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The St. Mary's University
McNair Scholars Program

RESEARCH JOURNAL

Fall 2012

Volume V

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ST. MARY'S UNIVERSITY



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St. Mary's University
McNair Scholars Program

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Introduction

In October of 2007, St. Mary's University received the very happy news that we had been awarded our first Ronald E. McNair Postbaccalaureate Achievement Program grant- and the world changed just a bit for St. Mary's undergraduate students. The McNair Program was funded with the charge to facilitate the pursuit of graduate degrees among students traditionally underrepresented in graduate education. St. Mary's program would be unique in that it would include students from Humanities & Social Sciences, the Bill Greehey School of Business and the school of Science, Engineering and Technology. These students would differ in many ways, but all would share a common aspiration- to join the professoriate and change the face of American higher education. This journal represents the final class of McNair scholars supported by that grant. Each scholar was mentored during his or her project by a dedicated expert in his or her area of interest. Many of these mentors are faculty members at St. Mary's, but others are from outside universities and agencies. Each of these mentors deserves special recognition for their dedication to these scholars and their future.

Five years from its inception, the St. Mary's University McNair Scholars Program is preparing to celebrate our first doctoral degree recipients. The scholars whose work is represented in this volume are embarking on a journey that will lead to their doctoral degrees in a few short years. This commemorates great beginnings from those who will build the future of higher education in our country. It has been our pleasure to work with these students and we look forward to celebrating their future accomplishments.

Jennifer Zwahr-Castro, PhD

Director, St. Mary's University McNair Scholars Program







Illustrating the Spread of Christianity through Mathematics: Using Markov Chains to Show the Impact of Highly Motivated Christians in Early Christianity



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Abstract

If one examines the growth of Christianity from 30 to 380 CE, a paradox appears. The more the Roman Empire tried to suppress Christianity, the more it grew contrary to expectations. There appears to be a correlation between the cost of being Christian and the motivation prompting the decisions. Also, the acts of faith professed by highly motivated Christians played a crucial role in the spread of Christianity. Thus, the project's goal is to illustrate the paradox through the use of a discrete, probabilistic mathematical model called a Markov chain. As a result of the absence of numerical data on the population of the Greco-Roman world, arbitrary percentage values will be used to illustrate the transitions of the entire population. Dividing the population into three distinct yet overlapping classes—highly motivated Christians, poorly motivated Christians and non-Christians—will contribute to the illustration of the two states of Christianity: one before, during and after persecution and two before, during and after non-persecution. Furthermore, the probabilities required for the model will be supported through pertinent historical literature.



Illustrating the Spread of Christianity through Mathematics

Introduction

Christianity is an “object of faith” that is expressed visibly and invisibly through the “relationship between man and God that God has established in Jesus Christ by his free, gracious, historical disposition and by his verbal revelation.”¹ Christianity is grounded in teachings of Jesus, “the One who both engenders that faith in us and realizes its content for us,” for whom “he himself constitutes that content.”² In other words, Jesus embraces humanity through his close relationship with God, which inspired many to follow his teachings. The growth of Christianity was primarily due to the Christians belief that Jesus had risen from the dead. His followers spread his stories and teachings in their own words and deeds. Some even surrendered their lives as proof of their devotion to God, accepting even death rather than denying their faith.

These acts of devotion reveal a correlation between the “cost” of being Christian and the quality of motivation displayed in the course of Christianity. In early Christianity (30-380 CE) one can see two states which Christians lived: persecution and lulls in persecution. During persecutions, Christians who professed acts of faith, such as martyrs, became the role models that motivated fellow Christians to deepen their commitment and non-Christians to convert. A paradoxical phenomenon occurred: the more the Roman Empire tried to destroy Christianity the more it spread. Tertullian, a famous apologist, expresses this idea when he states that “the blood of martyrs is the seed of the Church.”³ For as Christians were killed (reducing the number of Christians), the “exemplary deaths of Christians” prompted many others to convert, “therefore persecution seemed to encourage the spread of Christianity.”⁴

During lulls in persecution it appeared that even though the overall population of Christians increased, the percentage of highly motivated Christians tended to decrease. For “it needs but a second of nervous weakness for a hero to become a coward,”⁵ a choice many poorly motivated Christians selected. Another contributing factor is that “[S]he now included all and sundry; in other words, the virtue of her adherents had not increased in the same proportion as their numbers.”⁶ The result is a decrease in the percentage of highly motivated Christians, since the majority died as martyrs and an increasing percentage of those remaining are disoriented, poorly motivated Christians.

Christian population can be seen within a continuum, where behavior of highly motivated individuals falls to one end of the spectrum, while those poorly motivated individuals lie on the opposite end. In other words, describing Christians as poorly motivated or highly motivated, is based on assumptions that are concluded by the acts of faith individuals engaged in during the two cases, or “stages,” of Christianity—when Christians are undergoing persecution and when they are not. Three states describe each stage, Case A: before persecution, during persecution and after persecution; Case B: before lulls in persecution, during the lull period and after lull in persecution. These detailed subdivisions will help clarify the dynamic inflow and outflow between the overlapping categories of highly motivated Christians, poorly motivated Christians and non-Christians.

Therefore, this paper will illustrate the percent of highly motivated Christians, poorly motivated Christians and non-Christians in the cases of persecution and lulls in

1 (Vorglimler 1965, 73)
2 (Boyer 1965, 245)
3 (Chadwick 1967, 29)
4 (Gonzalez 1984, 86)
5 (Daniel-Rops 1962, 98)
6 (Daniel-Rops 1962, 101)

persecution during early Christianity. The illustration of this dynamic movement requires a distinctive approach that will function as a visual tool.

Methodology

An interdisciplinary approach through methods appropriate to mathematics and theology will be used. For the mathematics aspect a discrete, probabilistic model called a Markov chain will be used to illustrate the progress and connection among the populations of highly motivated Christians, poorly motivated Christians and non-Christians. A Markov chain is a tool that functions in closed systems whose states are non-continuous yet related in a describable fashion. The transition from a *present state* to the *next state* is manifested through both charts and tables. The probability values used in this project will be arbitrary “estimates, not recorded facts [which accepts the] suggestions that reality may have been a bit lumpier.”⁷

A Markov chain appears to fit the study for two reasons. First, the percentage values used in describing the transition probability from one state to the next are beneficial because of the absence of numerical data regarding the population of Christians. The labeling of specific percentages of Christians as highly or poorly motivated is arbitrary, but defensible. The description of attendant events that dramatically influenced the growth of Christianity (for instance persecution, legality, status etc.) can offer a rational if somewhat arbitrary trend line describing the motivation of Christians. In general, as the “cost” of being Christian increases, so too does motivation, and conversely “cost” is inversely related to motivation.⁸ This is specifically the case when the researcher can assume that if Christians are persecuted during a specific time (with a decrease in the number of Christians due to death) and yet the overall population of Christians increases, then those who become Christian must be highly motivated to do so.

Second, the presentation of a Markov chain describes the phenomena between states in clear manner. For instance, through a Markov chain chart one can trace the loops and jumps that occur within each transition by following its arrows. Also, the use of color highlights the direction in movement which becomes appealing to the viewer. Then, the probability values present in the Markov chain table are directly extracted from the chart and placed as a transition matrix. In other words, the transitions and values illustrated in the chart are reflected in the table which makes the creation of linear equations for such movement fairly easy to calculate. The reasoning behind each assigned probability in the chart will be justified by the literature.

The supporting literature will originate from the theological or historical literature, which highlights certain significant time frames or stages that dramatically influence the growth of Christianity. A key source is *The Rise of Christianity*, in which Rodney Stark emphasizes the need for describing the spread of Christianity quantitatively.

Such a procedure is difficult to illustrate because of the abundance of descriptive data and absence of numerical data in the spread of Christianity. Many scholars within the field of theology have experienced such complications, which are primarily due to the lack of records that were either never created or lost through the years. Thus, scholars have used creative methods to obtain numerical data. For instance, Keith Hopkins calculated the probable age structures of the roman population by using tombstone age engravings.⁹ Another scholar, James Packer, observed the structure ruins of Imperial Ostia, where he

7 (Stark, *The Rise of Christianity: a Sociologist Reconsiders History* 1996, 11)

8 (Bonhoeffer 1959, 47)

9 (K. Hopkins 1966)

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attempted to determine the size and population of the city.¹⁰

Nonetheless, Stark's bibliography was used as a guide for quantitative resources, which helped create the working assumption that major, identifiable life events outside Christianity profoundly influence the dynamics of Christians and their motivation. The different events that marked dramatic Christian growth (persecution, demands from the state, etc.) affected the number of Christians as well as the relative percentages of those who would be expected to be strongly or weakly motivated. Markov chains will illustrate such changes.

Note about Markov Chains

As mentioned previously, this paper will focus on two cases: persecution and lulls in persecution. Within each case there are three stages: Case A: before persecution, during persecution, and after persecution; Case B: before lulls in persecution, during lulls period, and after lulls in persecution. Each stage is illustrated through a Markov chain; hence with two cases that contain three stages each this yields a total of six Markov Chains.

Each Markov chain will be illustrated in three ways: a diagram, a table and a chart. First, the diagram is the image that contains two circles, a square, arrows and percentage values. Various shades of black are used to amplify and associate the transition among each "state".¹¹ "States" are the square and circles centered on the image; each shape is labeled as either non-Christian, highly motivated Christian, or poorly motivated Christian. Next, three arrows extend out of each state, one points to itself, another points to a state beside it, and the other points to the remaining state. These sets of arrows are color coded—black applies to non-Christians, light grey to highly motivated Christians and dark grey to poorly motivated Christians. Individually, each arrow illustrates the transition from the "present state," the tail of the arrow, to the "next state," the head of the arrow.¹² In other words, the arrow's origin is the starting point while the square or circle the arrow points to is the end point. The percentage values displayed above each arrow are probabilities for the transition from the "present state" to the "next state."

Second, the table is a transition matrix that functions as a tabular representation of the diagram. States are labeled horizontally and vertically. Probability values are read as the outcome of a "present state" combined with the "next state." Third, the chart displays the expected percentages of non-Christians, highly motivated Christians and poorly motivated Christians if the probabilities used in the Markov chains would continue. In other words, formulas were calculated and applied to each state in which they were allowed to run for a specific number of iterations. The stopping points were determined by their proximity to the descriptions of each period found in the literature.

Model Alterations

Markov chains tend to extend until an equilibrium is identified; however, this research has modified the model for the sole purpose of obtaining percentage values that would most accurately portray the Christians and non-Christians population. Thus, in several occasions the model is only allowed to run for three to five iterations. Also, the stopping point from each stage becomes the starting percentage value to the next state, except in the *before* stages.

10 (Packer 1967)

11 (Giordano, et al. 2009, 215)

12 (Giordano, et al. 2009, 215)

Case Descriptions

The Roman Empire was a nation overflowing with wealth and power; its citizens prided themselves in simply being called Roman. Their devotion was displayed through prayer and sacrifice to the gods for the well-being of its emperor and national standing. “All social activities—the theatre, the army, letters, and sports—were entwined with pagan worship,”¹³ thus religion and citizenship were inseparable. However, there arose a growing minority that abstained from such actions. This group was secretive and selective; their meetings were held at private homes at specific times, for only those willing to undergo a radical change of life were allowed to join. This minority, the early Christians, rose from Judaism and embraced the teachings of Jesus of Nazareth whom they believed to be the Messiah, the Christ. They lived as a close knit community embracing the religious zeal that manifested “Christian” beliefs and behavior. Such Christian devotion conflicted with Roman mentality because Roman unity was grounded in loyalty to the Emperor alone. This caused Christianity to be declared a *religio illicita*, an illegal religion, which eventually triggered the periods of persecution.

