrate specificity for tyrosine,

while D425G showed the least. Therefore, out of the three mutants, D425C was the most like wild type TyrH with 0.103% of wild type specificity (approximately 3 orders of magnitude less). D425G was the least like wild type TyrH with 0.000934% of wild type specificity (approximately 5 orders of magnitude less. D425M had 0.0326% of wild type specificity.
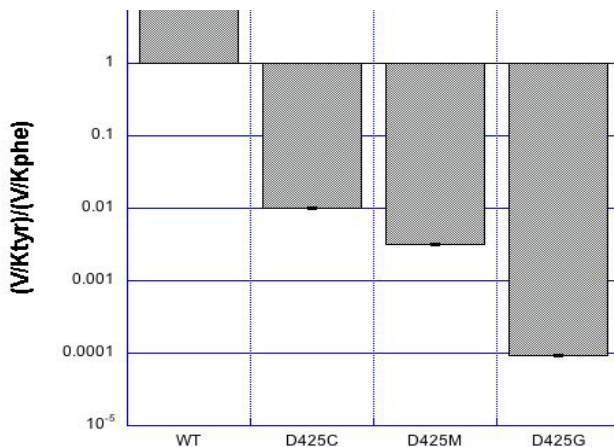
Graph 2. Substrate Specificities. Each bar shows the (V/Ktyr)/(V/Kphe) for each mutant. The wild type value reported is a literature value (3).

DISCUSSION

D425G was the least effective mutant. This may be due to glycine's very simple hydrogen side chain, making it slightly non-polar and greasy. Methionine has a longer hydrocarbon chain with a sulfur towards the end which makes its R-group hydrophobic, non-polar and greasy. Cysteine, a nucleophilic polar amino acid, has a shorter hydro-carbon chain with a sulfur on the end. On the other hand, aspartate is weakly basic and is able to undergo hydrogen bonding due to its carboxylic acid group losing its proton. The differences in the R-groups of the amino acids allow for different binding in the active site of the enzyme. Therefore, the basic aspartate at position 425 allows the TyrH to bind the substrates in place better than the other amino acids tested in this experiment at that particular position. This may be due to the electron-withdrawing properties of aspartate's R-group and its ability to participate in hydrogen-bonding. The R-groups are also important in terms of overall geometry of the enzyme and its secondary and tertiary forms in its ability to hold the substrates in place to allow proper catalysis. Therefore, the aspartate was also the best amino acid at position 425 in terms of overall fit and geometry.

The main goal of the project was to investigate substrate specificity of TyrH. Ultimately, the mutants D425G, C, and M were unable to produce the amount of DOPA that wild type TyrH is capable of, and therefore would be unsustainable if found in the human body. It can be assumed that if there were previous evolutionary events that led to the creation of a TyrH with a glycine, cysteine or methionine in position 425, they were not advantageous and eliminated through natural selection. The random mutation that occurred 750 million years ago that led to a functional TyrH may have allowed for the first synthesis

of L-DOPA and the first nervous systems to come into existence. This project has shown the importance of aspartate 425 in TyrH's ability to produce DOPA, and has also shed light on the idea that one amino acid has the ability to change substrate specificity and change the entire function of a protein. In terms of binding and chemistry, TyrH is more advantageous when it has an apsartate in position 425.

Future studies should be done with human TyrH so that the effects of mutagenesis on substrate specificity can be documented further.

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Home Monitoring for Parental Control

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Abstract

  Preventing a child from accessing a self-defense weapon in the parents closet when home alone, is difficult if the parent does not even know that the child has tried to acquire it. Designing a home monitoring system that can alert parents of children accessing restricted areas around the home even when they are away from the home could help prevent the child from doing something he should not be doing. To achieve this goal, an Internet connected microcontroller and sensor was used in congruence to detect the presence of a child in a restricted room, and then alert the parents through a twitter post. A smart phone could be configured to automatically retrieve the post within minutes of the child's breaching into the restricted area, notifying parents of the breach. The system consists of an Arduino microcontroller connected to a PIR sensor that could detect when there was motion and then send a twitter post to a dedicated twitter account. The twitter account can be linked to a smart phone and alert parents even when they are not around the house. A system like this would be a great way to monitor a child's activities at home and help parents control what their child is doing.

Introduction

In 1999, 3,385 children under the age of nineteen were killed with a gun. The goal of my proposed research project is to design an automatic home monitoring and parental control system, which will be able to alert parents via sending them a tweeter message when kids try to gain access to prohibited areas at home, such as parents' master bedroom, closet, where guns could be held, or liquor cabinet. Parents can receive the tweeter message on their mobile phone while away from home and can call their kids to make immediate intervention if necessary, preventing any unwanted actions from happening.

In order to accomplish the goal, a system that can communicate with the parents even while away is needed. The design of my project involves using a motion sensor to detect when a kid is in a "restricted" area and connecting it to a microcontroller with internet connectivity. The microcontroller can post messages to a twitter account which can be synced with a cell phone, allowing parents to receive notifications of intrusions.

The components chosen for this project are the Arduino Uno microcontroller board, Arduino Ethernet shield, and PIR motion sensor. The Arduino Uno microcontroller was chosen for its versatility. These types of controllers are widely used for prototyping, and work well with various inputs. The Arduino microcontrollers were also chosen for their ability to attach various shields, which widen their peripherals. The Arduino Ethernet shield was needed to give the micro controller connectivity to the Internet, which is needed to post messages to twitter. The PIR (passive infra-red) sensor was used due to the accuracy of detections. The PIR sensor uses the detection of the change in infra-red (heat). The human body naturally emits infra-red energy, and when near in the sensors range, it will detect the human motion.

To combine the components, I will integrate them together. The PIR motion sensor will be connected to the Arduino microcontroller via an analog input, along with the required Ethernet shield attached to controller. With the motion sensor connected to the controller, the controller will be able to process the information passed by the sensor, analyzing whether or not an intrusion has been detected. When an intrusion is detected, the microcontroller will be able to communicate with the Internet and post messages to a twitter account via the attached Ethernet shield.

To test the system, mock trials will be run using the system. Using our hands for motion, a false alarm will be detected by the sensor. Once the sensor has detected motion, to test if the system works, a twitter post will have to be posted to a twitter account. The test will be run ten times to ensure that the system works properly.

In conclusion, the goal of my research project is to design a proactive system for home monitoring and parental control system, which will ultimately lead to teen safety. With the parental control system in place, many unwanted incidents can be avoided. The implementation of the system would allow a parent to feel more comfortable when leaving a teen home alone.

Parts Used

In order to create a home monitoring and detection system that can alert parents, parts needed would have to be able to do the following functions.

1. Detect movement

2. A processor to control the system

3.   Connect to internet

4.   Connect to media site for retrieval

PIR SENSOR
In order to detect movement, a sensor was needed. There are various types of sensors that can be used to achieve the same outcome, like a contact sensor or PIR(passive infrared) sensors. The sensor used in this system was a PIR sensor. A PIR sensor uses infrared light as the source for detection. A PIR sensor will detect if there are any changes in infrared light. PIR sensors consist of separate sensor elements that are connected in such a way that they will cancel signals caused by vibration and weather. The sensor elements are set at different angles to remove false alarms by way of the time the sensors are activated. When set at different angles, the sensors will receive signals at different times. When both sensors detect simultaneously, it cancels the signal. See Figure 1 for configuration.
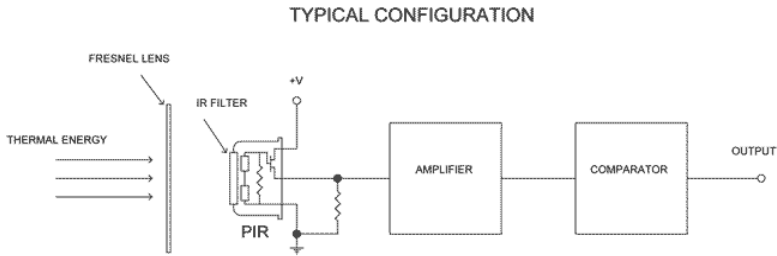
Figure 1: Configuration of PIR Sensor

The PIR sensor also has a lens that is used to filter and focus the infrared light. The filter in the lens works to only allow for infrared radiation between 8-14 µm range. The detected motion must then pass at a horizontal direction in front of the PIR sensor, allowing it to detect the motion on both sensor elements and sending a signal input through the signal wire. When motion is detected, the signal wire sends out a low signal, and keeps sending a high signal when motion is undetected. See Figure 2 for an example.
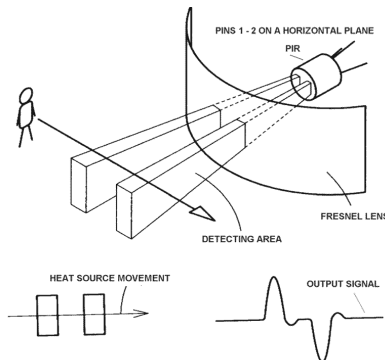
Figure 2: An Example

PIR sensors are most commonly used in security alarms or for automation, fulfilling our need for motion detection. For a sensor to work properly, both the alarm pin and DC pin must be connected to power, due to the alarm pin being an open collector.

ARDUINO MICROCONTROLLER

Arduino is an open-source prototyping platform that has easy to use hardware and software. There are various types of microcontrollers available by Arduino and the one chosen for this specific project was the Arduino UNO (see Figure 3). The arduino UNO comes with the programmable logic controller, and various digital and analog inputs and outputs. For this system only a few inputs and outputs were needed, therefore the Arduino UNO was sufficient. The Arduino UNO uses an Arduino programming language that is based on wiring and similar to programming in C. The Arduino platform also has a variety of shields that add functionality to the system, making it a great choice for further development of the design.
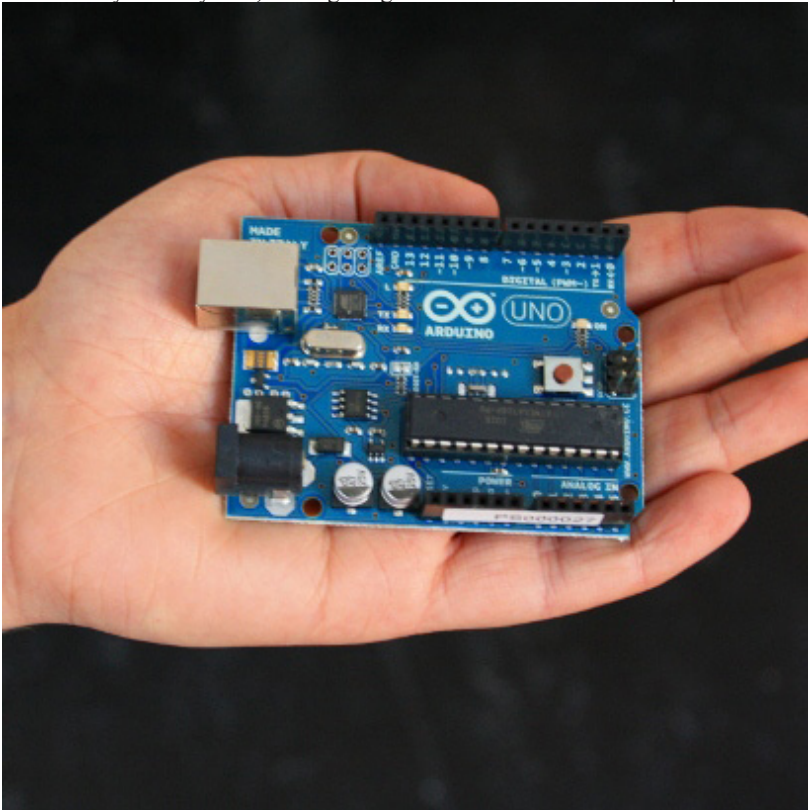
Figure 3: Arduino Uno Microcontroller