Case A: Persecution

During times of persecution it is known that Christians were deliberately sought out by angry mobs and authority figures, because refusing to participate in the “pagan emperor-cult was a political as well as a religious act, and could easily be constructed as dangerous disaffection.”¹⁴ This paper will examine persecutions from Nero in 64 AD to Diocletian in 303 AD. Many of these attacks towards Christians tended to be sporadic throughout the empire. For instance, after a “conflagration broke out in Rome which blazed for nine days and destroyed a quarter of the city,” Nero used Christians as scapegoats for the fire he set.¹⁵ The attack was focused in Rome, where Christians must have been “numerous enough to provide a spectacle...this means that in 64 Christians constituted an easily defined group, well aware of their own identity...significant but not vast in number.”¹⁶

In other occasions, persecutions were performed throughout the empire. An example is the general persecution under Decius from 249-251 AD, where Decius’s goal was to “restore Rome to her ancient glory.”¹⁷ He contended that once all citizens adored the Roman gods, Rome would be blessed with good fortune. However, he noted that if Christians insisted on refusing to accept the gods, then Rome was destined to fail. Thus, Decius passed an edict that made the worshiping of Roman gods mandatory, in which Christians were convinced “that to burn incense [an act of worship done before the statue of Decius] to them was to deny their faith in the one Lord Jesus Christ.”¹⁸ Thus, this edict escalated to a persecution aimed at Christians which illustrates the trend of highly motivated Christians preferring to die as martyrs during times of persecution.

Persecutions justified the maltreatment of Christians in several ways. For example, Christians were charged with cannibalism because of their Eucharistic belief that they were eating the body of Christ. Similarly, they were accused of infanticide because of Baptizing even infants by total immersion. An anti-Christian writer in 180 AD describes

- 13 (Gonzalez 1984, 35)
- 14 (Chadwick 1967, 24)
- 15 (Green 2010, 51)
- 16 (Green 2010, 52)
- 17 (Gonzalez 1984, 86)
- 18 (Goodenough 1931, 36)

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Christians as a “secret tribe that lurks in darkness and shuns the light, silent in public...and their vicious habits are spreading day by day...these conspirators must be destroyed and cursed.”¹⁹ Thus, misconceptions about Christian beliefs and rituals drove angry mobs to seek out Christians. Further, the fear that Christianity might overpower the Roman Empire encouraged emperors to react violently against Christians. Despite this hostility, Christians still “united probably about one-tenth of the population of the entire Roman world” during times of persecution.²⁰

The brief time periods of stillness after persecutions were governed by tension and anxiety because it was uncertain when the next persecution would strike. “In the background there was always the threatening shadow of the imperial police, ready to strike and punish,”²¹ also the accusation of Christian neighbors or enemies was sufficient to be beheaded. During these times of apparent calm many poorly motivated Christians became fearful and delusional. Many became overwhelmed with fear over the mere thought of being attacked by a lion, while others believed that trickery, such as public denial of their faith or the bribing of petty officers for sacrifice certificates, was a small price to pay in order to secure the future of Christianity. Hence, many individuals that were “left alive had something to hide or justify; those without stain were dead.”²² In other words, the majority of Christian survivors must have been poorly motivated because submitting to Roman authorities by denying their faith resulted in a pardoning of their life.

Case B: Lulls in Persecution

Despite this lack of courage, the “uncertainties of the times were moving many to seek security in religion, especially in one which was giving rise to so inclusive and strong a fellowship as the Christian Church.”²³ In other words, as Constantine became more powerful the Roman Empire was experiencing an instability that caused many to pursue sanctuary in religion, specifically in Christianity. This illustrates the importance and influence that highly motivated Christians, had on the growth of Christianity even after their death. Nevertheless, “there is no doubt that at the time Constantine took control of the Western empire, Christianity can have been the religion of only a minority.”²⁴ Therefore, Constantine ironically embraced a religion that was professed by a small fraction of the Roman Empire.

Christianity’s potential of being powerful motivated Constantine, the newly crowned emperor of the Roman Empire, to eventually embrace Christianity after the persecution of Diocletian failed. Constantine passed an edict of toleration, which removed the illegal status of Christianity. Thus, he was “known as a supporter of Christianity, but tolerant of the ancient ways.”²⁵ Whether Constantine was a “Christian from political motives only or from sincere religious conversion has been hotly debated.”²⁶ Regardless of Constantine’s true intentions, his actions had an impact on the growth of Christianity. For instance, when priest and clergy were granted exemption from paying taxes “this soon led to so great an influx into the Christian priesthood of those from the curial class who wished

19 (Johnson 1938, 70)

20 (Goodenough 1931, 39)

21 (Daniel-Rops 1962, 97)

22 (Johnson 1938, 82)

23 (Latourette, A History of Christianity: Beginnings to 1500 1953, 87)

24 (McManners 1992, 64)

25 (Green 2010, 228)

26 (Latourette, A History of Christianity: Beginnings to 1500 1953, 92)

relief from the heavy burdens,” that Constantine has to pass another edict that limited the number of ordained to reduce government loss.²⁷

Thus, “becoming Christian was increasingly becoming a socially and politically wise move” this was evident after the approval of the Edict of Milan.²⁸ This edict had two parts: first, it allowed freedom of religion; and second, it declared that all confiscated property would be returned and compensation made. The edict shows that the Empire had officially recognized and accepted Christianity as a legal religion. Also, this return in property meant the State was assuming responsibility for any prior damage committed. With the Edict of Milan in effect “a few years transformed Christianity from a persecuted minority sect into the official religion of the empire.”²⁹ Although, Constantine “did not make it [Christianity] the official or ‘established’ religion of the empire,”³⁰ it does eventually lead to the “rapid overthrow of the old pagan forms of worship and the conclusive triumph of the Gospel.”³¹ Thus, in the year 380 Theodosius I, a zealous Roman Emperor who was active in “curbing the old faiths and in encouraging the acceptance of Christianity,”³² declares Christianity the State religion.

This increase in Christian population does not suggest an increase in highly motivated Christians, however, because “people were flocking into the church in such manner that there was little time to prepare them for baptism, and even less to guide them in the Christian life once they were baptized.”³³ These new converts were ignorant of their own faith, yet they were unintentionally impacted by the Monastic reaction to the abundance of “cheap grace.”³⁴ Highly motivated Christians tended to be attracted to the solitude in a monastic way of life, by choosing to reside in the desert for the full devotion to prayer. The monks inspired many poorly motivated Christians to replicate such profession of faith which encouraged many to see monks as their role models. The monk eventually replaced the martyr as the ideal Christian after persecutions ceased. Therefore, the Church “forgets its recent past and settles to a long period of consolidation and growth.”³⁵

Results:

Case A: Persecution

Type of Individuals in the Roman Empire

	Non-Christian	Highly motivated Christian	Poorly motivated Christian
Before Persecution	71%	8%	21%
During Persecution	88%	11%	1%
After Persecution	70%	23%	7%

Type of Stage

- 27 (Latourette, A History of Christianity: Beginnings to 1500 1953, 92)
- 28 (Guy 2004, 120)
- 29 (Sordi 1986, 134)
- 30 (Chadwick 1967, 127)
- 31 (Daniel-Rops 1962, 156)
- 32 (Latourette, A History of Christianity: Beginnings to 1500 1953, 97)
- 33 (Gonzalez 1984, 126)
- 34 (Bonhoeffer 1959, 47)
- 35 (Green 2010, 236)

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Before Persecution:

The starting populations of the Roman Empire are 85% non-Christian and 15% Christian. The researcher's reasoning behind choosing such values is that immediately before the first major persecution, Nero's persecution, the Christian population was a significant minority. After running the model for four iterations the Roman Empire's population illustrates that the majority percent of the population will remain non-Christian because paganism is the religion of the State. Highly motivated Christians are a minority since these individuals tended to devote their life to the teachings of Jesus. Poorly motivated Christians are twice the percentage of highly motivated because the novelty of Christianity has begun to fade. See Appendix 1.

During Persecution:

The researcher used the previous stage percentages as the initial values for the purpose of consistency and a continuous linkage among the stages. During persecution, the majority of poorly motivated Christians will become non-Christian, because the risk of claiming an affiliation to Christianity when such devotion is weak is not worth the endangerment, hence the decrease that results in 1% of poorly motivated Christians. In regards to highly motivated Christians, many will remain faithful even to their death. Such display of faith will ignite a sense of curiosity about Christianity and a few will even convert, which explains the increase to 11%. Nonetheless, non-Christians will mostly form the general Roman population since death is the result of claiming to be Christian. See Appendix 2.

After Persecution:

Once again the researcher used the previous stage percentages as the starting values. Right after persecution, Christianity will be greatly weakened, which explains the gradual increase of poorly motivated Christians to 7%. However, the percentage of highly motivated Christians doubles to 23% because the demonstrations of faith martyrs displayed are still vivid in the minds of the people. Although non-Christians remain a strong majority, Christian conversions are beginning to surface. See Appendix 3.

Case B: Lulls in Persecution

Type of Individuals in the Roman Empire

	Non-Christian	Highly motivated Christian	Poorly motivated Christian
Before Lulls	75%	21%	4%
During Lulls	52%	26%	22%
After Lulls	11%	13%	76%

Types of Stages

Before Lulls in Persecution:

The researcher's starting population is 80% non-Christian and 20% Christian, because Christianity has survived persecutions and still remains a strong minority. After running the model for three iterations, the percentage of highly motivated Christians is greater than poorly motivated Christians because right after persecutions there tends to be an increase in motivation due to the example of martyrs. In the background, the numerous



Romans that remained unyielding to Christianity kept the population of non-Christians as a strong majority. See Appendix 4.

During Lull period:

The previous stage percentages are used as the initial values to run the model. This is the most ambiguous stage since people tend to react differently under fear and tension. Some Christians will experience a weakening in their faith, while others will gain strength with their community. Thus after running this model for three iterations, highly motivated Christians and poorly motivated Christians are closely tied. This illustrates the uncertainty among the Christian population because nearly one in every two members is poorly motivated. There is a significant decline in the non-Christian population because this period creates a temporary notion of peace in which some non-Christians will sample Christianity. See Appendix 5.

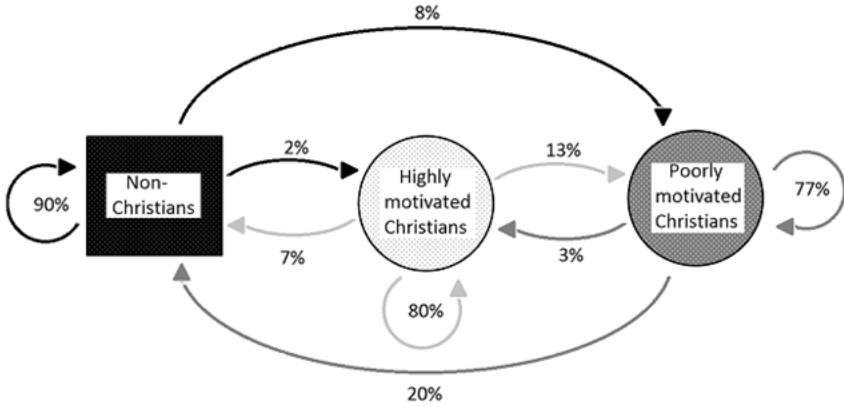
After lulls in Persecution:

Once again, the percentages of the previous stage are used as the starting values. After lulls in persecution includes instances of religious approval, such as the Edict of Milan and Theodosius's declaration of Christianity as the State religion. As Christianity becomes a wise political and social move, this results in a drastic increase of poorly motivated Christians. After running this model for five iterations, a significant decrease in highly motivated Christians and non-Christians was apparent. Highly motivated Christians felt discouraged from the spectacle of many nominal Christians that "paid only lip service to their ostensible faith and remained pagans at heart."³⁶ However, non-Christians received the greatest blow in percentage because they now only make 11%, compared to commanding 75% they once held. See Appendix 6.



Illustrating the Spread of Christianity through Mathematics

Appendix 1



Markov Chain Diagram 1: Before Persecution

Table 1: Before Persecution

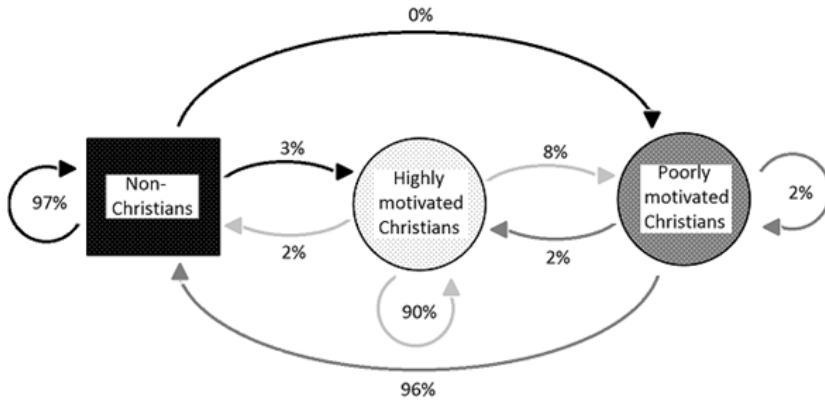
		Next State		
		Non-Christians	Highly motivated	Poorly motivated
Present State	Non-Christians	90%	2%	8%
	Highly motivated	7%	80%	13%
	Poorly motivated	20%	3%	77%

Chart 1: Before Persecution

n=	N(n)=	H(n)=	P(n)=
1	0.85	0.05	0.1*
2	0.7885	0.06	0.1515
3	0.74415	0.068315	0.187535
4	0.712024	0.075161	0.212815**
5	0.688646	0.080754	0.2306

*The initial population of the Roman Empire is 85% non-Christian and 15% Christian.

Appendix 2



Markov Chain Diagram 2: During Persecution

Table 2: During Persecution

		Next State		
		Non-Christians	Highly motivated	Poorly motivated
Present State	Non-Christians	97%	3%	0%
	Highly motivated	2%	90%	8%
	Poorly motivated	96%	2%	2%

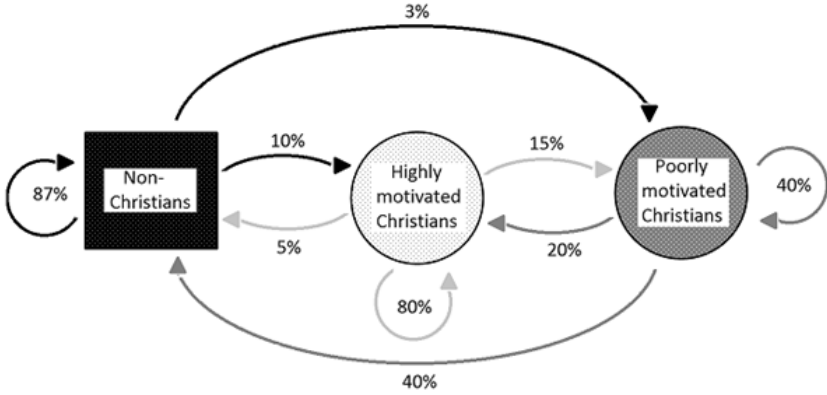
Chart 2: During Persecution

n=	N(n)=	H(n)=	P(n)=
1	0.71	0.08	0.21**
2	0.8919	0.0975	0.0106
3	0.877269	0.114719	0.008012***
4	0.860937	0.129725	0.009338
5	0.846667	0.142768	0.010565

**Used the pervious iterations as the starting percentages.

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Appendix 3



Markov Chain Diagram 3: After Persecution

Table 3: After Persecution

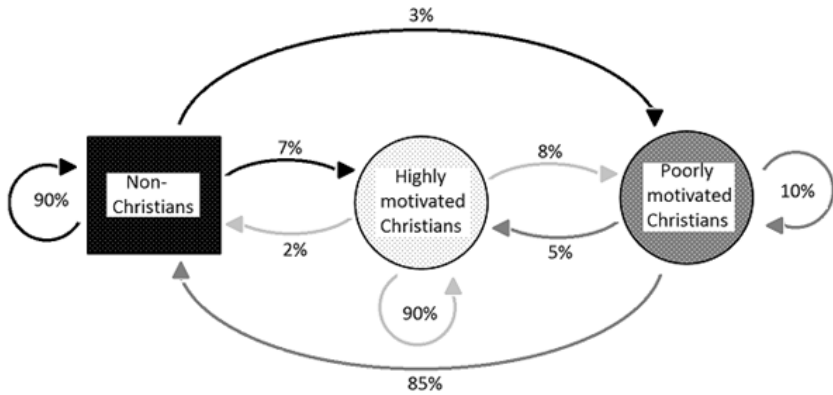
		Next State		
		Non-Christians	Highly motivated	Poorly motivated
Present	Non-Christians	87%	10%	3%
	Highly motivated	5%	80%	15%
	Poorly motivated	40%	20%	40%

Chart 3: After Persecution

n=	N(n)=	H(n)=	P(n)=
1	0.88	0.11	0.01***
2	0.7751	0.178	0.0469
3	0.701997	0.22929	0.068713
4	0.649687	0.267374	0.082939
5	0.611772	0.295456	0.092772

*** Used previous percentage as starting point

Appendix 4



Markov Chain Diagram 4: Before Lulls in Persecution

Table 4: Before Lulls in Persecution

		Next State		
		Non-Christians	Highly motivated	Poorly motivated
Present State	Non-Christians	90%	7%	3%
	Highly motivated	2%	90%	8%
	Poorly motivated	85%	5%	10%

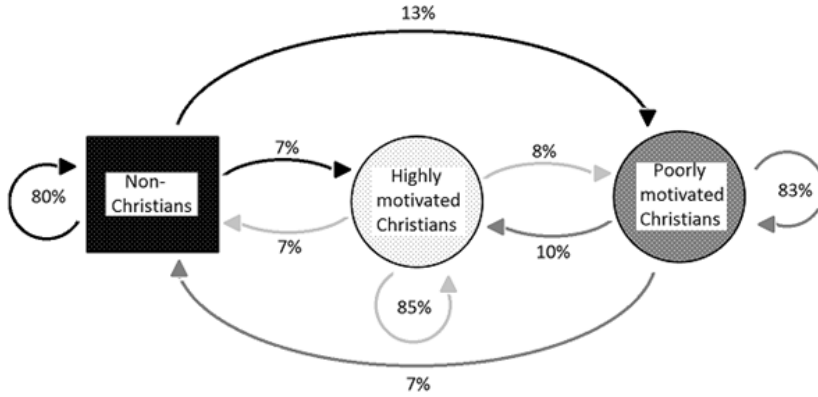
Chart 4: Before Lulls in Persecution

n=	N(n)=	H(n)=	P(n)=
1	0.8	0.12	0.08*
2	0.7904	0.168	0.0416
3	0.75008	0.208608	0.041312**
4	0.714359	0.242318	0.043322
5	0.684594	0.270258	0.045148

*Starting with a population of 80% non-Christian and 20% Christian

Illustrating the Spread of Christianity through Mathematics

Appendix 5



Markov Chain Diagram 5: During the Lull Period

Table 5: During the Lull Period

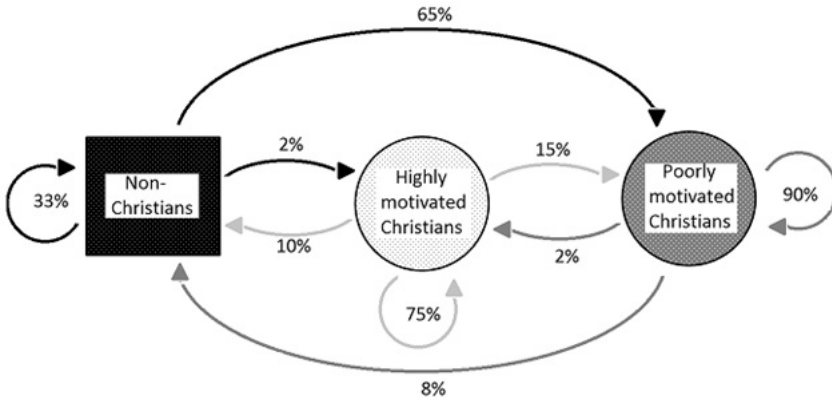
		Next State		
		Non-Christians	Highly motivated	Poorly motivated
Present State	Non-Christians	80%	7%	13%
	Highly motivated	7%	85%	8%
	Poorly motivated	7%	10%	83%

Chart 5: During the Lull Period

n=	N(n)=	H(n)=	P(n)=
1	0.75	0.21	0.04**
2	0.6175	0.235	0.1475
3	0.520775	0.257725	0.2215***
4	0.450166	0.277671	0.272164
5	0.398621	0.294748	0.306631

**Using previous percentages as starting values

Appendix 6



Markov Chain Diagram 6: After Lull in Persecution


Table 6: After Lull in Persecution

		Next State		
		Non-Christians	Highly motivated	Poorly motivated
Present State	Non-Christians	33%	2%	65%
	Highly motivated	10%	75%	15%
	Poorly motivated	8%	2%	90%

Chart 6: After Lull in Persecution

n=	N(n)=	H(n)=	P(n)=
1	0.52	0.26	0.22***
2	0.2152	0.2098	0.575
3	0.137996	0.173154	0.68885
4	0.117962	0.146402	0.735636
5	0.112419	0.126874	0.760708

***Used previous percentage as starting values



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Annotated Bibliography:

In the article entitled, “The Consciousness Reformation,” William Sims Bainbridge and Rodney Stark, demonstrated that a “traditional religion remains an influential meaning system, producing conventional attitudes and preventing experimentation with radical lifestyles and occult practices” (1). This was determined from a questioner given to college students that focused on four concepts found on Wuthnow’s prior research. These concepts were theism, individualism, social science and mysticism.

In the book entitled *The Cost of Discipleship*, Dietrich Bonhoeffer urges the reader to grasp the importance and sacrifices required when one embraces Christianity. For a Christian is not to partake in cheap grace, a grace without Jesus, on the contrary one is to earn costly grace, a grace that must be asked for and calls us to follow. It is a “taking up your cross, suffering when Jesus does and following obediently and single-mindedly” that demonstrates an ability to unconditionally follow Jesus (48).

In the *Dictionary of Theology*, the term I defined and found most useful was martyrdom, which is defined as a witness “by Christians who accept death out of faithfulness to their Savior” (295). Louis Boyer further develops this term by referencing to St. Paul and St. Ignatius of Antioch. He also describes martyrdom as the “free renunciation of the goods of the world as one of the first forms of Christian asceticism that was to lead to monasticism” (295). In other words, this voluntary act paved the road for selfless acts of faith.

The Modern Challenge to Religious Education was efficient in describing the catechism experience during the middle ages. Emmett G. Carter emphasizes the importance of the oral and written gospels. He then describes the catechesis of St. Peter, St. Paul and the Early Church. The importance of liturgy, bishops’ preaching, letters from other communities and reports of martyrs was highlighted during Catechumen classes. Thus, Carter recommends the use of St. Augustine’s method for it includes the use of Biblical narrative, instruction, and practical application.

Henry Chadwick, author of *The Early Church*, informs the reader about events and stages the Early Church underwent during its development. Major highlights are: first, the developments of Christianity, such as its rise from Judaism as a close knit community faithful to the “Messiah” who is Jesus. Second, the establishment of authority figures such as bishops and the formation of one united Church. Third, evangelization occurred, due to the influence of “James the Lord’s brother” and Paul, which allowed Christianity to spread northward and throughout the Roman Empire. Lastly, Christians encountered opposition from non-Christians such as pagans, Jews and emperors. Initially, persecutions were sporadic in nature, “which often depended on local attitudes (31).” However, as time progressed persecutions escalated in number and intensity, for example the general persecution under Diocletian. Then a time of approval occurs where Constantine’s favorability paves the road for Christianity to become an accepted religion.

Henri Daniel-Rops; *The Church of Apostles and Martyrs*, was a great source for Case B: lulls in persecution. He describes the actions and motives of Christians in such a detailed manner that the reader can actually sympathize with their lack of courage. For instance, Daniel-Rops describes poorly motivated Christians as self-centered, and easily overwhelmed by fear. The reader realizes that such great doses of fear and anxiety would influence the great number of Christians that denied their faith. Also, Daniel-Rops’ narrations of the martyrs procession to their own death, was completely inspiring and engaging. Finally, the explanation of the Edict of Milan was concise and easy to understand.

The textbook, *A First Course in Mathematical Modeling*, illustrates and instructs on probabilistic modeling with a discrete system called Markov chains. Examples and exercises of Markov chains are presented. A Markov chain has a finite number of states, the transition from one stage to the next can be traced and the “probabilities for transitioning from the present state to the next state is equal to 1 (215).”