Arduino Ethernet Shield

The Arduino Ethernet Shield (see Figure 4) allows for the added functionality of Internet connectivity. By attaching the shield to the Arduino, the inputs and outputs are extended to a new level and the added Ethernet RJ45 jack and a micro SD card reader are connected with Arduino. Using open-source libraries, functions for establishing connections with the Internet are available and easy to use. The shield is a key component of the system, allowing the system to connect to the Internet and establish a connection for working with a social media site.
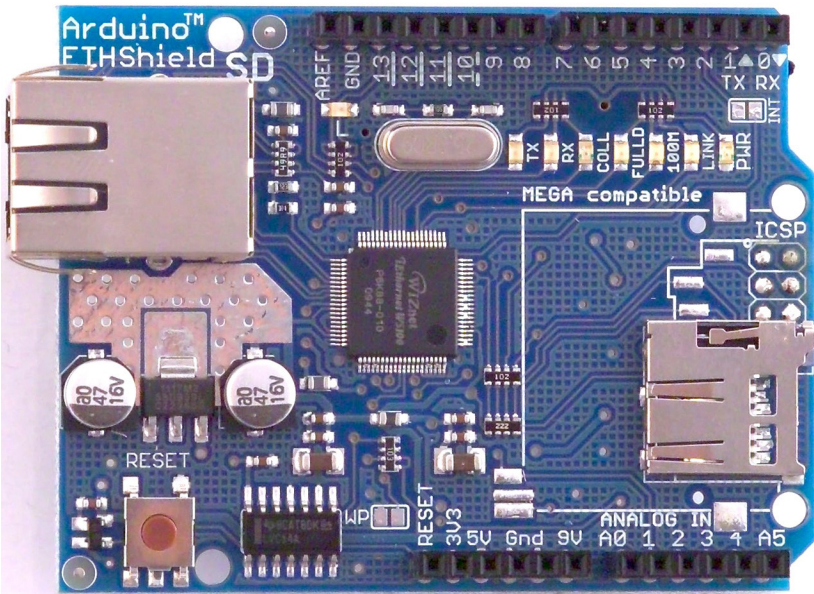
Figure 4: Arduino Ethernet Shield

Twitter

Twitter is a social media site that allows the postings of text. Twitter was chosen as the site of choice for its integration capabilities with Arduino. Arduino has an open-sourced twitter library for use with Ethernet capable Arduinos, which allows users with Arduinos to interface with a twitter account.

System Design

Hardware

In our system, the PIR sensor's power pin is connected in parallel to a 10k resistor and alarm pin (see Figure 5). The power pin will then be connected to 5v output of the Arduino board. The ground will be connected to the ground on an Arduino board (see Figure 6). The

Ethernet shield will be stacked on top of the Arduino board and the functionalities of each input and output will be kept intact, while also adding the Ethernet functionality.
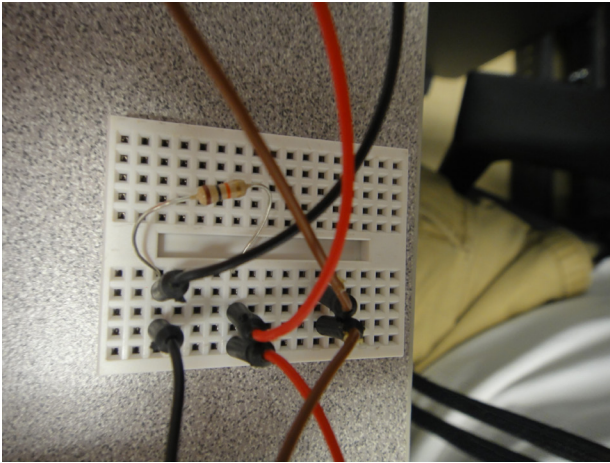
Figure 5: Sensor inputs
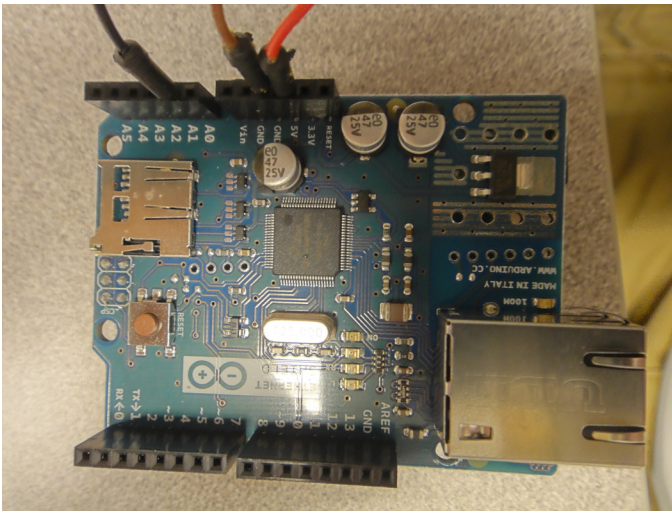
Figure 6: Arduino inputs

Software

The programming of the logic controller was done using the open source libraries available that helped simplify the coding Building upon the Ethernet libraries, I was able to write a program to communicate with a twitter account from our proposed system. Using a loop in the software code, I was able to have the system continue to scan the surroundings and look for human intrusion while the system was running. When the analog input dipped below a

certain value the loop would run a command to post a twitter comment on a predetermined twitter account. Due to twitter's rejection of identical posts, the post had to be marked using a counter to change the post, therefor eliminating the chance of being rejected.

System Implementation

Twitter requires a TOKEN, which is a unique ID given when you authorize a twitter account to let post be made from Arduino. To acquire a TOKEN you must have set up a dedicated account for the system and then sign up for a token at http://twitter.com/oauth/authorize?oauth_token=ikF2bWCcaobIlEhdiYXVU4Im3VeInMdh7qwm2H2fE2k, Once the token is received, it will then be hard coded in our program to link the Arduino with the specific twitter account. When the sensor detects motion, a low signal is sent to the analog input. When the input goes below a threshold value, a post will be made to the twitter account. With the use of an internet connected smart phone, the twitter post will be able to be retrieved directly from the phone at any time. With automatic sync activated on a phone, the twitter post will automatically get sent to the phone within minutes of being posted.

System Testing

Using a simple code to output the analog value given from the sensor when motion is detected and when it is not, I was able to determine that when no motion is detected, the analog value given is 1023, and when motion is detected the analog value given drops to 17. This is a great difference, reducing false alarms. Setting the threshold value to 100 was sufficient for this system. When the sensor detects a motion, the value drops below 100 and when it does not, the value stays far above 100, eliminating any false alarms due to close measurements. Time between posting and retrieval by phone vary depending on the time the post was made vs the time in the cycle of the phones interval for refresh. Table 1 shows the different time interval between posting and retrieval.

Trial #	Time Interval between Posting and retrieval on phone
1	4min 1 sec
2	4min 1 sec
3	4 min 25 sec
4	4 min 28 sec
5	4 min 48 sec
6	4 min 30 sec
7	3 min 27 sec
8	1 min 12 sec
9	4 min 13 sec
10	2 min 3 sec

Table 1

* The time in the application of the phone was set to minimum every 5 min refresh, therefore the post can be retrieved by the phone between a range of 1 sec to 5 min, depending on

what time relative to the refresh interval the post was made. Although the retrieval is not exactly at the time the post was made, upon retrieval it will also have in detail how long ago the post was made.

Conclusion

In conclusion, the system did exactly what it was supposed to do. The time interval between posting and retrieval is not constant, but that is a restraint on the application not the system. The system was able to connect properly and post properly, fulfilling my needs for what I wanted the system to do. The system has many areas where adaptations or improvements can be used, adding a camera or data logging for future references are among the few things that can be incorporated with the design in the future.

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Paying to Proliferate? Examining the Effects of Latent Nuclear Capabilities on U.S. Aid Distribution

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Abstract

     Nuclear proliferation constitutes one of the most prominent issues on the international political agenda. Numerous studies examine this phenomenon, yet little attention has been granted toward assessing how nuclear proliferation is determined by rising powers' perceived benefits of nuclear hedging. Nuclear hedging refers to the political bargaining process in which state leaders threaten to further develop nuclear weapons, or allow for the perception that they may further develop nuclear weapons, in order to receive benefits from another state actor or international organization. In this study, we provide a theoretical explanation for why state leaders engage in nuclear hedging, utilizing a rational-choice approach which emphasizes the expected utility of such a policy: where state leaders perceive a high probability of tangible gains for nuclear hedging, they are more likely to pursue this policy. In order to test this assertion, we assess U.S. aid allocation from the perspective of a rising power to determine whether it "pays" to pose a potential nuclear threat. Using country-years as the unit of analysis,

we conduct regression analysis, the results of which reveal that latent nuclear technology is a statistically significant determinant of U.S. aid, even when controlling for the effects of trade relations, formal military alliances, and target state regime type. These results suggest that, from the perspective of rising powers, it pays to engage in nuclear hedging, thus providing a very important contribution to our understanding of nuclear proliferation.

INTRODUCTION

Nuclear proliferation constitutes one of the most prominent issues on the international political agenda. The promises of nuclear technology -- including its development as an alternative source of energy, use in medical treatments for illnesses such as cancer, and contribution toward agricultural production – have led the international community to promote its development for peaceful purposes. The primary concern, however, is that states may shift the production of nuclear technology from peaceful purposes toward the development of nuclear weapons. The purpose behind developing a nuclear weapon pertains not solely to national defense, but to improved status and negotiating power in the international political scene.

The Nuclear Nonproliferation Treaty (NPT), effective March 5, 1970, sought to prevent further development of nuclear weapons, and non-nuclear powers who have signed the treaty have agreed to develop nuclear technology for peaceful purposes only. Such purposes are verified through inspections conducted by the International Atomic Energy Agency. Despite such assurances, it is possible that a state may find ways around inspections, or remove membership from the NPT altogether. Brazil provides a case of a country which is rising in power, actively engaged in the development of nuclear technology, and which has the potential for developing a nuclear weapon.

Brazil is the only rising power among the "BRIC" group (Brazil, Russia, India, China) which is not a declared nuclear power, yet it continues to develop nuclear facilities, with the declared intent of using these facilities for civilian purposes. Former President Lula da Silva's limitation of IAEA inspections, the transfer of uranium onto military grounds off-limits to inspections, open disgust with the NPT, combined with Brazil's past nuclear weapons development strategy, lead some to believe that Brazil is, in fact, on its way to developing a nuclear weapon. Brazilian officials have adamantly denied such claims.

The Brazilian case described above provides an example, some have argued, of the uncertainty associated with nuclear development and a state's true intentions. This study attempts to contribute to our understanding of the conditions which make a state more likely to develop nuclear weapons capabilities. Other studies have emphasized factors such as include a state's access to existing uranium reserves, involvement in the nuclear export/ import trade, military spending, spending on nuclear research and development, among other factors. In this study, we examine how potential political and monetary gains may influence a state's decision to pursue nuclear weapons development, or at least threaten to do so. This bargaining process is referred to as *nuclear hedging*. One might argue that the risk associated with threatening to proliferate are too great for states to consider this a viable bargaining tool, yet as we illustrate, states may indeed perceive that it "pays to proliferate." In order to assess the validity of this claim, this study focuses on the following research question: *why do states engage in nuclear hedging?*

In order to answer this question, we first begin with a review of the previous literature explaining nuclear proliferation and restraint. This is followed by a theoretical explanation for nuclear hedging specifically. This argument incorporates a rational-choice

approach, presenting a comparison of the expected utility associated with engaging in nuclear hedging versus not engaging in nuclear hedging. We argue that for states with greater latent nuclear capabilities, it the expected utility of engaging in nuclear hedging is greater than strictly adhering to nonproliferation. To test this hypothesis, we develop a research design using country-years as the unit of analysis and compare latent nuclear capabilities to U.S. aid allocations. As the analysis reveals, latent nuclear capabilities are a strong determinant of U.S. aid, even when controlling for other factors such as trade relations, alliances, and regime type. The implications of these findings suggest that traditional explanations of nuclear proliferation which focus on security concerns (realist and neo-realist) and the influence of international organizations (liberal and neo-liberal) ignore bilateral, strategic interactions between states in the form of nuclear hedging. They also lead one to question whether the distribution of U.S. aid is exacerbating nuclear proliferation rather than quelling it.