In *The Story of Christianity*, Justo Gonzalez does an excellent job in describing and elaborating on the development of early Christianity. His best explanations were on the impact of martyrs and times of persecution. Gonzalez states that “martyrdom was not something that one chose, but something for which one was chosen by God (44).” In other words their courage came from God and their deaths “seemed to encourage the spread of Christianity (86).” Also, he explains the impact of *the Apologists* and shines a positive light on the Constantine’s conversion.


The Church in the Roman Empire is a brief summary of the early years of Christianity. Erwin Goodenough, the author, describes Christianity as a brotherhood where every member believed in the saving grace of Christ. He further explains the importance of authority and the two obligations the Church embraced; to transmit the grace of Christ through apostolic succession and to preserve the true doctrine. Finally his best descriptions were on asceticism and monasticism.

In his book entitled, *Christianity in Ancient Rome: The First Three Centuries*, Bernard Green focuses on the major themes that shaped Christianity. The chapters most relevant to this project were those on persecution and Constantine. In the chapter on persecution, Green reveals that Christianity was illegal because of three reasons: it was sacrilege against the gods, an act of disloyalty towards Rome, and an insult to the emperor. Thus, Christians were blamed for any natural disaster or misfortune the Roman Empire experienced. In the chapter regarding Constantine, Green provides a detailed description on how Constantine conquered the Roman Empire. Green further explains the influence Constantine had on Church disputes and his view on the power of the Christian God.

Laurie Guy, the author of *Introducing Early Christianity*, does an astounding job in describing the early Church for an audience that may be lacking knowledge in theology. Guy touches upon issues such as the spread of Christianity, persecution, martyrdom, Constantine’s impact and monasticism. His portrayal of persecution was vivid and effective, for Christians saw Jesus as the ultimate example and dying for Him was reason enough. Also, Guy states that “society rejected the church and the church in turn rejected society (76).” That is to say that martyrdom was the only possible outlet Christians could use to express their faith. In Constantine’s impact, Guy describes Constantine’s true motive in becoming Christian was more for the wellbeing of the empire versus of his own soul. In other words, Constantine believed that embracing Christianity would positively contribute to the Empire’s social and political standing. Lastly, in the section on monasticism Guy provides stunning examples of devoted Christians that professed their faith in such great lengths. For instance, some resided in solitude and intense sacrificing to combat sin.

The mission and expansion of Christianity in the first three Centuries, written by Adolf von Harnack was primarily used by Dr. O’Connor, my mentor. He referenced this book in search of numerical data.

“On the Probable Age Structure of the Roman Population,” Keith Hopkins, calculates the average age of the Roman population by using Roman tombstones. Such method has become acceptable, since there is lack of numerical data. However, such calculations are inadequate to establish life expectancy for there are gaps in the representation



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of various age groups, such as infants and males. The majority of the gravestones were commemorations to parents and young wives. Although exaggerations are found in the age inscribed on the tombstones, Hopkins, still hypothesizes that the “Roman population had an expectation of life at birth of 20-30 years” (264).

In the journal article entitled “The Age of Roman Girls at Marriage,” M. K. Hopkins describes the living conditions of young women during the Roman Empire. He states that the Roman law for marriage was “the twelfth year in a girl and the fourteenth in a boy define the age of puberty” (310). Hopkins acknowledges the misconception that the data used only includes girls from the higher classes who tended to be given in marriage to older men. Hopkins calculated the age of these young girls by looking at grave engravings that provided the years of marriage and age of death. He determined that at an average pagan girls married between 12-15 years of age while Christian girls were between 15-18 years of age.

Laurence R. Iannaccone illustrates the idea that “strictness makes the organization stronger and more attractive” in the article entitled “Why Strict Churches are Strong” (1180). Iannaccone explains that strong churches have an increase in commitment levels, participation, and benefits of membership. Thus, “the groups-distinctiveness, costliness, or strictness-explains individual rates of religious participation than any other standard” (1200). Also, there must be limits to the amount of strictness for this can lead to imbalances in the benefits received from the church. Iannaccone concludes that a church needs to establish a distance between itself and society, also “successful strictness must invoke the sacrifice of external resources and opportunities that the group itself can replace” (1203). The book entitled, *A History of Christianity*, was an excellent source for the description and impact Constantine had on Christianity. Paul Johnson portrays Constantine as a dynamic character who had a hideous temper, enjoyed flattery and wore extravagant outfits. Johnson describes Constantine’s dark side that is so rarely revealed in similar literature. Also, the positive and negative transformations the Christianity underwent due to Constantine were clearly explained.

A History of Christianity: Beginnings to 1500, written by Kenneth Scott Latourette, is for a reader that has prior knowledge on the spread of Christianity for he does not elaborate in great detail each persecution. Each different perpetrator behind the persecutions against Christians is explained in a chronological order. That is, Jews being the first to assault Christians, followed by Nero, Decius, Valerian and the worst under Diocletian. Latourette was also a great source for the description of the growth and recovery of Christianity in-between persecutions.

John Lofland and Rodney Stark the authors of the article, “Becoming a World-Saver: A Theory of Conversion to a Deviant Perspective,” focus on the factors that contribute to conversion and establishment of doctrines by observing the Divine Precepts group. Conversion indicators are verbal claims and total claims such as deeds. Conditions that trigger a conversion are tension, problem-solving perspective and seekership. Once individuals are introduced to Deviant Perspective factors that influence their conversation are a turning point, cult affective bonds (friendships), extra-cult affective bonds (family rejections), and intensive interaction with the group.

The Oxford Illustrated History of Christianity was primarily used for the description of the time period after Constantine’s rule in the years 330-700 AD. The illustrations in this chapter were religious paintings, coins and items which were captivating and informative. However, they were irrelevant to my research project. Also,



the description of the Christian way of life was enlightening, for the reader was provided examples mundane problems Christians were faced with, such as the education Christians should receive, the church's stance on sex and the importance of bishops and monks.

Martyrdom Today is a collection of articles on martyrdom, in which two articles were the most promising. The first article, "Martyrdom and Persecution in Early Christianity" by Theofried Baumeister, describes martyrdom as bearing witness through actions. He explains the impact of confessors and martyrs. A confessor is defined as someone that was subject to domestic punishment, for instance the act of being imprisoned in which the Holy Spirit would speak through them. A martyr's loyalty to God is described as the willing acceptance of "death [that] becomes the gateway to heaven (7)." The second article, "Martyrdom: An Attempt at Systematic Reflection" by Leonardo Boff, explains that martyrdom will always exist because some prefer to sacrifice their lives rather than to act unfaithfully to God. Humanity's freedom is expressed in a human's ability to accept or deny God. Thus, Boff describes Jesus as the perfect example of a martyr, for he fully accepted God to take command of his life. He further explains the impact of martyrs on Christianity and the kingdom of God. Thus, dying a martyr is living a "life that is ordered to something greater and more worthy (16)."

Though the *Atlas of the Early Christian World*, seemed promising at first in the end it was clearly ineffective. The color use in each map was not easily marked and there was a lack of maps that illustrated the impact of persecutions. The time gap between each map was considerable and the different concepts that were illustrated with every time period were not relevant to my research. Thus the lack of consistency and time periods made this source ineffective.


In the article entitled "Housing and Population in Imperial Ostia and Rome," James E. Packer attempts to determine the size of a city's population by taking into account the housing preference and number of inhabitants in each structure in the ruins of the port Ostia. Vast amount of unearthing and discovering has taken place in such ruins. With the lack of numerical data that illustrate actual population of Rome, Packer assumed the average size and inhabitants of each building in calculating the population of Rome. The textbook entitled *Linear Algebra: A Modern Introduction* was used to learn the procedure on how to multiply matrices. Since I have not taken linear algebra this textbook was useful in learning some relevant mathematical techniques.

The Christians and the Roman Empire is a personal narrative from Marta Sordi as she expresses her opinion on the motives that ignited the persecutions under Decius, Valerian and Diocletus. She describes each event through the perspective of how it influenced and contributed to Christianity.

Rodney Stark in the article "Class, Radicalism, and Religious Involvement in Great Britain," reveals the tremendous influence one's choice in politics has on religion. Although religion has been viewed as the "painkiller for frustration and deprivation that interfered with their attaining true class consciousness," Stark demonstrates that religion now no longer plays such a role (699). Instead the middle class is more likely to attend worship while the lower class is more likely to not participate but simply believe in their religion. Stark is assuming that church attendance equals social status. Thus, the accepting status quo correlates with religion inclination for which "political affiliation is markedly related to church attendance" (704).

In the "The Rise of a New World Faith," Rodney Stark shows that Mormons (a recently established religion) will soon achieve worldwide recognition and numbers





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comparable to that of dominating world faiths. While reviewing numerical data on the population of its members, Stark noticed a doubling in size which is attributed to the huge success of their missionaries. For all young Mormon men are encouraged to spend two years missionarying, which cultivates a “steady supply of young, talented eager missionaries” (21). Their youth attracts converts and their gained experience enables Mormons to “rely on a volunteer, unpaid yet trained, priesthood to staff of the church” (21). Thus, such actions have contributed to their increase in members especially from people who initially had no prior religious affiliation.

The Rise of Christianity: a Sociologist Reconsiders History was essential for this research because Rodney Stark’s quantitative approach on the spread of Christianity inspired the use of mathematics to illustrate a theological idea. This procedure involved the use of theological literature to support the arbitrary values used in the mathematical aspect. Also, this book’s bibliography was used as a guide to for the literature obtained and used in this project. Thus, Stark’s book is the role model for this project.

“Of Churches, Sects, and Cults: Concepts for a Theory of Religious Movements,” the authors, Rodney Stark and William Sims Bainbridge, begin by establishing a definition for religion and church-sect conception. “Religion is a system of general compensations based on supernatural assumptions” (121). In regards to church and sect Stark and Bainbridge, define church as a “group that accepts the social environment which it exists, [while] sect is a religious group that rejects the social environment which it exists” (123). These two kinds of religious movements tend to occur within non-schismatic religions; cultural innovation and cultural impartation. Thus, the authors establish the difference between a sect and cult. Sects emerge from a prior religious movement while cults “represent an independent religious tradition in a society” (125). Ultimately, the origin of many social institutions and much of human culture is “lost in mystery” (130).

Precalculus: Mathematics for Calculus is a textbook used to help determine which mathematical model would best fit this research.

The *Theological Dictionary* by Rahner Vorgrimler was used to define two terms: martyrdom and persecution. Martyrdom was defined as “death for the sake of Christian faith or Christian morals” in which such act is a manifestation of “unconstrained faith” (275). Thus, martyrdom has the same power to justify baptism for being a martyr is an proof of the supernatural origin of the Church. Persecution is considered inevitable because Christianity does not exist in a world “free of contradiction and attack” (350). Thus, persecutions are “situations of true faith and hope” in which Christians are called forth to defend their one God and acknowledge that criticism to their faith will always exist.

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Factors Related to Contact During Social Interactions



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Abstract

*Cetaceans are highly social animals found in small and/or large groupings. Many cetaceans develop social relationships or selective associations with each other between same sex adults, mixed sex adults, mothers and their calves, and calves with other calves. Within these associations, contact seems to influence the behavior and social interactions displayed. Much of what is known about contact and social relationships comes from the Delphinidae family while little is known about the Monodontidae family, or belugas (*Delphinapterus leucas*). The purpose of the present study was to investigate the relationship between social interactions and contact displayed by four mother-calf pairs located at Sea World San Antonio, with the primary focus on the first two years of each calf. Two 15-min focal-follow videos per month were randomly selected from the 1,000 available videos. A total of 178 videos were coded for the following variables: time of day (AM/PM), initiator of contact, receiver of contact, body parts used to make contact, body part that received contact, type of contact (rub/touch), duration of contact, number of companions in pool, frequency and duration for the type of social interaction (affiliative pair swim, affiliative interaction, aggressive interaction, or sexual interaction) that occurred, and animal combination for each social interaction. The results of regression*

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analyses indicated that different variables significantly influenced the average length of a social interaction and the average length of a contact event. These results suggest that contact may play an important role in the maintenance of a social interaction and contact events are sustained by longer social interactions. Additional research is necessary to better understand the development and maintenance of relationships, particularly mother-calf relationships, in the context of contact during social interactions.

The order Cetacea is composed of the suborder Odontoceti (toothed whales), consisting of five families: Delphinidae (e.g., dolphin), Monodontidae (e.g., beluga), Phocoenidae (e.g., porpoises), Physeteridae (e.g., sperm whale), and Kogiidae (e.g., pygmy and dwarf sperm whale). Cetaceans are usually highly social and are found in small and large groupings, depending on the species. These groups of individuals share social interactions, which develop into relationships or selective associations. Selective associations may be formed between males, females, males-and-females, mothers and their calves, and calves.

Much of the available research has focused on the Delphinidae family and has indicated that strong associations exist between males, females, and mothers and their calves (Connor, Mann, & Watson-Capps, 2006; Mann & Smuts, 1999; Tamaki, Morisaka, & Taki, 2006). Male dolphins form strong alliances other male dolphins that may be temporary or long-term (Connor, 2007; Connor & Richards, 1992; Connor et al., 2006). These alliances may be used to facilitate their access to cycling females or simply as companionship. Female dolphins form long-lasting and strong relationships, often with related females (Tamaki, Morisaka, & Taki, 2006). These female-to-female relationships are also used for companionship, foraging, and protection (Connor et al., 2006; Tamaki et al., 2006). Mothers and their calves clearly form highly stable and long-term social relationships (Herzing & Miles, 2003; Mann & Smuts, 1999). While calves rely upon their mothers for food, safety, and social knowledge, they also use their mothers for companionship (Gibson & Mann, 2008; Mann & Smuts, 1999). Previous research on the social patterns of dolphin calves indicated that calves spent most of their time in close proximity with their mother during the first week of life engaged in affiliative behaviors, such as rubbing and touching around the melon area (Mann & Smuts, 1999; Reid, Mann, Weiner, & Hecker, 1995). However, as the calves matured, the proportion of time they spent with their mothers decreased as their distance from their mothers increased (Mann & Smuts, 1999). This independence is related to maternal activity as the mothers decreased their role in maintaining in close proximity to their calves (Mann & Smuts, 1999).

Social patterns play an important role in social interactions engaged in by dolphin calves. Some of the first social interactions to which calves are exposed are the social interaction with their mothers and interactions with other calves, which are somewhat dependent upon interactions initiated by their mothers with other mother-calf pairs (Gibson & Mann, 2008; Mann & Smuts, 1999). Recently, Gibson and Mann (2008) examined the sociability development of dolphin calves from birth to four years of age, using two measures: number of associates while they were with their mothers and separated from the mother and the proportion of time spent in a group of individuals. Overall, dolphin calves display variations in their level of sociability. However, these social patterns may be related to an interaction between time calves are separated from their mothers and the calves' sex and age. The calves' sex did not seem to directly influence the number of associates a calf had, but when male calves showed a greater degree of independence from their mothers, they had more associates than females. The calves' age was also negatively



correlated with their proportion of time socializing. Thus, the older the calf, the less time they socialized. Finally, Gibson and Mann found that the more time calves spend in groups, the more associates they had.

This recent research clarifies the earlier findings in which calves tended to interact with other calves as their mothers were more likely to interact with other mother-calf pairs (Mann & Smuts, 1998). Thus, dolphin calves should interact and form relationships with the calves of the females preferred by their mothers. It is possible that this early period of development is a critical or sensitive period for developing the skills necessary for social relationships, implying that if calves are not exposed to calves their age early in their development that they may not develop species typical social skills (Tamaki et al., 2006). More recently, research has supported this hypothesis as the social patterns of adults appear to reflect the mother-calf interactions they experienced as calves (Gibson & Mann, 2008). Clearly, the mother-calf bond plays a significant role in the socialization, of calves, which includes their future behaviors and social interactions (Wells, Scott, & Irvine, 1987; Connor, Wells, Mann, & Read, 2000; Tamaki et al., 2006; Herzog; 1987).

A longitudinal study on the behavioral development and mother-calf relationship in nine newborn dolphin calves indicated that contact between mothers and their calves occurred in a variety of contexts and serve a variety of functions, including echelon or infant swim positions (Gubbins, McCowan, Lynn, Hooper, & Reiss, 1999; Mann & Smuts, 1999; Weihs, 2004). Very young dolphin calves spent most of their time in one of two primary positions: echelon position or infant position (Gibson & Mann, 2008; Mann & Smuts, 1999). Echelon position is similar to contact swimming (Mann & Smuts, 1999), in which the calf swims parallel and alongside the mother's body. Echelon swimming has been demonstrated to facilitate calf swimming and breathing, especially during their first few weeks of life when they lack swimming coordination and motor skills (Weihs, 2004). Infant position is when the calf swims under the mother's abdomen touching the mammary slits with its melon, and usually serves for nursing purposes. Infant position rarely occurred during the first week of a calf's life, and did so mainly during nursing bouts. Infant position requires more advanced motor skills because the calf must break the position to breathe and then glide back into position. The transition between these swim positions reflect the developmental changes in pair swim social interactions between mothers and their calves. By the second week of life, dolphin calves remained in infant position for longer time periods and for reasons other than nursing (e.g., protection, fatigue). During the first month dolphin calves spend most of their time in echelon position, but by the second month dolphin calves spend more time in infant position.

The research on contact in delphinids has also suggested that contact influences the behavior of individuals and the relationships between individuals (Brown, 2001; Connor, Mann, & Watson-Capps, 2006; Dudzinski, Gregg, Ribic, & Kuczaj, 2009; Mann & Smuts, 1999; Tamaki et al., 2006). Contact in female dolphins of Shark Bay, which usually occurs through contact swimming or echelon swimming appears to influence relationships. Namely, contact swimming increased during stressful situations, and seemed to decrease or prevent male harassment. Contact swimming also increased female bonding, and provided locomotion assistance for dolphin calves (Connor et al., 2006). These contact swimming contexts suggest that its primary purpose is affiliative in nature as it strengthens, maintains, and establishes bonds between adult female dolphins and mothers and their offspring (Connor et al., 2006). In contrast, contact swimming did not occur as frequently between male dolphins. Rather, male dolphins contact each other most often through



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petting (Connor et al., 2006). Petting is, “pectoral fin-to-pectoral fin rubbing where active movement between pectoral fins of two dolphins is observed” (Dudzinski, Gregg, Ribic, & Kuczaj, 2009), and may facilitate the bonds and alliances between males as they may enhance reproductive success and prevent harassment from other male dolphins (Connor, Smolker, & Richards, 1992, as cited in Tamaki et al., 2006).

In two other wild populations of dolphins, the functions and rates of contact behaviors (petting, rubbing, touching) were 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 for social and relationship maintenance and not for hygienic or self-stimulation purposes (Dudzinski et al., 2009).

Contact may also occur between the calves and their mothers or other dolphins during social interactions. These interactions (e.g., affiliative, aggressive, or sexual) include a broad range of behaviors, such as petting, rubbing, mounting, chases, genital inspections, gooses, pokes, play, and aggressive actions like raking and ramming (Mann & Smuts, 1999). Contact events played an important role in the development and maintenance of social interactions and/or relations. Focal follows with male and female bottlenose dolphins in Shark Bay, Western Australia indicated that touch was very important for both sexes but for different reasons (Connor et al., 2006). Affiliative behaviors or gentle contact behaviors, which are important for bonds, were demonstrated through petting, rubbing, or contact swimming (Aureli, Cords, & van Schaik, 2002; Connor et al., 2006; DeVries, Glasper, & Detillion, 2003).

Contact also contributed to relationship repairs in dolphins (Tamaki et al., 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 a unique species (Krasnova, Bel’kovich, & Chernetsky, 2006). Unfortunately, the role of contact in beluga behavior and interactions has only been addressed within the mother-calf context and rarely (Krasnova, Bel’kovich, & Chernetsky, 2006; Krasnova, Bel’kovich, & Chernetskii, 2009). 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 swam and followed their mothers at birth (Hill, 2009; Krasnova et al., 2006). Similarly the beluga calves increased their distance and duration away from the mother as they matured (Hill, 2009; Krasnova et al., 2006). Beluga calves also displayed different swim positions while swimming with their mothers (Krasnova et al., 2006). As with the dolphins, these different swim positions allowed for different degrees of contact between the beluga mother and her calf.

In belugas, during the first days of life, the calf was usually *at* the cow’s side or

at the cow's tail perhaps because it facilitated the calf's movement through the water. The positions identified in these early beluga studies resembled the infant position displayed by dolphins (Gubbins et al., 1999; Krasnova et al., 2006; Krasnova et al., 2009; Mann & Smuts, 1999) and may or may not involve contact. Beluga calves also spent longer and more 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 required a high degree of coordination, strength, and extended contact (e.g., on the mother's back or on the mother's tail) were shorter in duration. These positions seem to be avoided early in development perhaps because of their physical difficulty. As the calves matured, they became more independent, spent less time at their mother's side, and swam ahead of the mother or at the mother's head more often. When distance increased between mothers and their calves, the possibility for contact may decrease as close proximity to each other declined. However, this increase in independence also increased the opportunity for intentional contact interactions.

Little is known about belugas and the role of contact during social interactions, the purpose of the present study was to investigate the degree of physical contact and social interactions displayed by four mother-calf pair belugas, keeping a focus on the four calf belugas during their first two years of life under the care of humans. The frequency, duration, initiator, receiver, body parts used or contacted, type of contact, and type of social interactions were recorded. Thus, the following questions guided the current study:

1. What factors influence the length of a social interaction?
2. What factors predicts the length of a contact event?

Method

Subjects

The subjects included four mother-calf beluga pairs: TIN-OLI, SIK-QIN, CRI-BEL, and LUN-ATL. OLI, a male calf, was born June 23, 2007 to TIN, a wild-born female whose age was estimated to be 25 at the time of OLI's birth. TIN passed away when OLI was 21 months old. QIN, a female calf, was born July 31, 2008 to SIK, a wild-born female that was approximately 26 years old at the time QIN's birth. BEL, a female calf, was born June 12, 2009 to CRI, a wild-born female that was approximately 24 years old at the time. ATL, a female calf, was born June 23, 2010 to LUN, a captive-born female that was approximately 12 years old at the time. LUN was also the daughter of TIN, making LUN and OLI half siblings. The remaining belugas do not share a genetic lineage. All of the mother-calf pairs were housed at White Whale and Dolphin (WWD) Stadium in Sea World San Antonio (SWSA) during the first two years of life. TIN and OLI were moved to the zoological area two weeks following his birth at the stadium. This alternative housing lasted for 10 months and was performed to meet facility constraints and health concerns about OLI.

Facility

The current data were collected from archived video recordings made at WWD, which consisted of seven interconnected pools, which held approximately two million gallons of man-made salt water. Figure 1 displays a diagram of this facility. Pool A is the main front pool with underwater viewing. Pools B1, B2, C, D1, D2, and MED were located behind the show pool with no underwater viewing. The majority of the recordings were made above water. Recordings collected at the zoological pool were above water. This pool held approximately 75,000 gallons of man-made salt water.

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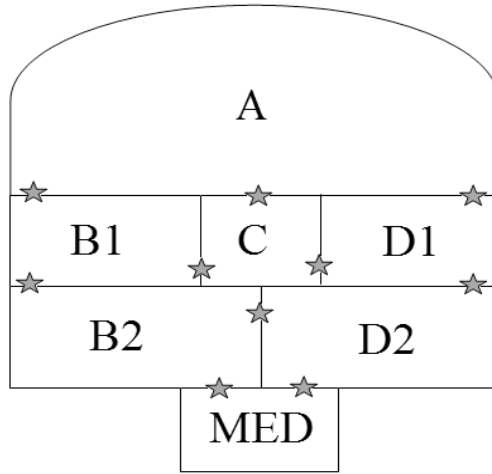


Figure 1. Schematic diagram of the facility, White Whale and Dolphin Stadium at SWSA. Stars represent location of the gates that connect pools. Diagram is not drawn to scale.