LITERATURE REVIEW
Many factors influence the decision of state leaders to proliferate and restrain their nuclear capabilities. The concern facing the international community, given the spread of nuclear technology, is not only whether states will use this knowledge to develop nuclear weapons, but also whether non-state actors may acquire this knowledge from states through some form of security breech and use it for more sinister purposes. Although it is rare for non-nuclear states to develop nuclear weapons programs, given the expense and revolutionary nature of such a decision, the greater access to nuclear technology lowers the costs associated with developing such weapons systems.

The primary focus of this study concerns conditions which make a state more likely to engage in nuclear hedging, particularly assessing this movement between nuclear proliferation and restraint as a form of political bargaining (rather than treating it solely as a means for enhancing security). Many scholars have contributed to our understanding of when states move toward nuclear proliferation, and fewer have identified specific factors associated with nuclear restraint. Before providing a theoretical explanation of the political bargaining tool of nuclear hedging, we first survey the existing literature which addresses nuclear proliferation and restraint. Explanations of nuclear proliferation and nonproliferation can be categorized according to unit of analysis, or by identifying factors that relate to the *international system, bilateral relations,* and *domestic considerations.* In this section, we define concepts of nuclear capabilities and present factors from the categories described above. This is followed by highlighting the need to further examine the effect of nuclear hedging on nuclear proliferation.

Defining Concepts: Nuclear Capabilities
Most states may be categorized along a continuum according to their nuclear capabilities, and state leaders may move either further toward or further away from "nuclearization" (Solingen year), warranting a dynamic depiction of this concept. Rather than thinking of nuclear weapons as a dichotomous variable, Singh and Way (2004) conceive of " 'degrees of nuclearness' arrayed along a continuum, ranging from absolutely no effort or interest, at one end, to possession of a vast nuclear weapons arsenal, at the other end" (866). Correspondingly, Jo and Gartzke (2007) emphasize that there are distinct stages of nuclear proliferation – "the presence of nuclear weapons programs and the possession of nuclear weapons" (167). Thus, dichotomous depictions of nuclear capabilities are too

simplistic. One must allow for the possibility that states may move along this continuum in incremental ways, and that changing factors both at systemic, dyadic, and monadic levels determine the movement and direction along this continuum, or for that matter, lack of movement.

International System

During the Cold War, there was an obvious distinction between major powers with nuclear capabilities and those who did not pursue nuclear proliferation. The United States and the Soviet Union were two major nuclear players, and their rivalry has often been used as a baseline for explaining strategic nuclear weapons development; that is, the primary assumption among traditional realists has been that states pursue nuclear weapons in response to the development of said weapons by other states, thus begetting an arms race. During this time period, some state leaders refrained from pursuing nuclear weapons due to guarantees offered by both the U.S. and the Soviet Union's nuclear umbrellas, calling into question the spiraling arms race depiction of nuclear proliferation. The end of the Cold War, however, brought about a less secure environment for those states that had previously been protected under their respective nuclear umbrellas. Some argue that this induced these states to pursue their own nuclear weapons programs (Jo and Gartzke 2007).

The end of the Cold War brought about a perceived end to guarantees previously provided by the Soviet nuclear umbrella, leading to a shared fear among those in the international community that rising powers and other states most vulnerable to outside threats would be more likely to pursue nuclear arms.   The existing Nuclear Proliferation Treaty (NPT) served as an institutional means for preventing, or at least delaying, the pursuit of such weapons. The international community created the NPT to prevent the spread of nuclear weapons, but encourages the use of nuclear energy for civilian purposes. The NPT came into effect on March 5, 1970 when it was ratified by the U.S. This treaty holds the United States, Russia, United Kingdom, France, and China accountable for preventing the spread of nuclear proliferation in terms of technology, materials, and education to non-nuclear states. Under the NPT these states are required to reach agreements with other countries in terms of nuclear disarmament. Non-nuclear states are forbidden from acquiring the necessary materials and technology to pursue nuclear proliferation. Yet, they are still protected from international nuclear threats through agreements and alliances with states that are nuclear powers. All signatories to the NPT are also required to participate in the International Atomic Energy Agency's (IAEA) inspections of nuclear facilities. This is done to make sure that states using nuclear energy for civilian purposes are not implementing steps to acquire nuclear weapons.

Aside from providing incentives in the form of nuclear energy technology in exchange for nonproliferation, some argue that norms of nonproliferation have developed within the international community. Norms can work to either induce or mitigate nuclear proliferation. On the one hand, it may induce proliferation by leading states to pursue nuclear programs in order to achieve greater status within the international system. On the other hand, more recent negative connotations associated with nuclear proliferation may deter states from pursuing programs lest they be considered "rogue" states (Sagan 1996/97). As Jo and Gartzke (2007) argue, "The NPT is the most obvious example of efforts to curb the spread of nuclear weapons through the enforcement of an international norm. Leaders who oppose nuclear weapons may use international agreements as barriers against domestic pressure for nuclear proliferation" (, 171).   Likewise, their findings

reveal statistical support for the notion that NPT has the systemic effect of reducing nuclear proliferation.

Despite the NPT's potential nonproliferation effects, some argue that the treaty has many loopholes that allow countries to pursue the development of nuclear weapons. Although there are requirements that states should follow to enforce the NPT, such as allowing the International Atomic Energy Agency to inspect nuclear facilities, there are still some states that have openly retracted from the NPT. North Korea, for example, openly withdrew itself from the NPT to pursue a nuclear weapons program, and it uses nuclear proliferation to insert fear in the international community to receive aid and other incentives.

Furthermore, the NPT, although designed to prevent weapons proliferation, encourages development and sharing of nuclear energy technology. Thus, the existing technology diffusion in the international system may provide easier access to nuclear knowledge that may be used for either weapons or civilian purposes. Fuhrmann (2009) argues "all types of civilian nuclear assistance raise the risks of proliferation" (8). This is because they reduce "the expected costs of [pursuing a nuclear weapons program] and inspire greater confidence among leaders that the bomb could be successfully developed" (8). This is further enhanced by a threatening security environment. Although weapons inspections are currently in place, it is difficult to distinguish whether a state is developing nuclear technology for weapons, energy, or both. "Peaceful nuclear cooperation and nuclear weapons are related in two key respects. First, all technology and materials linked to a nuclear weapons program have legitimate civilian applications…Second, civilian nuclear cooperation increases knowledge in nuclear related matters (Fuhrmann 2009, 12). Thus, a state which appears to be developing nuclear technology for civilian use at one point in time could decide at a later date to remove itself from NPT, prevent weapons inspections, and develop nuclear weapons with its newly acquired scientific knowledge. Or, it could continue to allow inspections of some sectors, while keeping weapons development facilities hidden or safely within military bases: "…civilian nuclear energy cooperation can aid nuclear weapons production by providing the technology and items necessary to provide fissile material. [Although] there are set restrictions on nuclear fissile materials, fissile material production is the most difficult step in building the bomb" (Fuhrmann 2009, 14). Thus, once this step is finished, further development of a nuclear weapon is easier.

Bilateral Relations
U.S. Influence

Aside from international systemic effects, such as polarity of the system and international organizations such as the NPT, other states within the international community may also use their influence to prevent or encourage the expansion of nuclear arms. If a rising power seems to be taking the necessary steps to pursue nuclear arms, then a state with established nuclear capabilities might discourage the state from further production and study of nuclear weapons. Scholars argue that the U.S. utilizes its capacity to prevent states from acquiring nuclear weapons: Methods such as providing states with protection against nuclear attacks, giving foreign aid to state leaders who oblige with nuclear restrictions, and using their international presence to shame those who do not follow the NPT. Levite (2002) highlights the case of Brazil, stating, "In 1976 President Gerald Ford's outgoing administration worked out a secret agreement with Brazil in which the latter agreed to annul a 1975 contract it had awarded to Germany for the purchase of reprocessing plants

in return for U.S. security guarantees and promises of military sales…" (79). Interestingly, however, Jo and Gartzke (2007) find that the presence of a nuclear threat decreases nuclear proliferation. "Nuclear defenders do discourage a deepening of nuclear proliferation among protégés, but there is not much difference between states possessing or lacking nuclear defenders in terms of the likelihood of having a nuclear weapons program" (Jo and Gartzke 2007, 186).

States that do not have the economic resources, manpower, and technology to pursue nuclear proliferation have to find other ways to protect themselves from a nuclear attack. Minor powers seek alliances with a major power, such as the U.S., to ensure their security in the international community. Scholars argue that a state's status in the international community can be use to the advantage of the state. Major powers can use nuclear proliferation to deter minor states from pursuing nuclear proliferation. According to Levite (2003), "U.S. nonproliferation efforts entail both positive and negative inducements. Positive inducements include security guarantees, promises of economic and technological assistance, diffusion of nuclear technology, while negative inducements include threats of withdrawing these provisions" (78). Major powers are able to pursue nuclear proliferation and maintain the program because they have the economy, technology, and desire to pursue nuclear proliferation. "…The United States had bilateral security arrangements with Japan, Australia, New Zealand, the Philippines, South Korea, and Taiwan, providing Washington with unique leverage on some of them…Likewise, Egypt would have pursued the bomb had not it been for U.S. diplomatic initiatives, including reassurances that Israel 'will not introduce' nuclear weapons into the Middle East" (Verdier 2008:443). With the ability of the U.S. to pursue and fund many agreements with other states, they are able to have leverage over many decisions in the international community.

Results of Singh and Way's studies indicate that alliance with a major nuclear power is not a statistically significant determinant of nuclear weapons proliferation, although the relationship is negative, as expected, and reduces the risk of nuclear proliferation by 54 percent (2004, 873, 876). Jo and Gartzke also find this relationship to be negative, and with statistical support.

Rivalry and Militarized Disputes with Other States

One of the most important aspects of being an international identity is having a secured state that is safe from all external threats. Both Jo and Gartzke (2007) and Singh and Way's (2004) results reveal that conventional threats, participation in an ongoing enduring rivalry, and involvement in militarized disputes are strong determinants of nuclear weapons proliferation, granting support for the idea that security environment matters. Singh and Way identify a number of states that pursued nuclear weapons "but should not have," according to their model. Brazil appears on this list; "although its relationship with Argentina often rendered its security environment less than benign, it has not faced a high-intensity threat environment compared to most other proliferators" (2004, 880). Still, presence of a conventional threat makes a state 164 percent more likely to proliferate (Jo and Gartzke 2007, 182). Rising powers feel threatened by other states that have nuclear weapons, and set out to acquire a nuclear weapons program of their own, to have leverage in the international community. Most rising powers have an economic need that could be filled with, the manufacture, study, and production of nuclear proliferation. Scholars argue that once a rising power has achieved nuclear proliferation, new threats to the state emerge. This will then lead to the rising power deterring its nuclear weapons program

since the outcome outweighs the result. Instead of nuclear proliferation increasing a states international security, their security is disrupted since other states feel threatened in terms of their nuclear proliferation program. This then leads to new threats emerging in the state, so a rising power would revert back to a non- nuclear state.