Measures

All behaviors of interest were recorded in an Excel-based ethogram using a spreadsheet for each mother-calf pair. The behaviors of interest included video date, time of day (AM/PM), initiator of contact, receiver of contact, body part used to make contact, body part that received contact, type of contact (rub/touch), duration of contact, number of companions in pool, frequency and duration for the type of social interaction (affiliative pair swim, affiliative interaction, aggressive interaction, or sexual interaction) that occurred, and animal combination (Mother Calf (MC), Mother and Other Adult (MOA), Mother and Other Calf (MOC), Calf and Other Adult (COA), Calf and Calf (CC), Mother Calf and Mother Calf (MCMC), Calf and Other Adult and Calf (COAC), Mother Calf and Other Adult (MCOA), Mother Calf and Other Calf (MCOC)) for each social interaction. Table 1 lists all the operational definitions of these variables. A stop watch was used to measure all duration data. To increase consistency in the recording of body parts used to initiate or received contact, the beluga was divided into five areas: head, body, pectoral fins, flukes, and full body. See Figure 2.

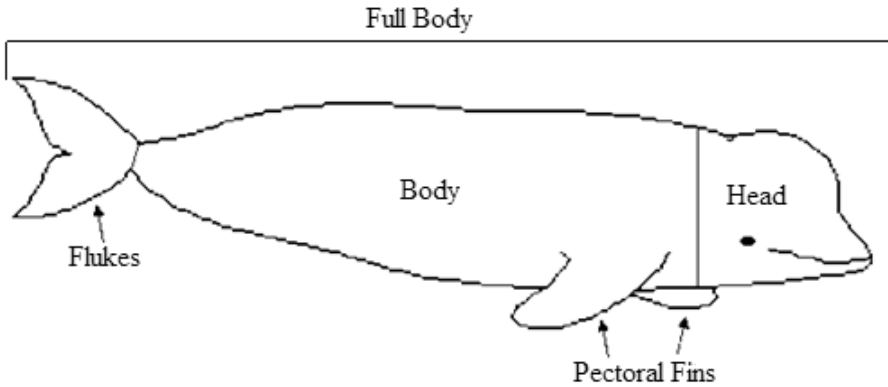


Figure 2. Schematic diagram of the body parts on Beluga whale. Beluga whale is divided into four body parts where contact behaviors were observed. (Diagram adapted from Col, 1998.)

Table 1

Operational Definitions for Variables of Interest

Target Behavior	Operational Definition
Initiator of Contact/ Interaction	Beluga that makes the first move or starts the social interaction by being the first to approach another beluga; or beluga that made the contact on another beluga
Recipient of Contact/ Interaction	Beluga that gets approached by another beluga during a social interaction; or beluga that received the contact by another beluga
Contact	A beluga can either initiate or receive an individual physical contact in two forms:
Rub	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); rubbing is characterized as a moving, active type of contact that usually lasts more than 1 second

Factors Related to Contact During Social Interactions

Table 1 Continued

Touch	Physical contact between one individual and another individual (Dudzinski et al., 2009); touch is characterized as a type of contact that does not consist of rubbing, or an active movement between one body part of one individual to another body part of another individual; touches are characterized as a static, sustained, inactive type of contact that usually lasts less than 1 second
Body Parts	A beluga can either initiate contact with four different body areas or receive contact in four different body areas:
Full Body	Beluga made contact with the use of its full body or received contact on its full body, consisting a contact from head to flukes
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 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
Social Interactions	A beluga can either initiate or receive a social interaction, which is characterized by one beluga approaching another beluga and acting, cooperating, or sharing some behavior. Social interactions can come in four forms:
Affiliative Pair Swim	This is a synchronous swim between two or more than two belugas, swimming about the same rate and in close proximity usually less than 5 meters apart. Pair swims can consist of contact. Pair swims can come into several forms:

Infant Position	Calf swims underneath the mother touching the mother's body/abdomen area with its' head/melon; and it is coded as a mother-calf head to body touch; infant position breaks and contact ends when the calf comes out from under to surface usually to breath (Mann & Smuts, 1999), this position resembles below the cow, <i>at</i> the cow's belly, and <i>at</i> the cow's tail (Krasnova 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)
Affiliative Interaction	This is a social interaction that is characterized by sharing of space between belugas and consists of gentle, non-aggressive, friendly behaviors such as floating, orienting, vocalizing, play behaviors and gentle physical contact may occur.
Aggressive Interaction	This is a social interaction that is characterized by sharing of space between belugas and consists of rough and threatening behaviors such as open mouth threat, chases, jaw claps, head thrusts, head jerks, hit, bite, charge, and raking (DiPaola, Akai, & Kraus, 2007)
Sexual Interaction	This is a social interaction that is characterized by sharing of space between belugas and consists of courting/mating behaviors such as presenting, coupling, posturing, swimming together, and intromission (DiPaola et al., 2007)

Procedure

Since the birth of the first two beluga calves in 2007, video observations have been recorded two to four times a week for each mother-calf pair using 15-min focal follows outside of training or feeding sessions. The total available videos for four mother-calf pairs at the time of this study numbered over a 1,000. Two videos per month for the first two years of each calf's life were selected from the available videos, for a final total of 240 videos. To select the 240 videos, the available videos were randomly assigned a one or a two. All ones were eligible to be selected using the following criteria: 1) one video had to be near the beginning of the month and the other video had to be near the end of the month, and 2) the videos had to have sufficient visibility for the coding of contact. Some videos were poorer in quality due to lack of visual visibility, which was often related to lighting, recording position, and animal visibility.

Contact events or social interactions occurring between non-focal belugas were not recorded (e.g., while observing mother-calf pair, CRI-BEL, contact events or social interactions occurring between two other calves or two other adults on the video were not recorded). Individual contact events occurring during a social interaction were recorded in seconds, such that data could be collapsed and it would give a total duration and total frequency in seconds for one individual social interaction. Contact events during social interactions were recorded by starting the stopwatch when body-to-body contact was observed between the focal-follow beluga (calf) and another beluga. The stopwatch was



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stopped when there was no body-to-body contact. While recording a mother-calf pair swim, if the mother-calf pair became not visible, such as swimming behind an obstacle, the stopwatch would be paused and restarted once the mother-calf pair became visible; this was done to avoid recording the social interaction as two separate social interactions. This procedure was repeated for each of the four mother-calf pairs, with the primary focus on the behaviors of the calf.

Data Analyses

Data were recorded in Excel and then transferred to SPSS © 17 for all data analyses. Data for contact events and social interactions were entered as individual events for each video session for each mother-calf pair. Individual events for each video session were collapsed per bout for each mother-calf pair observed, giving a total duration and total frequency for social bouts and contact bouts. These composite variables were then transformed into two dependent variables, reflecting the average duration of a social bout and the average duration of contact event. The total duration variables were divided by the relevant frequency variables. A series of ANOVAs were performed to examine the relationship between various factors and these two dependent variables of interest. A series of chi square tests of independence were conducted to assess the relationship between type of interaction and type of contact, preferred body parts, and preferred social interaction partners. Finally, two regressions were conducted to assess the importance of various predictors on the two criteria of interest: average duration of a social bout and average duration of a contact event.

Results

Observation Sessions

Three of the four mother-calf pairs (TIN-OLI, SIK-QIN, and CRI-BEL) produced 48 independent sessions, for approximately a total of 720 minutes of observation each. Only 34 independent sessions were collected for LUN-ATL, representing approximately 472 minutes of observation. A total of 178 independent sessions were coded and averaged 14.79 minutes in duration.

Descriptives for Social Interactions

A total of 1103 social interactions occurred across the total 178 observation sessions. Including affiliative pair swim, affiliative interactions, aggressive interactions, and sexual interactions, social interactions occurred at a rate of 0.43 per minute. Social interactions were initiated by TIN-OLI ($N = 251$), SIK-QIN ($N = 402$), CRI-BEL ($N = 437$), and LUN-ATL ($N = 13$). When mother-calf pair belugas were examined individually, TIN-OLI engaged in social interactions 55.5% out of their total observed period, SIK-QIN were in social interactions 80.5% out of their total observed period, CRI-BEL were in social interactions 53.2% out of their total observed period, and LUN-ATL were in social interaction 3.6% out of their total observed period. Out of the 786 interactions that occurred during TIN-OLI observations, the more common type of interactions were affiliative pair swims (69.5%; $N = 547$). Out of the 402 interactions that occurred during SIK-QIN observations, the more common type of interactions were affiliative pair swims (52.9%; $N = 213$). Out of the 437 interactions that occurred during CRI-BEL observations, the more common type of interactions were affiliative pair swims (59.3%; $N = 259$). Out of the 13 interactions that occurred during LUN-ATL observations, the more common type of interactions were affiliative (69.2%; $N = 9$).

Descriptives for Contact Events

A total of 997 contact events occurred across the total 178 observation sessions. Contact occurred at a rate of 0.39 events per minute. When contact events were examined across all mother-calf pair belugas, contact events were mainly initiated by OLI (34%), and received by TIN (32%). When mother-calf pair belugas were examined independently, the majority of the contact events were initiated by each calf and directed at their mothers across all pairs. That is, OLI initiated toward TIN, who received, most frequently, QIN initiated toward SIK, who received, most frequently, BEL initiated toward CRI, who received, most frequently, and ATL initiated toward LUN, who received, most frequently. When mother-calf pair belugas were examined independently, 363 contact events occurred during TIN-OLI observations, 355 contact events during SIK-QIN observations, 278 contact events during CRI-BEL observations, and 1 contact event during LUN-ATL observations.

Contact events occurred during different types of social interactions. Overall, 732 contact events occurred during affiliative pair swim interactions, 243 contact events occurred during affiliative interactions, 5 contact events occurred during aggressive interactions, and 2 contact events occurred during sexual interactions. When mother-calf pair belugas were examined independently, TIN and OLI exhibited 316 contact events during affiliative pair swim and 45 contact events during affiliative interactions, SIK and QIN exhibited 229 contact events during affiliative pair swim, 119 during affiliative interactions, 5 during aggressive interactions, and 1 during a sexual interaction, CRI and BEL exhibited 187 contact events during affiliative pair swim, 78 during affiliative interactions, and 1 during a sexual interaction, and LUN and ATL exhibited a single contact event during an affiliative interaction.

The body parts most frequently used to initiate contact was the head, and the body part that received contact most frequently was the body. With the exception of the mother calf-pair, LUN-ATL, this pattern of body part contact occurred in the three other mother-calf pairs and represents an infant position swim.

Preliminary Findings for Social Interactions

A one-way univariate ANOVA was performed to assess the influence of specific factors on the average duration of social interactions. The results of these analyses indicated a significant difference between the average duration in social interactions across six types of interactions, $F(4, 129) = 13.634, p < .05$. Dunnett's T3 post hoc analyses indicated that the length of social interaction was significantly longer for mother-calf pair swims ($M = 219.48, SD = 290.83$) than any other type of interaction. The remaining categories of social interactions did not significantly differ from each other: mother-calf affiliative interaction ($M = 54.29, SD = 40.39$), calf-calf pair swim interaction ($M = 45.42, SD = 41.52$), calf-calf affiliative interaction ($M = 35.20, SD = 18.46$), and calf-calf agonistic ($M = 20.70, SD = 16.69$).

A chi square test-of-independence was conducted to assess the relationships between the animal initiating and the animal receiving the social interaction. The results indicated that social interactions occurred between calves and their mothers more often than expected by chance, $\chi^2(400, N = 1,091) = 4513.51, p < .001, V = .508$.

Preliminary Findings for Contact Events

A one-way univariate ANOVA was performed to assess the influence of specific factors on the average duration of contact events. The results of these analyses indicated

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no significant difference between the average duration in contact events across six type of interactions. In other words, the type of interactions did not influence the length of a contact event ($F(4, 114) = 0.549, p > .05$). A chi-square tests-of-independence was conducted to assess the relationship between the animal initiating and the animal receiving the contact event. The results indicated that contact events occurred between calves and their mothers more often than expected by chance, $\chi^2(88, N = 989) = 2699.15, p < .001, V = .584$.