Domestic Considerations
State Capacity
In order to have a nuclear weapons program a state must have necessary qualities such as an economy suitable for the project, education and information on nuclear proliferation, and the technology to manufacture and produce nuclear weapons. "No nation can build nuclear weapons without attaining a minimal economic/technological capacity" (Singh and Way 2004, 860). Leaders of a country which has the capacity to develop nuclear weapons, in terms of both scientific knowledge and economic prosperity, will be inclined to pursue nuclear production given security concerns and alternative sources of energy. If a state does not have the funds to pursue their itinerary then it is very unlikely for the state to have nuclear weapons. Jo and Gartzke (2007) find economic capacity to be a statistically significant determinant of nuclear proliferation (177), but Singh and Way's results indicate this effect is nonlinear: "at low levels of GDP, further economic growth steadily increases the likelihood that a country will explore the nuclear option; yet at high levels of development, the effect levels off and, in fact, reverses because very high levels of income are associated with a falling hazard rate" (872). Yet, both major and regional powers are more inclined to continue nuclear weapons proliferation than non-major powers (Jo and Gartzke 2007, 177).
Economic Openness
Trade liberalization appears to have a negative effect on nuclear weapons proliferation (Singh and Way 2004, 874). According to Solingen (2007), "nuclear weapons are seen as less likely to emerge when the domestic political landscape is sympathetic to economic openness, trade liberalization, foreign investment, and international economic integration" (cited in Potter and Mukhatzhanova 2008, 145).
Regime Type
Scholars also argue that nuclear proliferation depends on the regime type of a state, whether it is autocratic, meaning that one individual holds all the power, or a democracy where citizens have equal representation. "One group of scholars argues that autocracies may be in a better position to quell domestic objections and pursue the development of nuclear weapons. Another group of scholars argue the opposite, that democracies may be more disposed to develop nuclear weapons" (Jo and Gartzke 2007, 170). Neither democracy nor democratization are found to be statistically significant determinants of nuclear proliferation in Singh and Way's study (2004, 874), but Jo and Gartzke find that democracies are *more* likely to deepen nuclear weapons development (177). Since democracies generally have the means to produce and develop nuclear weapons, they are capable of expanding nuclear proliferation. Also most major powers are democracies that want to attain leverage within the international community, so they would rather expand their nuclear capabilities and defense instead of deferring. In their explanation of why democratic governments may be more likely to develop nuclear weapons, Jo and Gartzke (2007) argue, citing the case of public support for nuclear tests in Pakistan: "Populist politicians scrambling to mobilize public opinion may be tempted to pander to nationalist hysteria" (170). Their findings also reveal that democracies are more inclined to deepen nuclear weapons development (177).

Political Survival

Nuclear proliferation is a crucial topic in a politician campaign and within their political career, and it can make or destroy agendas and politicians. Solingen emphasizes the importance of political coalitions, expecting that these political groupings "typically will make rational choices based on their calculation of regime (rather than state) benefits. These decisions, moreover, are apt to vary significantly from state to state and regime to regime" (Potter and Mukhatzhanova 2008, 164). Politicians will use nuclear proliferation or non- proliferation to their advantage, and not for the benefit of civilians or the actual state.

Conclusion

The *international system, bilateral relations,* and *domestic considerations* are all factors that scholars have studied to identify whether a state is going to participate in nuclear hedging. In the international system we saw that most states turn on and off their nuclear capabilities depending on what the international community is doing. This decision, according to realist, is based on a security dilemma. If there are external nuclear threats to the state, then that state is more like to become a proliferation state. In bilateral relations one state, usually a state with nuclear capabilities and one that is a major power, can provide other state's incentives to put up a system or to not pursue nuclear weapons. A nuclear umbrella protecting a rising power or a minor state is given to protect the state from a foreign nuclear attack. Other incentive such as aid, food and good standing with the state offering the protection are other incentives that are offered. Domestic considerations, where the criteria's that a state needs to have in order to pursue a nuclear program, such as good economics, the manpower, and technology to pursue nuclear proliferation. Many scholars argue that nuclear proliferation is used as a tool to enhance a states national security. Yet nuclear hedging as a tool for political bargaining has received less attention among the international community.

THEORY

In the literature review we discussed the research of previous scholars pertaining to nuclear proliferation and nuclear hedging. Most scholars have identified nuclear proliferation as a continuous rather than dichotomous notion, and have contributed to the understanding of when a state moves toward nuclear proliferation. In this study, we provide a theoretical explanation for why state leaders engage in nuclear hedging. Utilizing a rational-choice approach emphasizing the expected utility of such a policy, we argue that where state leaders perceive a high probability of tangible gains from nuclear hedging, they are more likely to pursue this policy.

Nuclear hedging as a form of political bargaining requires the participation of at least two actors, the nuclear hedger and another actor (who we will call the patron) with the capacity to dole out the perquisites to be received by the nuclear hedger. Hypothetically, the nuclear hedger would be one who already has some degree of latent nuclear capabilities, making any ambiguous intentions or open threats to proliferate more credible. The patron may be an international institution, a single state, or a group of states. One obvious example of the latter is the United States. As Levite (2008) argues, the U.S. has significant capacity and a perceived responsibility for acting as patron in an attempt to slow nuclear pursuits. Still, given that this is a strategic interaction between a hedger and patron, one must explain why *both* would consider engaging in such a political bargaining process.

Nuclear Hedger's Perspective

A long-standing argument among international relations scholars contends that states pursue nuclear capabilities not solely for security purposes, but also for international recognition. Having such weapons grants them bargaining power, and hence greater influence in the international system. In order for a state which is a rising power to gain the perquisites associated with having more power in the international system, according to the realist perspective, a state must enhance security or enhance their military capabilities. Brazil would be an example of such a case above because it is part of the BRIC (Brazil, Russia, India, and China). The BRIC is a set of countries which are labeled as rising powers, but Brazil is the only country without nuclear weapons. However, we argue that aside from attaining greater status within the international system, political leaders are also guided by more tangible, direct perquisites of nuclear hedging. One example of this is evident in the benefits provided by the Nuclear Non-proliferation Treaty (NPT). In exchange, for opening their nuclear facilities to inspections, signatories receive knowledge pertaining to the development of nuclear energy programs. Another less obvious example, however, is the aid provided by the United States to those with nuclear potential. As is illustrated in the analysis section of this paper, the U.S. is shown to grant more aid to those with latent nuclear capabilities than to those without, defying existing notions of the U.S. "sanctioning" nuclear powers. What follows is an explanation of why each actor, nuclear hedger and state provider, would engage in the nuclear hedging bargaining process.

Expected utility is determined by perceived benefits, costs, and probability of a successful outcome. Leaders determine probability of success by observing the previous actions of other actors in the international system (learning). Consider the perspective of a potential nuclear hedger with some existing nuclear capabilities (not a weapon, but nuclear processing facilities). The leadership in this state has the option to leave these capabilities as they are, destroy them as an act of good faith and in exchange for some other benefit provided for complete disarmament, or to further develop their nuclear capabilities. Nuclear hedging refers to the strategy of choosing a course which *leaves open the option* of further development, without necessarily implementing development. On the one hand, one might argue that leaving one's intentions ambiguous is risky, as it can make other states feel threatened and lead them to act aggressively toward the nuclear hedger. However, if a nuclear hedger observes that states with latent nuclear capabilities allow for perceived ambiguity of their intentions and do not suffer consequences, they will "learn" from this not only that this behavior goes unpunished, but that some states instead receive more aid from the U.S. for leaving this perception ambiguous. In other words, creating the opportunity for ambiguous perceptions of nuclear intentions has greater utility than leaving it unambiguous.

Still, one must question why the U.S. would engage in such a game. Does the U.S. not punish states that leave their nuclear intentions ambiguous by implementing sanctions, as is done with the case of Iran and North Korea? Although publicly the U.S. may punish states with sanctions, observation of U.S. aid distributions reveals that it does not withhold all aid. Consider, for example, that in 2004, the U.S. infused $11.07 million in combined military and economic aid to Iran (U.S. Overseas Loans and Grants), and $191 million in aid to North Korea. Although these amounts appear small on the surface, once must consider that these are *aid* distributions, and also that annual average U.S. aid from 2000-2009 to countries with GDPs of less than $783 million was $11.77 million, while it

averaged $126 million for those with GDPs greater than $783 million. This implies that it is not always the needy who receive aid from the U.S., supporting the notion that the U.S. uses aid as a political tool, as well.

Still, why would the U.S. expend its resources on nuclear hedgers, as realist theory leads us to believe it would never grant resources which could potentially strengthen another state? From the U.S. perspective, a state threatening to further develop nuclear weapons does not necessarily pose a direct threat to the U.S., but an indirect threat. The indirect threat relates to the possibility that any newly acquired nuclear know-how could be acquired by state or non-state actors with more sinister intentions. Furthermore, states with latent nuclear capabilities, as well as greater military spending, receive more attention from the U.S., as any intentions to further proliferate are more credible. By providing a nuclear hedger with tangible benefits, it buys time which could instead be used to further develop nuclear weapons programs. The obvious concern is that the U.S. may be unaware of secret development programs not open to inspections.

Returning to the perspective of the nuclear hedger, as was argued, a state's leadership will be more inclined to use nuclear hedging as a bargaining tool if it perceives that such a policy pays. This is contingent upon a state's having some existing nuclear capabilities, as the expenses of starting up such a program from scratch would not be worth the small gains provided by U.S. aid. That is, states may use existing nuclear capabilities to their political advantage, without devoting much in the way of additional resources. This would be considered a viable strategy only if state leadership had observed that such a strategy worked in the past. Thus, in order to assess the validity of the strategic interaction described above, one would need to first observe that it does indeed pay to engage in nuclear hedging. This is depicted in the following hypothesis: *The greater a state's latent nuclear capabilities, the greater U.S. total aid this state receives.*

There is support for the theory described above depicting learning behavior if we find support for this hypothesis. If instead, we find no relationship between latent nuclear capabilities and U.S. aid, or a negative relationship between these variables, we would have to conclude that state leaders in the international system do not necessarily perceive that it "pays" to have nuclear capabilities.

RESEARCH DESIGN

This section describes how we test the hypothesis stating that a state's latent nuclear capabilities determine the amount of U.S. total aid this state receives. We first explain the method selected to examine the hypothesis and follow with a description of how the variables are measured.

Methodology

One may assess factors influencing the nuclear proliferation decision-making process using qualitative or quantitative methods. In this study, we rely mostly on the latter approach. Although important details are often lost when utilizing a quantitative approach, this method allows for a broader perspective, and more parsimonious conclusions. We do, however, also discuss the case of Brazil, more closely examining a potential case of nuclear hedging.

Dependent Variable – U.S. Total Aid

Using 158 countries with respective data from 1990-2009, the unit of analysis

is country-year, creating 2,209 observations.[1] The dependent variable is U.S. total aid (including both economic and military assistance), and it is measured in U.S. millions ($USM). Data for U.S. total aid were collected from the U.S. Overseas Loans and Grants website.

Primary Independent Variable – Latent Nuclear Capabilities

Latent nuclear capabilities for each country-year are compiled using Eric Gartzke's " N_CAP7" variable from his article with Dong-Joon Jo entitled "Determinants of Nuclear Weapons Proliferation." These data are available from Gartzke's website: http://dss.ucsd.edu/~egartzke/htmlpages/data.html). As described by Gartzke in his Codebook (http://dss.ucsd.edu/~egartzke/data/jo_gartzke_0207_codebk_0906.pdf), this variable is "a composite index of latent nuclear weapons production capability, summing up…seven indicators." These seven indicators are described briefly below:

1. uranium deposits or production

2. ability to process uranium

3. whether a country produces nitric or sulfuric acid

4. enabling it to chemically make nuclear munitions

5. explosive and electronic capability

6. nuclear engineering capability (nuclear reactor is more than 3 years old)

7. capability to produce enough electricity to run a nuclear weapons program

Control Variables

In order to understand the relationship between the independent variable, latent nuclear capabilities, and the dependent variable, U.S. total aid, we place control variables. Other variables which may determine U.S. total aid distributions include: the previous year's aid, trade relations between the U.S. and target state, a target state's regime type, and a formal alliance between the U.S. and target state.

The previous year's aid is determined by creating a lag variable from the U.S. total aid variable. Trade relations are measured by providing a value for total trade between the U.S. and target country (both exports and imports) for a given year, in $USM (source: IMF Statistical Yearbook). Regime type comes from the Polity IV Project's "polity2" variable, available at their website (http://www.systemicpeace.org/polity/polity4.htm). Polity2 measures the degree of autocracy and democracy by assigning numerical values ranging from -10 to +10, with -10 being most autocratic and 10 being most democratic. Finally, formal alliance between the U.S. and target State is measured dichotomously using the Alliance Treaty Obligations Provisions (ATOP) Project developed by Brett Ashley Leeds, Jeffrey M. Ritter, Sara McLaughlin Mitchell, and Andrew G. Long (http://atop.rice.edu/).