Another chi-square test of independence was conducted to assess the relationship between type of interaction and type of contact (rub or touch). The results of this test indicated that the type of interaction had an effect on the type of contact used, $\chi^2(5, N = 981) = 153.62, p < .05, V = .396$. Rubs were used more frequently in mother-calf affiliative and calf-calf affiliative interactions. Touches were used more frequently in mother-calf pair swim interactions. Another chi-square test of independence was conducted to assess the relationship between body part that initiated contact, body part that received contact, and type of contact (rub/touch). The results indicated that the body parts used to make contact had an effect when the type of contact was rub, $\chi^2(16, N = 252) = 116.018, p < .05, V = .339$. When rub was used to make contact, there was more full body to full body than expected by chance alone, more head to head than expected by chance alone, more body to body than expected by chance alone, and more pectoral fin to pectoral fin than expected by chance alone. The results also indicated that the body parts used to make contact had an effect when the type of contact was touch, $\chi^2(12, N = 740) = 77.421, p < .05, V = .189$. When touch was used to make contact, there was more pectoral fin to pectoral fin than expected by chance alone, and more flukes to body than expected by chance alone.

Regression Analyses

The first research question attempted to ascertain if any predictors influenced the average length of social interactions. A linear regression using a stepwise method was performed to determine which, if any, predictors identified predicted the average duration of a social interaction. The results produced a significant model of one predictor, $F(1, 2118) = 421.10, p < .001$ with an R^2 for the model of 0.16, and Adjusted R^2 of 0.17. The average duration of a contact event significantly predicted the average duration of social interactions, $\beta = .407, t = 20.52, p < .001$. Thus, when contact events were longer on average (approximately 7.2 seconds), the social interaction lasted longer on average (about 11.4 seconds).

The second research question attempted to determine what factors predicted the length of a contact event. The results produced a significant model with one predictor, $F(1, 2118) = 621.489, p < .001$ with an R^2 of 0.23, and Adjusted R^2 of 0.23. The average duration of social interaction significantly predicted the average duration of contact events, $\beta = .476, t = 24.93, p < .001$. Thus, when social interactions were longer on average (about 36 seconds), the contact event lasted longer on average (about 1 seconds).

Discussion

The purpose of the present study was to investigate the relationship between social interactions and contact displayed by four mother-calf pairs located at Sea World San Antonio, with the primary focus on the first two years of each calf. Specifically, what factors influence the length of a social interaction? And, what factors predicts the length of a contact event?



Frequency of Social Interactions

Out of 152,700 seconds, or 2,545 minutes, of total observation time across four mother-calf pair belugas, social interactions were observed 52.13% of the time and occurred at a rate of 0.72 interactions per second. The majority of the social interactions occurred primarily during mother-calf pair swims. This preferred activity indicates the importance of social interaction between mothers and calf belugas, as calves learn many components of life when with their mothers. Specifically, they learn important survival skills such as how to swim and breathe efficiently, how to forage, how to communicate with others, and how to socially interact with others (Gibson & Smuts, 2008; Tamaki et al., 2006; Herzing, 1987; Krasnova et al., 2006; Krasnova et al., 2009; Mann & Smuts, 1999; Wells, Scott, & Irvine, 1987).

Contact Events

Contact events were observed for 15,241 sec, or 240 minutes, out of the total observation time of mother-calf pair belugas. Contact events occurred at a rate of 0.19 events per second, or 0.09 events per minute. A previous study conducted in the summer 2011 (Alvarez & Hill, 2011) found a lower rate of contact in belugas (0.02 event per minute). The different rates of contact between the two studies may reflect the greater amount of observation time or more likely the composition of animals studied. The previous study examined contact among a group of belugas involving both calves and adults while the current study focused solely on mother-calf pairs and calf-calf interactions. Evidence for this possibility is supported by the fact that the only contact events observed in the previous study occurred between mother-calf pairs or calf-calf pairs. Although the contact rate is apparently higher in a group of mother-calf pairs, it remains much lower than previously documented contact rates in different populations of dolphins (Dudzinski et al., 2009). The contact rate between dolphin populations ranged between 0.27 and 0.37 events per minute. Additional research is necessary to determine if the lower rate of contact in a captive beluga population focused on mother-calf pairs is a product of insufficient data or a true species difference. For the current study, about 30 minutes of video per chronological month was examined for each mother-calf pair. This limited sample over a developmental period of two years may have biased the contact rate observed in the current study. However, it is also possible that contact simply may not occur as frequently in belugas as in dolphins.

Most of the observed contact events occurred during specific types of social interactions. For example, most of the contact occurred during mother-calf affiliative pair swims particularly during infant swims as indicated by the large percentages of head-to-body touches observed over and above other types of contact. Unfortunately, above-water video observations make it difficult to clearly observe when actual physical contact occurs between the abdomen of a mother and melon of a calf. Some researchers have suggested that animals swimming in the infant position may not always be in contact with their swim companion (Gubbins et al., 1999; Mann & Smuts, 1999; Weihs, 2004). It is therefore unclear exactly what role contact has, if any, when animals are swimming together. It may simply be a by-product of the close swim position, which can facilitate swimming efficiency. Future 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.

Additionally, swim position of the calf should be specifically identified along with body parts used to initiate and receive contact as this information may help to clarify the nature of a mother-calf pair swim, a nursing, restorative swim or a more social, active swim. The current study grouped all types of pair swims together, and since many of the





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mother-calf pair swims included infant position contact, it is possible that the pair swim interactions had a greater influence on the type of social interaction observed. To better represent how much time beluga mothers and their calves spend time socializing with each other, pair swims should be divided into the different types, including infant swims, echelon swims, side by side swims, and chasing swims.

Unlike the young belugas in this study, the adult belugas were never observed touching one another. This finding corroborates the previous data in which contact between adult belugas at the same facility as the current study never occurred (Alvarez & Hill, 2011). Considering the gregarious and social nature reported for belugas and their behavioral similarities to dolphins (Hill, 2009; Krasnova et al., 2006), one might have expected some degree of contact between adult belugas. 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 observed contact events the majority were initiated by the calves, and received by the mothers. This pattern suggests that calves may have a greater responsibility for initiating contact, and mothers share the responsibility of being recipients of contact. This behavior pattern replicated contact patterns observed previously with dolphins in which calves initiated social interactions 99.9% of the observed events (Dudzinski et al., 2009; Mann & Smuts, 1999). In the current study, of the contact events occurring while bonded beluga calves swam with their mothers, the calves initiated all of the events. This responsibility of 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 these four mother-calf pairs was also 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). Additional research should be conducted to continue to examine the influence of age on the nature of mother-calf contact.

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. Again, contact was not used by adults during affiliative interactions in this study. However, three of the adult females had nursing calves, which may have limited their opportunities for social interactions and potential contact events with animals not involving their calves. Contrary to this possibility, the female who did not bond with her calf, LUN, did not engage in any contact events with other whales. Thus, there may be other constraints limiting the possibility of contact between adult belugas at this facility. Unfortunately, sexual interactions between adults were not observed during this study, which may also contribute to the lack of contact observed.

While contact may not be used by adult belugas to facilitate relationships, it may



enhance the development of the relationship between mothers and their calves. Three of the four mother-calf pairs showed similar socializing patterns and social interactions that appear to indicate the presence of a bond between each mother-calf pair. Contact events occurred primarily between mothers and their calves. However, LUN and ATL show different types of socializing patterns and social interactions with ATL rarely engaging in social interactions in general and never swimming with her biological mother, LUN. The reason behind LUN and ATL atypical relationship is unknown, and further research is necessary to fully understand the nature of the mother-calf relationship and its development on social behavior in belugas.

Conclusion

As predicted from previous work with delphinids, social interactions and contact events were related. Regression analyses indicated that social interactions appeared to be maintained for longer periods when contact occurred, and contact was sustained when social interactions lasted longer. While social interactions generally lasted a little over 11 seconds and contact events averaged about 7 seconds in the current study, social interactions were lengthened when the more contact was made through rubbing. If social interactions occurred roughly 4% of the session or an average of 36 seconds, then contact events were longer in duration. Combined with these results, and the fact that most contact events occurred primarily during mother-calf pair swim, the current study suggests that contact by beluga calves may be more important factor in their social development with their mothers as well as their physical development. Following contact with their mothers, calves were next most likely to contact other calves during their social interactions. These contact events typically involved head-to-head or body-to-body actions, which may also facilitate the social interaction and bond formation between calves. Additional research is necessary to better understand the frequency and duration of contact in beluga populations, including captive and wild groups.



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Investigating Diet, Exercise, and Sleep in School-Aged Children: An Exploratory Study to Assess Methodologies



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Abstract

The current study investigated diet, sleep, and physical activity in children 8 to 13 years of age over the span of three days. Parents and participants were given a series of surveys at baseline, and followed up each day of the experiment through phone interviews and diaries. An accelerometer was given to each child to wear for the duration of the study. The research looked into the effects of sleep and peer and parental influences on a child's diet and health beliefs in order to prevent health problems in children, such as obesity and diabetes. The hypotheses stated that parental health practices influence a child's own, especially on younger participants, as well as that sleep schedules would be a major contributor to a child's physical activity and food intake.



The Centers for Disease Control and Prevention's (CDC) enthusiastic approach to children's healthy living has brought wide-spread awareness to the obesity epidemic happening in America through things like flyers, surveys, and research. Although programs like *Farm to Where You Are* have been somewhat successful and well accepted by the public, the battle for healthier living continues. According to the Forum of Child and Family Statistics ("America's Children," 2009), obesity in children and adolescents 6-17 years old has tripled, with the majority of obese children being of Hispanic descent and male in the last 30 years. Around 12.5 million children ages 2-19 were obese in 2008 ("Childhood Obesity Facts," 2012). Obesity and overweight status in children are typically determined by the child's Body Mass Index (BMI), which can be calculated by dividing the child's weight over the squared height and then comparing the total scores to those on the CDC's Growth Charts according to the appropriate age and gender (Mozlin, 2005). A BMI score of 85% or above (but under 95%) indicates that a child is overweight, and a score of 95% or above indicates that a child is obese (CDC Growth Charts, 2010). The consequences of obesity vary from physical to psychological problems. The CDC states that children who are obese are at a higher risk of cardiovascular disease later in life (Schwimmer, Burwinkle, & Varni, 2003), Type 2 diabetes (Fagot-Camagna, Pettitt, & Engelgau, 2000), Obstructive Sleep Apnea (Ebbeling, Pawlak, & Ludwig, 2002), joint problems (Visscher & Seidell, 2001), and psychosocial problems due to bullying and low self-esteem (Epstein, Wu, Paulch, Cerny, & Dorn, 2000). Obese children are also more likely to grow up to become obese adults ("Obesity Among Low-Income," 2012). The blame for the epidemic is placed on several different factors, including the environment (i.e. school cafeterias, unsafe communities, costly recreational centers, advertising, "A Growing Problem," 2012), parents (Anderson, Hughes, & Fuemmeler, 2009), and socioeconomic status ("Obesity Among Low-Income," 2012). In the case of SES, the United States 2009 Census reported the highest number of people living in poverty since the census first began to measure SES, 51 years ago (U.S. Census Bureau, 2009). In addition, as the price on health food increases, people with few resources rely on junk food for larger meals at a cheaper price ("Obesity Among Low-Income," 2012).

A study attempting to determine the health-related Quality of Life of children (QOL; Schwimmer, Burwinkle, & Varni, 2003)—a compound of a person's physical, emotional, social, and school functions—found that obese children reported lower QOL than healthy children, and were on the same level as children going through cancer therapy. The authors suggest that the alarming results might be due to the small, mainly Hispanic, sample used in the study, yet still give insight into the severity that obesity has on children's health and psychological well-being. Ethnicity, age, gender, and SES did not have significant effects on QOL.

Parental influence is one important factor in determining a child's diet and health habits, with some evidence showing that this process begins in the womb as the mother chooses certain foods to eat during the pregnancy. This may determine the infant's attitude towards solid foods later (Hauser et al., 1985). During childhood, parents often give up trying to introduce foods that look less appealing to children, such as vegetables, with the belief that the child has stated a clear dislike (Carruth, et al., 2004), while in truth the disdain might be due to the novelty of the food rather than the taste. Such practices are what have caused many children to grow accustomed to eating too many carbohydrates and not enough greens, resulting in a taste aversion. For the same reason, parents are encouraged not to jump to conclusions when faced with introducing children to new foods, and instead, to slowly expose the new objects (Sullivan & Birch, 1990).