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1   This is the number of observations ultimately included in the analysis, as STATA automatically drops observations with missing values.

ANALYSIS

Descriptive Statistics

Table 1 below depicts descriptive statistics for each of the independent variables included in the analysis. The dependent variable, U.S. total aid, reveals a negatively skewed distribution, with a mean value greater than the median. Surprisingly, the modal category for latent nuclear capabilities is 7, indicated that more country-years had this value than any other value. Closer examination reveals that the mean value of U.S. total aid for country-years with a latent nuclear capabilities value of 7 is $265.02M, higher than the baseline U.S. total aid mean of $114.02M.

Table 1. Descriptive Statistics

	Mode	Mean	SD	Median	Range
U.S. Total Aid	N/A	$114.08M	568.97	$9.01M	$0-11,290M
Latent Nuclear Capabilities	7	N/A	N/A	3	0-7
Total Trade	N/A	$8377.85M	30260.86	$496.1M	$0-$427,776M
Regime Type	10	N/A	N/A	5	-10-10
Formal Alliance	0	N/A	N/A	N/A	0 or 1

Greater mean than median values for U.S. total trade also reveal a negatively skewed distribution. The mean value of U.S. total aid for observations with total trade values greater than the mean ($8,377M) is $189M, again greater than the baseline mean, though with a less substantial difference than that for country-years with a latent nuclear capabilities value of 7. The modal regime type category is 10, although it is interesting to note that the mean U.S. total aid value for country-years with a regime-type value equal to 10 is $99.66, lower than the baseline mean. Finally, the modal category for a formal alliance value is equal to 0, accounting for 74% of observations. Interestingly, the mean value of U.S. total aid given a formal alliance with the target state is $65M, much lower than the baseline mean. The next sub-section depicts the results of multiple regression analysis of these variables on U.S. total aid.

Inferential Statistics – Regression

Multiple regression is used to test the hypothesis that latent nuclear capabilities partially determine U.S. total aid. Results of the regression analysis are illustrated in Table 2 below. Given p-values less than 0.05, the following variables are found to be statistically significant determinants of U.S. total aid: latent nuclear capabilities, previous year's aid, and formal alliance. Thus, the null hypotheses expecting no relationship between these variables and U.S. total aid may be rejected. The r-squared value also indicates that the model performs fairly well, explaining 0.55 percent of variance in U.S. total aid. It is interesting to note that neither trade relations nor regime type were found to be statistically significant, indicating that the U.S. does not only support its trading partners, and nor does it provide greater amounts of aid to democracies than non-democracies.

Table 2. Multiple Regression of U.S. Total Aid

Variable	Coefficient	Standard Error	t	P>t	[95% Conf.	Interval]
Latent Nuclear Capabilities	13.089	3.697	3.540	0.000	5.839	20.338
Previous Year's Aid	0.751	0.015	50.360	0.000	0.722	0.780
Total Trade	0.000	0.000	-0.990	0.323	-0.001	0.000
Regime Type	0.027	1.470	0.020	0.985	-2.855	2.909
Formal Alliance	-48.420	21.561	-2.250	0.025	-90.702	-6.138
Constant	1.376	14.469	0.100	0.924	-26.998	29.750
Number of observations =2,209						
R-squared = 0.555						

In terms of substantive strength, for each unit increase in latent nuclear capabilities, U.S. total aid increases by $13.09 million. This may be compared to the effects of other statistically significant variables. Each additional million dollars of aid in the previous year accounts for an increase of $750,000 in the following year. Surprisingly, although formal alliance with the U.S. is found to be statistically significant, it is in the unexpected direction, indicating that a formal alliance with the U.S. *decreases* U.S. total aid by $48.31 million. This is most likely due to the fact that the U.S. has more formal alliances with more developed states, those least in need of U.S. aid.

The regression results support the primary hypothesis examined in this study stating the latent nuclear capabilities are a significant determinant of U.S. total aid. This supports one aspect of the broader theoretical argument which provides justification for why states would engage in nuclear hedging. Observing U.S. aid distributions to other states, potential nuclear hedgers "learn" that it pays to have latent nuclear capabilities. However, in order to further assess this theory, one would need to observe nuclear hedging in action. The next section attempts to do this by presenting the case of Brazil under the Lula administration.

The Case of Brazil

As a part of a group of rising powers referred to as "BRIC" (Brazil, Russia, India, and China), Brazil represents the only state which does not possess a nuclear weapon. Most assume there is no attempt underway to acquire one, yet three actions on the part of former President Lula da Silva represent "signals" of nuclear hedging. These include: open disapproval of the NPT, meeting with Iranian leader Mahmoud Ahmadinejad regarding potential uranium trade, and Lula's prevention of inspections of military bases where uranium deposits were being transferred. These behaviors, coupled with the fact that Brazil already has significant latent nuclear capabilities, is considering building new nuclear plants, and has the strongest military in the southern hemisphere, signify a state primed for nuclear hedging.

When questioned about nuclear weapons and nuclear hedging, most Brazilians

are quick to answer, "Brazil does not need or have the intentions of building nuclear weapons." Yet, there are many factors that suggest that Brazil is building a bomb. "Only a few months after Lula's inauguration in 2003, the country officially resumed the development of a nuclear-powered submarine" (Rühle 2010, 1). Despite the fact that for the last ten years before his presidency there was no nuclear production occurring in Brazil, President Lula made it his priority to build nuclear submarines as soon as possible. Even though Brazil is a signatory to the NPT, President Lula avoided inspection from the IAEA by placing uranium and nuclear fissile materials in military bases. Aside from President Lula's disapproval of the NPT, other members of his government opposed of the NPT, and where in favor of nuclear proliferations program. "For a country with a 15,000-kilometer border and rich offshore oil reserves, Alencar says, these weapons would not only be an important tool of "deterrence," but would also give Brazil the means to increase its importance on the international stage"(Rühle 2010, 1).

As expected, Brazilian officials deny any claims that they intend to reignite a nuclear weapons program. Yet, it is not political rhetoric but behaviors which make nuclear hedging such an effective bargaining tool. By leaving intentions ambiguous, yet publicly claiming to have no such weapons program underway, Brazil walks a fine line between provocation and acquiescence. They garner greater attention from the international community without provoking too harsh a response, an illustration of nuclear hedging.

Consider, for example, Brazilian claims of pursuing nuclear technology for energy purposes. These seem to be surprising to energy experts, given the expense and dangers associated of further developing nuclear facilities, and significant development of alternative forms of energy (particularly hydropower). In meetings with contacts at the Companhia Paranaense de Energia (COPEL), a provincially run energy company, and with engineering Professor Maria te Vaarwerk at Pontifícia Universidade Católica do Paraná, nuclear energy was dismissed as a viable option for addressing Brazil's nuclear needs. In fact, despite the fact that Paraná has been considered a site for development of a future nuclear plant, COPEL has no intention in the near future of pursuing nuclear research and development. This disconnect between high-level government rhetoric regarding the pursuit of nuclear energy and the dismissal of nuclear energy by energy experts signifies ambiguity in intentions. Uncertainty is key to using nuclear hedging as a bargaining tool.

Nuclear hedging is difficult to assess, however, because state leaders will not openly admit they are using nuclear hedging as a bargaining tool. One must instead observe the interaction between the hedger and state providing resources. Examination of the annual average U.S. total aid to Brazil and Argentina over the years of the Lula administration is telling (see Table 3 below). Although both states have latent nuclear capabilities, Brazil's annual average military spending was 10 times that of Argentina during the 2003-2009 timeframe. One may observe the U.S. perception of threat posed by a state which spends as much as Brazil on its military, is a rising power, and is the only current rising power not to have acquired a nuclear weapon. Public relations between the U.S. and Brazil have appeared contentious, particularly given Lula's open animosity, yet aid distribution paints a different picture. The average annual U.S. total aid to Brazil is nearly six times that to Argentina. Although one would need an inside government official to verify what political bargaining drives this aid, we have observed from the quantitative analysis that latent nuclear capabilities play a significant role, and we may assume that the more credible the nuclear threat (perhaps indicated by military spending), the greater the aid.

Table 3. Comparison of Brazil and Argentina

Annual average from 2003-2009 (Lula's administration)	Brazil	Argentina
Latent Nuclear Capabilities	7	7
U.S. Total Aid	$27.44 million	$4.61 million
Military Spending in constant $US	$21.08 billion	$2.14 billion
Total Trade between U.S. and Target State	$45.40 billion	$9.30 billion
Regime Type	8	8

CONCLUSION

The primary goal of this study has been to contribute to our broader understanding of nuclear proliferation. It was argued that understanding why states proliferate weapons, or threaten to do so, requires consideration of nuclear hedging as a political bargaining tool. That is, states may purposefully leave their intentions ambiguous regarding nuclear proliferation in anticipation of tangible benefits. An example of such benefits may be U.S. aid. Both quantitative analysis of the relationship between latent nuclear capabilities and U.S. aid, and qualitative analysis of the case of Brazil, find support for this claim. That is, it appears the U.S. is paying states to proliferate – or paying them to behave as if they might proliferate – rather than to *not* proliferate. If this is the case, the U.S. may be inhibiting longer term nonproliferation goals for the sake of short-term gains associated with buying time. Further examination of this U.S. policy is warranted to determine its viability. At the very worst, in their attempts to mitigate nuclear threats to the international community, the U.S. and NPT may in fact be providing resources which exacerbate this threat.

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Union Officers, Confederate Colonists, US Senators: Americans in the French Intervention of Mexico, 1862-1867

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Abstract

The American Civil War lasted from 1861-1865, the French Occupation of Mexico also known as the French Intervention lasted from 1862-1867. Both of these conflicts in North America would take the lives of thousands and when the dust settled one continued on as a nation undivided and the other country maintained its sovereignty. Both of these nations have storied histories of these great upheavals that threatened their nations, but these stories are often told separately, ignoring Mexicans' role in the US Civil War and Americans' role in Mexico's struggle against the French. This project focuses on the latter question: what role did Americans play in the French Intervention in Mexico? By Americans, this project refers mostly (though not exclusively) to Anglo Americans, focusing on two groups: official policymakers and former Confederates.

This project offers two findings. It notes the change in policymakers' attitude towards Benito Juárez and his Republican Mexico, which shifted dramatically from 1862 to 1867. At first the United States chose to stay on the fence and not take a stance, later on the United States

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went ahead and took a stance of neutrality and finally after the Civil War the United States commended Juárez and Mexico for their success in driving out the French and executing Emperor Maximilian. This project also identifies an irony in which the Confederates side with the imperial Mexican government in sharp contradiction to the principles of states' rights in defense of which they had fought the Civil War in the United States.

Senator Chandler of Michigan made this statement in 1867: "…if any European monarchy determined to fight Mexico, it must fight the United States also". When one thinks of the French Intervention in Mexico most Americans think of a Mexican struggle, Mexico's struggle to maintain its sovereignty against an imperialistic European nation. In fact this struggle wasn't solely vested on the shoulders of Mexican; instead there were Americans who supported Benito Juárez and the Republic of Mexico. In addition to this there were also Anglo-Americans who supported the reign of Emperor Maximilian. What must be understood is that the period of the French Intervention (1862-1867) the United States was preoccupied with the American Civil War (1861-1865). In addition to that the Monroe Doctrine which declared that the colonization of the Western Hemisphere by European powers would be deemed as a threat to the security of the United States and would be met with intervention, despite this bold claim the US had no power to intervene because it was preoccupied with the Civil War.

The motivation for Americans to act in the French Intervention varied, as did their contributions. In general, I argue that the ones who supported Maximilian and the Empire were Confederates who fled to Mexico in the wake of General Lee's surrender, to avoid persecution from the north or to resist surrender and subordination. They did sell arms to the Imperial cause, but they did not join forces to fight with them, preferring instead to settle in Mexico as civilian colonists, entrepreneurs, or even government officials. Most Americans, both Anglo and Mexican, championed Juarista resistance to the French and to Emperor Maximilian. Their reasons varied, though in general, Americans espoused ideological stances of upholding the Monroe Doctrine or defending republican governments from monarchies, as well as practical ambitions of profiting in Mexico. In the most extreme expression of profit, Anglo Americans wanted to gain more Mexican territory.

This research intends to make a practical contribution to US history as well as a scholarly one. This research project will help lay the foundation to write a proposal to Ken Salazar, the current Secretary of the Department of the Interior. Mr. Salazar has set up an initiative to better integrate the American Latino heritage into the story of America. My research will also shed light on important locations where Mexican-Americans were either sending help to Juárez or were raising support for Juárez. We will use this research to propose to the US Parks Service a "Cinco de Mayo Route" which maps American contributions to Mexico's resistance to the French.

Confederates and the French Intervention in Mexico

Towards the end of the American Civil War when the defeat of the south was eminent there were members of the Confederate army that would not accept defeat. General Sterling Price was one of these men. Instead of surrendering to the north he and his men went down to Mexico to establish a Confederate colony, this colony was located near Córdoba, Veracruz. This colony was named Carlotta (Carlota) after Emperor Maximilian's wife, one Confederate stated that it was "a compliment to the Empress, whom we all

love and admire, and for whom we are ready at any moment to shed what remains of our Confederate blood, in this or the other country if necessary".[1] A New Yorker paid a visit to Carlotta City on his way to Mexico City. Upon his arrival General Price was happy to see him, thinking he was a colonist coming to settle Carlotta.[2] Price's was disappointed to learn that his guest was just passing through. The New Yorker had been told by his Confederate conductor that Carlotta City was to rival New Orleans and Richmond. Upon his arrival he found a tent city and scores of nearly completed adobe houses.[3] General Price had become accustomed to his new life of farming, "I have here six hundred and forty acres which I would not exchange for any twelve hundred acres in any part of the Unite States".[4] General Price was not the only prominent Confederate who had made the trip to Mexico. Several other high-ranking officers, including General Ewell, General Shelby, Governor Harris and "other officers of distinction were among his nearest members".[5]

The colonists felt a false sense of security based on faith in the strength of the Mexican Empire as evidenced in the discussion of security of Carlotta City. . The New Yorker raised two questions: whether the General feared a raid by Juarista forces on the city, and what will come of an alliance between the Juaristas and the United States. Price explained that he and his officers would not have settled in Mexico if they feel that they were to be threatened by Juaristas. Price went on to explain that if and when an alliance is brokered, the Empire would remain intact for numerous reasons. He explained that the highway men that had been wreaking havoc on travelers had been dramatically reduced through Maximilian's government. He argued further that the nature of Mexicans was also morphing through Maximilian's government:

> Mexicans begin to understand that good laws and order are preferable to anarchy and plunder. They shake off their traditional lethargy and are awakening to the necessity of protecting themselves.[6]

Price addresses the possibility of a northern invasion of Mexico to rid Maximilian. He hints that the aristocracy of Mexico might ally with the aristocracy of the south "for the purpose of creating disturbances in our midst". Price states that the public opinion in Mexico is against the Republic, insisting that "every man having a little property is for the empire and against the Republic". Lastly he addressed the fact that the United States has a significant population of Roman Catholics specifically Irish, the dominant religion in Mexico is Roman Catholicism. He deduces that if Mexico were invaded, both Mexican and Irish could "carry war into the heart of your country (United States), to your very threshold". [7]

There was General Edmund Kirby Smith; he was the rebel commander at Brownsville, Texas at the end of the war. General Smith "sold all the rebel artillery in that quarter to Maximilian".[8] Two months after the end of the war there was an influx of Confederates heading south, "all the rebels who think it unsafe to trust their necks within reach of northern justice are fleeing to Mexico and joining Maximilian".[9]

The influx of Confederates to Mexico became a problem for Maximilian. As I already mentioned there were Confederates who came to Mexico in order to avoid being held accountable for their treasonous acts, there were however some that came to Mexico to establish new homes and fortunes under the rule of Emperor Maximilian. What's rather peculiar is that most of these Confederates who made their way to Mexico were bitter towards France because they felt abandoned by Napoleon. Despite their bitterness towards the French, they were willing to fight and die for Maximilian if war were to break out

with the United States. In fact their willing and eagerness to go to war with the United States seemed to be their downfall in Mexico. There were some Confederate veterans who wished to join the French Foreign Legion in Mexico. Despite being in dire need of men to fight off Juarista forces; France deemed that these men would be a liability to them because they felt that they might start trouble on the Texas-Mexico border which would drag the United States into the war. Maximilian's policy for Confederate colonization was a political one. The Confederates wished to establish colonies in the northern provinces of Mexico, Maximilian was absolutely against Confederate colonization of the north, and Maximilian felt that in the future there would be a call for these colonies to gain independence from Mexico. He decided that the northern region was not viable as well as the Isthmus of Tehuantepec where a large portion of Confederates had investments before the war. Maximilian decided that the only logical area for the Confederates to not pose a threat to his empire was to spread them thinly over central Mexico, with the idea that they must mix in with the rest of the population. By the late spring and summer of 1865 there were several thousand Confederates who had made their way to Mexico. Matthew Fontaine Maury became the leader of Confederate colonization. He had optimistically predicted that 200,000 Confederate families would establish plantations in Mexico. On September 5, 1865, Maximilian issued his decree on Confederate colonization. Maury however was not fully happy with the wording of the decree, it originally had been proposed by him that the colonization would be a "New Virginia" for southerners; instead Maximilian decreed that Mexico was to be opened to "all immigrants of all nations".[10] Not all was lost in Maury's struggle for colonization; Maximilian made a "provision for bringing former Negro slaves on an apprenticeship basis.[11] This apprenticeship clause amounts to a weak endorsement of the institution of slavery—a position contradictory to Maximilian's politics and in defiance of Mexico's strict abolition of slavery. . Despite wording it as "an apprenticeship basis" it is quite clearly a thinly-veiled endorsement of slavery, one that Texans in the 1820s when Mexico had abolished slavery. Maury would later become a naturalized Mexican and was appointed imperial commissioner of colonization. Under the former Confederate General, John B. Magruder, a land office was established. Land surveys were conducted by Confederate engineers and Confederate immigration agents were placed on both the coast and the interior of Mexico. *The Mexican Times*, a Confederate newspaper was established in September 1865 that was founded by the empire and edited by the former Confederate governor of Louisiana, Henry W. Allen.[12] Many Mexicans condemned this colonization effort as a new American invasion of Mexico. The most infuriating aspect of the colonization process for them was the surveying of public lands. Maury's role as imperial commissioner of colonization would later be dissolved by Maximilian in February 1866. This marked the end of the Confederate's attempt to colonize Mexico. By the fall of the Empire in 1867, most of the Confederates had left Mexico.[13] Certainly, not all Confederates settled in Mexico .Indeed, most stayed in their native parishes and states. General Price's city would not grow to rival New Orleans and Richmond; he would die penniless in St. Louis, Missouri a year later.

The US involvement in the French intervention was small, though it must be taken into account that during the period of the French Intervention in Mexico (1862-1867) the US was engulfed in a Civil War and two years afterwards they were still busy consolidating the south. American attitudes toward Mexico varied considerably. Many Americans opposed the occupation of Mexico for various reasons. Some Americans felt that Mexico was essentially US territory. Others sympathized with the Mexican struggle.

Others were primarily motivated by business prospects in Mexico. Some Americans however championed the French occupation of Mexico, and believed that Emperor Maximilian would give Mexico the best government that it had ever seen.

<u>US Congress and the French Intervention in Mexico</u>

Beyond the wide-ranging civilian attitudes toward Mexico, the US government view also shifted over time. In the February of 1862 the "Senate Committee on Foreign Affairs had the Mexican matter under consideration for two hours this morning, but no conclusion was reached".[14] Now unfortunately I do not have the Senate notes on this meeting so for this project I will not be able to delve into what was said in the meeting. However this indecision shows how occupied the US was with the Civil War. The US chose to "play the fence" early on during the intervention because of the Civil War, they feared French or European recognition of the Confederate States of America. This stance had clearly changed once the US had won the Civil War in 1865. As this Senate hearing dated the 12 of July, 1867 shows:

> Mr. Chandler, of Michigan, called up his resolution
> on Mexican affairs, and made a speech justifying
> the execution of Maximilian. He hoped Congress
> would not only adjourn without expressions,
> not only of sympathy, but of aid, if need be, to
> Mexico. [15]

A zealous Chandler goes on to say that "…if any European monarchy determined to fight Mexico, it must fight the United States also, and that the whole world could not whip the United States on American soil".[16] Senator Chandler's statements provoke a couple of responses. First, the US doesn't need to "justify" the execution of a monarch who was "ruling" a country that did not want him there. I feel that there should be no "justification" from the US on behalf of Benito Juárez's decision to execute Maximilian. Given that the US had not formally taken a stance with Juárez and the Liberals, nor sent aid to Mexico during the French occupation of Mexico, then the US need not presume to judge nor condone Juarez's decision to execute Maximilian.

Some Senators were asking what took so long for the US to formally get involved with the French Intervention in Mexico. "Mr. Fowler, of Tenn. spoke against the policy of the Government toward Mexico, during her struggle for freedom. He reviewed the history of Mexican troubles and justified the execution of Maximilian".[17] Though Senator Fowler has strong sentiments towards Mexico's struggles, it seems to him that though the US was embroiled in war during the French Intervention that they still could have sent some form of aid to Mexico. I find this rather interesting because, typically most historians suggest that the US did not want to help Mexico outright for two reasons: fear of French recognition of the South, and no resources to spare because they were dealing with their own war. Senator Fowler feels differently, he feels that the US could have done something to help Benito Juárez and his country's struggle instead of hindering it by claiming neutrality.

Senator Johnson of Maryland had a different view on the execution of Maximilian, he felt that "Maximilian would have given Mexico a better government than she ever had".[18] Senator Johnson clearly deemed Mexicans unfit to govern themselves and that a European monarchy was necessary to instill law and order in Mexico. His views may have been sealed when these indigenous people went ahead and executed their only "savior". The view that French rule would bring stability to Mexico ignores France's history of far

worse instability throughout the nineteenth century France lurched back and forth from monarchy to Republic, blood and fire devastating the nation.

Senator Nye of Nevada "…regarded Mexico as naturally belonging to the United States".[19] Nye doesn't explain what he means by Mexico belonging to the US but he does go onto show his love for Juárez and his abhorrence towards European monarchies. He [Benito Juárez] "though not a warrior, had like Lincoln led great armies to victory".[20] Nye's stance on foreign monarchies was categorical, "Nye had no sympathy with those imported monarchs that come to subjugate, and not to invigorate, a country".[21] It seems to me that Senator Nye saw parallels between Mexico's struggles against an unwanted monarchy to that of the US's struggle against our former monarch. Nye also compares the "enlightened world" to republics that govern themselves, "…the enlightened world would say 'Amen' to the fate of Maximilian".[22]

While there were some Senators who questioned the legality of the execution of Maximilian, Senator Howard felt that the legal proceedings for Maximilian were in fact adequate. "Senator Howard thought it fair to presume that the court-martial before which Maximilian was condemned, acted fairly and in accordance with the laws of war".[23] I believe that Juárez had a court-martial of Maximilian in order for his government to seem legitimate to not only the United States but to European powers. In my opinion though Juárez didn't recognize Maximilian as the emperor of Mexico he still gave him a "court-martial" to not hinder the image of the Republic of Mexico. Moreover, he grounded his legal case for execution on the very laws of execution that Maximilian had decreed against leaders of the Republic.

In 1862 the Senate had discussed the "Mexican issue" for two hours; five years later they led it into Executive session. Senator Yates of Illinois "thought this subject [Maximilian's execution and the other Mexican affairs] deserved more discussion than it had received, and therefore moved that the further consideration he postponed, and that the Senate go into Executive session".[24] I find this very interesting, five years prior Mexico and her troubles were only worth two hours of the Senate's time, now in 1867 Mexico and her troubles deserved an Executive session. Five years before this Mexico and Juárez were the ones fighting the occupation, while though the US was pre-occupied; we adopted a stance of neutrality. A US organization known as The Friends of Mexico had asked in vain that the Senate to pass a treaty that would send aid to Mexico, "…the Friends of Mexico are pressing on the Senate the ratification of the treaty, granting pecuniary aid to her"[25]. Now that Mexico no longer needed aid, the US entertained the possibility of rendering aid. .

Americans who contributed to the Republican forces

Some Americans took it upon themselves to go and help the Liberal Army in Mexico. Officers were commissioned in Juárez's Liberal Army, according to the following report: the "Mexican Consul in this city [San Francisco, California] is informed that the party of American officers who went to Mexico last summer with Cols. Montero and Green, and who received commissions in the Liberal army, have marched with Gen. Aranda to attack Durango".[26] This article was dated November 23, 1866. In a separate article it notes that Juárez arrived in Durango on December 26, 1866 with "18 American officers who had lately arrived from California". [27]

These 18 American officers were a part of the "American Legion of Honor," a legion of Americans veterans of the Civil War who made their way to Mexico to be paid for their military services and to also receive land from the Republic of Mexico for their services in the Liberal Army.[28] The most visible reason for Americans fighting for

Juárez was the monetary and land incentives. This incentive was a"…liberal bonus offer announced by the Juárez government and publicized by Mexican agents in the United States. Under the law of August 11, 1864, a bounty of land was promised to all foreigners who joined the Mexican republican forces."[29] This land incentive was to be added to their regular military pay. For all privates and noncommissioned officers it amounted to land valued at $1,000; $1,500 for all officers; and $2,000 for field grade officers.[30] The pay scale for the Mexican Army also served as another incentive for American veterans to enlist in the Liberal Army. Given that the base pay was about the same for comparable ranks in the United States military. Cavalry, artillery and engineer units were generally higher paid than foot soldiers".[31]

However not all members of the American Legion of Honor were Anglos. According to Miller "there were several prominent Californians of Spanish ancestry who sailed with [General Plácido] Vega's foreign legion including Captain Uladislao Vallejo, Lieutenant Melitón Alviso, and Victor Castro".[32] We know the nationality of these men, they are American. What is difficult to define is their ethnicity. Miller describes them as "Californians of Spanish ancestry", and they also self-identified as Spanish Americans judging by their voluntary membership in a Spanish American club of San Francisco. Spanish Americans in these clubs included Chileans, Central Americans, and Mexican-born émigrés. Regrettably, the label "Californians of Spanish ancestry" tends to obscure the contributions of those who were Mexican-American, born in the US of Mexican heritage or originally Mexican before California became US territory. Though this research cannot identify which Mexican-Americans served in the Liberal Army with Mexican General Plácido Vega, we can claim that some, perhaps many, did.

The American Legion of Honor did not just sit on the sidelines and watch the Mexicans fight the French. They were involved in several battles that led to the downfall of the Empire. The American Legion of Honor was a part of the central division of the Mexican Army that was headed by General Silvestre Aranda. The legionnaires were under the direct leadership of Colonel George Green, and they had asked to be placed in a separate company from the rest of the army and to receive different details from the main body of the army.[33] The relationship between the American Legion of Honor and the Liberal Army was strained at times. At the Battle of Zacatecas in January 1867, a counter-attack by the French-Austrian forces nearly captured Benito Juárez. Americans claimed that this counter-attack would have been successful if it hadn't been for the American Legion of Honor., indeed that Benito Juárez would certainly been captured if it wasn't for the Legion's success, "Whilst the Mexican soldiers were retreating" an officer wrote, "we dashed into the town and attacked the French Austrian troops…and kept them at bay, so that Juárez was enabled to get away in safety, when otherwise he would have been taken".[34] Historians can certainly identify sufficient incentive for bias in the account both of Americans' heroism and Mexicans' cowardice. At the Battle of Querétaro, the Legion again played an important role. The Emperor was captured on May 15, 1867. The Legion was on the frontlines of the battle, there were numerous accounts recorded that the emperor, with a white flag in hand, prepared to surrender to Colonel Green. Unwilling to upstage Mexican officers, Col. Green guided Maximilian to General Ramón Corona who then sent Maximilian to the commander in chief of the Republican armies, General Mariano Escobedo.[35] The preference to surrender to American Foreign Legion is repeated nearly 50 years later during the Mexican Revolution. In the Battle of Ciudad Juarez, General Juan Navarro refused to surrender to the rebel forces that were under the

direction of Francisco I. Madero, preferring instead to surrender his sword to the leader of the American Foreign Legion, Guisueppi Garibaldi. The parallels are rather interesting, in 1867 Maximilian attempted to surrender to a foreign army not a Mexican army and in 1911 General Juan Navarro attempted to surrender to a foreign army and not a Mexican one. One possible interpretation is that the internal Mexican conflicts are bitterer than foreign ones. Another possibility is that surrender to the foreign legion might internationalize the conflict and bring the defeated troops under the protection of international codes of war—codes arguably more lenient than those enacted in civil wars.

According to the US Department of State's Office of the Historian, the US position during the French Intervention was "…was to avoid direct conflict with France, and voice displeasure at French interference in Mexican affairs, but ultimately to remain neutral in the conflict".[36] US policy didn't shift to providing more direct support to the Republic of Mexico until after 1866 when Juárez's forces began gaining ground against the French occupation. The intervention was drawing to an end, France wasn't willing to keep investing men and money in maintaining the Mexican Empire, and this in turn eased Franco-American tensions.[37]

The US and France played an intricate dance with each other during the five years of intervention. The US felt that Mexico, either because of the Monroe Doctrine or because it was sympathetic towards the Mexican struggle, should be its own independent, unoccupied nation. This anti-imperialistic sentiment towards the French occupation was influential, but the practical difficulty of the Civil War prompted neutrality. Though the US officially recognized Juarez' government, it chose not to blatantly send support to Juárez lest they risk French recognition of the Confederate States of America. However France understood that if they were to recognize the Confederate States of America, the US would in turn break their neutrality and begin to send supplies to Benito Juárez which might undermine or complicate the French occupation of Mexico.

The significance of this research highlights that the struggle to maintain Mexican sovereignty wasn't solely a Mexican struggle. Americans, for diverse reason, also proved severely vested in the Mexican struggle. Some may have fought for a monetary gain and some may have came to Mexico to start or maintain their way of life, yet despite the differences in motives these Americans shaped the end of the Mexican Empire. This research contributes not only to the historical record of US role in the French Intervention in Mexico, but also clarifies US celebration of Cinco de Mayo. In response to questions of why we celebrate Cinco de Mayo so fervently here in the United States, we can answer that Americans contributed to the Mexican triumph over the French. Mexican-American and Anglo alike both fought and died to defeat the Empire and restore the Republic!

(Endnotes)

1   (Cordova Mexico Description of Gen. Price's Settlement, 1866)

2   (Gen. Price in Exile--His Flattering Prospects--His Opinion of Mexico's Fu
         ture, 1866)

3   (Cordova Mexico Description of Gen. Price's Settlement, 1866)

4   (Gen. Price in Exile--His Flattering Prospects--His Opinion of Mexico's Fu
         ture, 1866)

5   (Gen. Price in Exile--His Flattering Prospects--His Opinion of Mexico's Fut
         ure, 1866)

6   (Gen. Price in Exile--His Flattering Prospects--His Opinion of Mexico's Fu
         ture, 1866)

7   (Gen. Price in Exile--His Flattering Prospects--His Opinion of Mexico's Fu
         ture, 1866)

8   (Texas and Mexico, 1865)

9   (Texas and Mexico, 1865)

10   (Hanna, 1954)

11   (Hanna, 1954)

12   (Hanna, 1954)

13   (Hanna, 1954)

14   (From Washington, 1862)

15   (No Headline, 1867)

16   (No Headline, 1867)

17   (No Headline, 1867)

18   (No Headline, 1867)

19   (No Headline, 1867)

20   (No Headline, 1867)

21   (No Headline, 1867)

22   (No Headline, 1867)

23   (Fortieth Congress, 1867)

24   (Fortieth Congress, 1867)

25   (No Headline, 1862)

26   (From San Franciso, 1866)

27   (Important from Mexico San Francisco, Jan 18, 1867)

28   (Miller, 1961)

29   (Miller, 1961)

30   (Miller, 1961)

31   (Miller, 1961)

32   (Miller, 1961)

33   (Miller, 1973)

34   (Miller, 1973)

35   (Miller, 1973)

36   (Milestones: 1861-1865)

37   (Milestones: 1861-1865)

Women's Intramural Sports Participation at Crisis Level

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Abstract

According to the U.S. Department of Education, female students now represent 57% of the nation's college enrollment. With this rapidly growing student population of women comes a challenge for the curricular and extracurricular programs in higher education. Most intramural leagues have a small female population participating in these programs. A methodical approach was developed to assess the participation of this underserved group, as well as to understand the factors contributing to their lack of involvement in intramural sports. In order to decrease the barriers these females face, intramural directors must implement updated marketing strategies that entice this particular target market to participate. Included in this study are collegiate intramural sports programs.

Introduction

College students that compete in intramural sports are just a small percentage of a school's overall population. Women participate at a much lower rate than men. This has been an ongoing trend in most college campuses across the nation; in fact, the rate of female participation has declined as the percentage of women in the overall population increased.

It is important to understand the benefits gained by playing organized sports - valuable skills that can only be gained while playing on a team. Most of these abilities can be used later in life and include skills such as constructive communication, active listening, and commitment to the team. Often students fail to recognize the opportunities available at universities, which many times are offered at low or no cost.

Many intramural directors may lack the marketing background and broader thinking that could be the key strategy to reverse this trend. The purpose of this study was to understand the barriers that are keeping college women from taking part in intramural sports.

Literature Review

Available literature was reviewed to assemble existing information on levels of female participation in intramural sports and compare these findings to male participation. It aided in identifying the reasons for and against participation, as well as suggesting potential ways to encourage women to play. From a review on the subject and primary research conducted with college and university intramural directors, it was discovered that female participation in intramurals on college campuses has decreased in the last several years. Many causal factors were determined.

O'Dell and McCormick examined several aspects of intramural sports as they relate to female participation (1997). They discovered that female participation in intramural sports declined on college campuses and was a concern to intramural directors for several years. Some of the reasons suspected were attributed to low awareness of programs, a self-perceived lack of skills, involvement in other campus activities, time constraints due to studies or work, and inconvenient game scheduling.

The motivation for participation in intramurals differs between males and females. Kanters & Forester discovered through their research and analysis that men generally were motivated by the competition, whereas women preferred the recreational aspects (1997). Women favored the interpersonal relationships derived or supported through recreational leagues; however, both sexes had motivation to participate overall. This study resulted in a recommendation to expand co-ed sport activities, provided that skill levels could be appropriately matched. An added benefit would be that co-ed sports would encourage more social interaction, thus increasing the chances of female participation. Another aspect of participation is that males are more likely to participate regardless of familiarity with other participants, and they are also more likely to participate in competitive leagues. Female students were more interested in participating with people they knew and were more attracted to the social aspect. Female students also reported they would be more interested in sports activities that were not competitive (Beggs, Elkins & Powers, 2005).

Forrester & Beggs found that women with lesser sport experience have lower self-esteem than men with lesser experience, but both women and men with greater sport experience do not differ in levels of self-esteem (2004). This finding

is a powerful example of how education concerning the benefits of participation is so important if females are going to be persuaded to take advantage of intramural sports.

Tharp showed in an article on Title IX and its effect on intramural sports that, since the passage of the law, opportunities have increased significantly for women to compete in athletics. However, many intramural sports budgets for women's programs have not increased, and space and hours that were previously available for intramural sports and recreational activities have been reduced. Tharp's research also found that appointing women on staff in the roles of campus recreation directors, assistants, and student leaders could help encourage stronger involvement among female students (1994).

Proescher agreed that there is a consistent downward trend of female participation in intramurals. This could be attributed to involvement in other recreational activities. It was noted that female students were participating in group fitness classes or working out on their own rather than playing in intramural leagues, resulting in an increase in fitness programs and a decrease in intramural programs (1996).

In a study conducted by Meecci and Price at Pennsylvania State University, it was concluded that the scheduling of intramural and recreational activities was an important factor in female student participation and found that activities for females should include racquetball, swimming, volleyball, softball, tennis, bowling, and basketball. Female students tend to desire less competitive sports and prefer the social aspect of these types of programs (Meecci and Price, 1986, Beggs, et al., 2005). These sports could also be scheduled as co-ed activities to provide additional encouragement. Even though this study is dated, their research continues to be the basis for many other studies that produce more current findings.

The European model of sport presents parallels worth studying in American research about women and sport. Robert Decker wrote that the European model of sport includes five functions: an educational function, a public health function, a social function, a cultural function, and a playful function (Decker, 2000). The European Commission on Sport ruled that sports must be offered in a less competitive, less structured nature to attract the majority of youth and young adults. In a study by the commission it was found that barely 10% of adolescent females are interested in competitive sports. They are more attracted to non-competitive, alternative, simple forms of sport activities practiced in a convivial atmosphere eliminating the stress of competition (Decker, 2000). In this respect, European women feel the same way about participating in sporting activities. They would prefer the social interaction as opposed to the competition.

Consistent findings are that female students cite lack of time, lack of knowledge of the programs being offered, lack of skill, and the competitive environment as primary reasons for not participating. Beggs also found that female students are more likely to use time management strategies and are willing to practice and learn basic skills in order to participate in activities (Beggs, et al., 2005). These findings could empower campus recreation administrators with their intramural sports program design.

McCombe presented three ideas to keep in mind as the field moves forward on this issue. First, directors need to continuously evaluate intramural programs through the lens of female involvement. Second, obtaining feedback from the female students that are not already engaged in intramural activities is imperative; however, noting that there is no single true "solution." Awareness of the issue is the first step towards making a difference in female participation. Lastly, be sure that added activities actually meet the needs of the

female student population (2008).

In another article by McCombe, it was stressed that people generally tend to shy away from activities with which they are unfamiliar. However, these activities and sports may be the ones that the students have the most interest in participating given some level of familiarity. A good example is a relatively new opportunity offered at Middlebury College. Since 2005, they have been playing Quidditch, a game adapted from J.K. Rowlings' *Harry Potter* series. The game is a cross between rugby, dodgeball, and tag. Today, in a relatively short time period, the game has spread to more than 400 schools and colleges across the country as an intramural or club sport, according to the International Quidditch Association. This kind of thinking demonstrates that times are changing and that intramural sports need to keep moving in new directions (McCombe, 2010).

Perhaps another way to think differently is to provide participants with a rewards system. In an article by Titlebaum, Beadle, Ferranti, and Daprano (2011), it was found that an incentive program could be implemented to reduce drinking on campuses. The students surveyed in the study agreed that a rewards system to participate in non-alcohol related events would entice them to get involved. The proposed rewards system would utilize ideas such as advanced housing opportunities or early class registration. This same framework could be applied to intramural sports programming as a way to entice more female students to play.

In a different article, the authors point to enhancing appeal to females by adding an educational component to intramural sports (Whaley, Titlebaum, & Wallace, 2011). Female students revealed that they often do not play intramural sports because they lack the confidence to participate. Adding sports clinics and other non-competitive avenues of play may increase overall participation by female students. By offering a more informal atmosphere where one can learn and practice a sport, these female students will gain the confidence needed to then become regular participants. Even small variations in programming in order to accommodate the needs of the female students can have a big impact.

Methodology

In order to assess the causes of this issue, two surveys were developed from the review of the literature: one was distributed to intramural directors via a professional organization and the other to female students at a Midwestern university. The researchers submitted the instruments to a panel of experts with extensive experience with intramural sports on the college campus. The panel included the Assistant Director, Intramurals & Sports Clubs Campus Recreation at the University of Dayton; the Assistant Director, Competitive Sports at Wright State University; and Senior Assistant Director, Campus Recreation at the University of Nebraska-Lincoln. The feedback and suggestions from the panel were integrated into the surveys to include what they believed could shed light on why female students do or do not participate in intramural sports on their college campus.

Methods

The survey of directors was sent via a listserv in the fall of 2010 to intramural directors belonging to the National Intramural Recreational Sports Association (NIRSA). Ninety- three directors completed the instrument. The study was used to measure the current level of female participation in intramural sports at their institution, as well as assessing the perceived barriers to lack of participation by their student body. Information was also gathered on any strategies that have proven effective in increasing female participation.

The study of female students was conducted at a private, Mid-Western, Catholic university with roughly 7,000 undergraduate students. The student body is evenly divided by gender. A well-equipped, fully modern recreation venue was built in 2006. The facility is located near the center of campus and is easily accessible to most students, faculty and staff. A survey was sent in the fall of 2010 to 3,250 female students asking them about their experience with intramural sport. Surveys were completed by 700 students with a return rate of just above a 21%, clearly indicating an interest in the subject. There was incentive offered for survey participation, as respondents were made eligible to win a $25 gift card. The study was used to measure the current level of female participation in intramural sports, as well as assessing potential reasons for the lack of participation.

Results

In the data collected from the directors, 45 of the 93 respondents indicated that less than 10% of their school's females participate in intramural sports (Table 3). A mere three schools indicated that their female participation levels exceed 30%. More than 85% percent of the directors reported that they offer female-only leagues in at least one sport. Several directors, however, indicated that they had a difficult time filling the female-only leagues, thus discouraging female leagues during a season. More than two-thirds, 67%, of the schools report volleyball as their most popular female league, with flag football being the least popular at the majority of schools. Eighty-nine percent of directors reported that co-recreational leagues are more popular than single-sex leagues with their female students. Indoor sports also receive the most female participation. This is likely due to the fact that the more social sports, such as bowling, volleyball, and swimming are usually conducted indoors. Sophomores comprise the largest female user group, followed by freshman, juniors, and seniors. Many directors stated that lack of time, lack of skill level, and high involvement in fitness activities seem to be reasons why females are participating less and less in intramural sports.

The survey results from the female students validate many of the responses that the directors provided (Tables 1 and 2). The data reports that 302 out of 686 (44%) of the respondents have not played an intramural sport at the school, and less than 15% answered they would definitely play. More than half (54%) of the surveyed females indicated that volleyball is their sport of choice. Their response is not surprising based on both published research cited and the unpublished director's data. Perhaps not shocking then, a staggering 82% of respondents agreed that the social aspect of intramural sports was either very or extremely important when deciding to play. Exercise was also listed as being a very important reason to participate in intramural sports. Sixty-six percent of the females also noted that being able to play with friends would make playing intramurals more enticing. These female students also cited lack of time, lack of skill, and a larger interest in other forms of exercise as reasons that they and their friends do not seek intramural sport participation. Interestingly, the female students also largely responded that lack of marketing outside of the recreation complex may impact participation. Many suggested that a larger marketing plan may help spread the word about the intramural programs and how to register.

 Limitations

The primary limitation of the study was that the population surveyed drew from a single college campus. While the Midwest is typically considered to be representative

of mainstream America, results might differ if a broader region was included. Due to the limited sample size differences, if any, from suburban, urban, and rural college campus settings are not represented.

Future Research

Additionally, another area of study for college campus recreation is the lack of participation in intramural sports of minority and or exchange students exploring why they don't take advantage of this programming. Understanding the barriers that prevent participation can empower programming in the future.

Conclusions

This information provides a clearer picture of what might seem like a simple issue, but both sets of data point to the need to revamp intramural programming in order to engage collegiate female students. This research was done to investigate why female college students are not participating in intramural sports programs as frequently as their male counterparts. Female students do seem to have an interest in participation, albeit for different reasons than males. However, a greater understanding of their needs by program directors is required. Female students are looking for a more social, less competitive program than what is currently offered at most schools. Furthermore, an increase in more co-recreation leagues and more socially oriented sports might just help increase female participation. More attention to marketing strategies may also help increase overall participation by female players.

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Table 1 (Directors)

Factor	Frequency	Percent
What percentage of females at your institution participates in intramural sports?		
0 to 10%	48.9	45
11% to 20%	37.0	34
21% to 30%	13.0	12
31% to 40%	3.3	3
41% and above	0.0	0
What intramural sport attracts the MOST female participation at your institution?		
Basketball	18	16
Softball	12.4	11
Volleyball	67.4	60
Flag Football	15.7	14
Ultimate Frisbee	1.1	1
Soccer	25.8	23
What intramural sport attracts the LEAST female participation at your institution?		
Basketball	18.2	16
Softball	13.6	12
Volleyball	0.0	0

Flag Football	62.5	55
Ultimate Frisbee	25.0	22
Soccer	4.5	4

Do you offer female-only intramural sports leagues? If yes, please select one.

Basketball	88.5	69
Softball	51.3	40
Volleyball	73.1	57
Flag Football	65.4	51
Ultimate Frisbee	23.1	18
Soccer	66.7	52

What day of the week gets the greatest female participation? (check all that apply)

Monday	47.6	40
Tuesday	59.5	50
Wednesday	56.0	47
Thursday	42.9	36
Friday	1.2	1
Saturday	2.4	2
Sunday	46.4	39

Do you have fees for intramural sports?

| There is no charge for intramural sports | 50.0 | 46 |
| Yes there is a charge for intramural sports | 50.0 | 46 |

Do you believe fees have more of an impact on female participation then male partipation in intramural sports?

Yes impacts women more	12.4	11
No impacts men more	6.7	6
Impacts both man and women equally	80.9	72

If women's intramural games were offered on a consistent time and day of the week by how much would participation improve?

Not at all	61.1	55
Slightly greater	34.4	31
Significantly greater	4.4	4

In what type of program do you notice the greatest rate of female participation?

Co-rec sports	89.0	81
Single sex	11.0	10

What type of program do you notice the greater rate of female participation?

Outdoor Sports	30.3	27
Indoor Sports	73.0	65

In which academic year do you see the greatest amount of participation for female students?

Freshman	39.0	32
Sophomore	46.3	38
Junior	24.4	20
Senior	14.6	65

Table 2 (Female Students)

Factor	Frequency	Percent
When you exercise, how often do you use the school's recreation facility to exercise?		
Never	28	4.0
Rarely	66	9.4
Sometimes	122	17.4
Usually	188	26.9
Always	268	38.3
How likely would you be to play intramurals?		
Definitely would not	26	3.7
Probably would not	67	9.6
Not sure	73	10.4
Probably would	93	13.3
Definitely would	45	6.4

Table 3 (Female Students)

Factor	N	Mean	Standard Deviation
How important are each of the following outcomes in intramurals?			
Competitiveness	211	2.68	1.08
Social	211	4.22	0.76
Exercise	211	3.91	0.82
Break from study	211	3.81	0.94
To what extent do you think the following reasons that women would choose not to participate in intramurals?			
Takes too much time	651	3.29	1.14
Schedule conflicts	651	3.86	0.97
No interest	651	3.16	1.11
No incentive	651	2.82	1.16
Can't find a team	651	3.20	1.22
Too competitive	651	2.66	1.18
Not competitive enough	651	2.39	1.03
How likely do you think it would be that women would participate in intramurals under the following conditions?			
If just dorm floors/sororities were involved	651	3.52	1.16
If teams were randomly assigned	651	1.88	1.11