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One of the main players in the fight against obesity is exercise. Many measures have been developed in the attempts to determine the best routine for children and adolescents to follow in order keep a healthier living. Anderson, Hughes, & Fuemmeler (2009) utilized a series of questionnaires for both the child and the parent, as well as an accelerometer, for more accurate data. The researchers wanted to measure child physical activity and sedentary behavior, beliefs on activity type, and BMI. The data suggest vigorous team sports enforced by parents were significantly associated with parent education and being Hispanic, in favor of boys, while vigorous team sports was significantly associated with more children in the household, in favor of girls. In general, Hispanic parents enforced moderate chores and less team sports participation for girls, and the opposite for boys. TV watching was significantly related to being African American, regardless of gender. In turn, a significant relationship was found between parental influence and child attitude towards physical activity. Regarding vigorous physical activities, the child's participation positively reflected the parent's value of the activity.

Aside from adult influence, if children find an activity reinforcing enough, the chances of that activity being repeated increase, despite the level of obesity (Epstein, Kilanowski, Consalvi, & Paluch, 1999). A laboratory experiment shows that children who engaged in moderate to vigorous physical activity (MVPA) more frequently and with enough intensity so as to exert some effort, found the activity more reinforcing. The MVPA must also be carried out through a long periods of time rather than in short bursts. Within actual levels of activity, spring tends to be the time of year with the most activity shown by children (boys significantly higher than girls), and winter is the least (with no gender difference; Garcia, George, Coviak, Antonakos, & Pender, 1997).

Another important factor that affects obesity and general health, yet is often overlooked in studies related to better living, is sleep. On average, children lose 0.178 hours (on weekdays and 0.079 hours on weekend days) per week each year, mainly due to later bedtimes, not accounting for other factors such as TV watching, homework, work, meals, household rules, etc. Being of Hispanic descent is significantly related to 0.39 less hours of sleep on children, and 0.49 less hours of sleep on adolescents, on a weekend day, than non-Hispanic whites. African Americans and Asians sleep less than Hispanics on a weekday, and significantly less than non-Hispanic whites. Also, girls tend to sleep less than boys all days of the week (Adam, Snell, & Pendry, 2007). Past research shows a relationship between amount of total sleep per night and obesity (Garauler et al., 2011). Shorter sleepers (total sleep less than 8 hours per night) generally have higher values of BMI, body fat, waist and hip circumferences, and fat mass index. Shorter sleepers also tend to go for the fatty, unhealthy, easy to make foods, rather than spend the effort into making a healthier meal.

The current study will look at the relationship between diet, physical activity, and sleep in children, with an expected strong association between all three. Also expected, is the influence that parents' health beliefs will have on the younger children, while the older children will be more influenced by peers.

Method

Participants

The sample consisted of 12 children, ages 8 to 13 years ($M_{\text{age}} = 11.18$, $sd = 1.94$), recruited through a snowball method in San Antonio, Texas. All participants were accompanied by one parent during the first and last interviews after an informed consent and assent had been administered. Completion of all surveys was required to be included in the study.

Procedure

Personal interviews could be completed either at the Sleep Therapy and Research Center where the study was focused, or at a location that was convenient for the participant and the parent (i.e. home, school, etc.). Interviews were conducted by research assistants with previous IRB training. During the first meeting, both parent and child were informed more thoroughly about the proceedings of the study and were given the chance to ask any further questions before continuing. The parent was given a series of questionnaires asking about personal health beliefs, sleep behaviors, and child demographics. The first set of questionnaires consisted of two parts: one contains 8 items that measured health competency on a 5-point Likert-type scale, where 1 = *strongly disagree* and 5 = *strongly agree*, and the other contains 18 items that measure health locus of control in three dimensions (internal, chance, and powerful others) on a 6-point Likert-type scale, where 1 = *strongly disagree* and 6 = *strongly agree*. The second questionnaire asked about sleep behaviors in total number of days/nights (e.g. "How many nights per week do you go to bed at the same time?"). And finally, the last questionnaire asked about general demographics and physical activity with a series of options to choose from.

While the parent was given the chance to fill out the questionnaires, the interviewer asked the participant a series of questions related to diet, in which the interviewer would ask about certain foods to get an idea of how often the child consumed those products (1 = *never*, 2 = *seldom*, 3 = *2-3 times per week*, 4 = *once per day*, 5 = *more than once per day*). Once done, both parent and child were given three other surveys to take home. The first was an activity and sleep diary that recorded the child's daily activity (type of activity, duration of activity, who the activity was performed with, etc.) and sleep (time gone to bed, time woken up, total amount of sleep in hours, etc.) over the span of three days. The second survey was a food diary that recorded the child's food intake per meal, as well as day, over the span of three days (in total fat, calories, and carbohydrates). The last survey was a phone interview placed on the parent by the designated research assistant on the second and third day of the study, which consisted of some of the child's sleep, food, and activity behaviors over the past day (i.e. "Did your child eat what the rest of the family ate?").

After completing all surveys required at baseline, the child was given a wrist watch to measure actigraphy. The watch tracked the participant's activity and sleeping characteristics continuously for three days. The participant would be selected to be part of either the Weekday Group (Monday through Wednesday) or the Weekend Group (Friday through Sunday) and then sent home to begin the process.

On the fourth day of the study, participants were asked to meet with the research assistant once again in order to return the finished surveys and to fill out one final questionnaire. The last questionnaire was the same as at baseline in which the interviewer asked the child to indicate how frequently certain foods were consumed.

Results

Of the participants, 45.45% were Hispanic ($n = 5$), 36.36% were Caucasian ($n = 4$), and 18.18% were African American ($n = 2$); 45.45% were male ($n = 5$) and 54.54% were female ($n = 6$). Children who, on average, slept less than 9 hours per night over the experimental three day period were considered to be shorter sleepers ($n = 3$) while children who slept an average of 9 or more were considered to be longer sleepers ($n = 8$). The average BMI reported was 18.98, of which 6 were under 60% as seen on the CDC's growth charts, and 5 were above. Other individual participant demographics are available on Table 1.

Spearman correlation analyses were performed to investigate the relationship

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between health competence, Internal, Chance, Powerful Others, average calories consumed, average fat consumed, average carbohydrates consumed, average sleep time, and average physical activity. The analyses showed negative significant relationships between chance and average sleep time, $r_s(9) = -.76, p < .01$, and health competence and average calories burnt, $r(9) = -.64, p < .01$. Children slept less on average when the parent scored higher in Chance, and burnt fewer calories when the parent scored high on health competence. No other significant correlations were found.

Mann-Whitney U analyses revealed one significant difference between the Weekday and Weekend groups. Children in the Weekend group reported more physical activity (M rank = 8.00, $n = 6$) than children in the Weekday group (M rank = 3.60, $n = 5$), $U = 3.00, p < .05$. A second Mann-Whitney U test was applied to low and high scores of health competence and physical activity, where children with parents who scored low health competence showed more physical activity (M rank = 8.00, $n = 6$ for low; M rank = 3.60, $n = 5$ for high), $U = 3.00, p < .05$. A third and final Mann-Whitney U test found a difference between low (M rank = 8.50, $n = 6$) and high (M rank = 3.00, $n = 5$) levels of Chance, indicating that children who sleep less tend to have parents who attribute more health factors to luck.

Several regression analyses were run comparing average sleep time with activity, average calories consumed, average carbohydrates consumed, and average fat consumed but no significance was found. On closer inspection, several non-significant trends were shown that could be related to power. For example, with a bigger sample, a significant positive correlation between Powerful Others and average calorie consumed might appear.

Discussion

The results drawn from the questionnaires given to the parents of the participants, comparing health beliefs and practices to the actigraph measures on the participants, showed, as expected, that parents who were less concerned about keeping good health and had a chance locus of control had children who, in general, slept less, implying the possibility that the parents might not believe that a set bedtime could have a significant effect on health. Surprisingly, however, parents who scored higher on the health competence measure, had children who burned less calories over the three day period. The results might be due to the small sample, as well as, the less rigorous activities that children generally engage in during the summer.

Another surprising outcome was when comparing the average physical activity the weekday group had as compared to the weekend group. The weekend group showed higher amounts of physical activity than did the weekday group, contradicting the expectations that, during the summer time, both groups would have the same amount of physical activity reported.

The study has some limitations which should be addressed for future research. First, the sample was very small, with only 11 children finishing participation. The size of the sample was mainly due to time constraints and difficulties in recruiting during the summer time. Because of the location of the study and manner of recruiting, most participants are of Hispanic descent and are part of Upper and Upper Middle classes, which might account for less variability in the results. The study will continue to recruit participants in order to obtain a larger, better representative sample and to investigate the several non-significant trends that appeared in the regressions of sleep and diet, and sleep and exercise.

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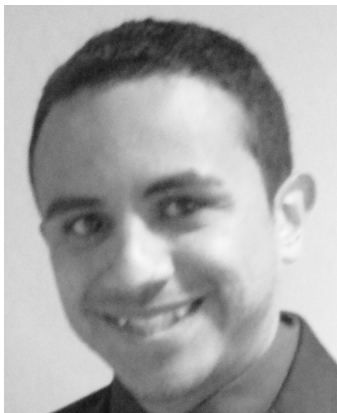


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When Newspapers Tweet: The Approaches Four Newspapers Take in Using Twitter



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Abstract

Newspapers emerged in the 17th century as a way to report the news, promote discussion and reach audiences. Four centuries later, newspaper organizations face heavy online competition and are wrestling with what do about it. While many continue publishing daily, many also use social media, like Twitter, “tweeting” differently to stake out audiences and experimenting online to see how best to do it. This research compared four newspapers and the main Twitter account of each to determine the approaches each takes as to what goes into print, what gets “tweeted,” and what gets referenced. The results indicate variation in how the organizations approach Twitter and share news, and to what effect. While each organization has its own style, The New York Times appears to be acting more as a legacy medium than do The Wall Street Journal, USA Today, and the San Antonio Express-News, which seem to be experimenting more with the different tools available online to reach and serve their audiences.





Introduction

American newspapers have been around since 1690 with Benjamin Harris' *Publick Occurrences* (Clark, 1991), and Twitter has been around only since March 2006 (Arceneaux and Weiss, 2010). Yet, despite the three-century age difference, it's newspapers that seem to be adapting to the technology—Twitter and the speed it brings.

Once the *Seattle Post-Intelligencer*—a major newspaper founded in 1853 that had survived the Great Fire of 1889, the Panic of 1893 and the Great Depression of the 1930s—became the first major metropolitan daily newspaper in the country to adopt a web-only format in 2009 (Tate, 2009), newspaper organizations realized that adapting to new technology would be the only choice if they wanted to survive. Since the *Post-Intelligencer's* conversion, the *Rocky Mountain News* and the *Tucson Citizen* shut down operations and both of Detroit's major newspapers, the *Detroit Free Press* and the *Detroit News*, cut circulation to three days a week in favor of targeting readers to go online (Tate, 2009).

In 1991, Donald Shaw researched trends in mass media, observing how a rise of a new major mass medium takes over as the dominant form of mass communication. "Major mass media rise to the status of 'top' medium, where they may remain for several years, even decades. But inevitably all mass media have found they have to narrowcast to survive. This has been the historical fate of all mass media. There is no escape," (1991, p. 4). As Shaw noted, when television took over, "Some radio news stars shifted to the new medium. New entertainment stars such as Sid Caesar and Imogene Coca became household words" (p. 9). Now, newspaper organizations, just as Shaw predicted, must adapt to the online medium and its tools, such as Twitter, because that seems to be where many people want to get their news.

On Twitter, users write short messages, called "tweets," of 140 characters or less which are distributed to other users who "follow" that user. Twitter can be accessed from any device with Internet access, including laptops and desktop computers. However, the brevity of tweets makes Twitter particularly suited to mobile devices, which users can easily check and manage while doing their daily routines (Arceneaux and Weiss, 2010). Though newspapers aren't limited to reporting the news in 140 words or less, to attract Twitter followers the organizations must introduce a story and include a hypertext link to an online page in 140 characters or less.

Drawing on the theories of the Lasswell model, gatekeeping, the two-step flow of communication, and agenda-setting, this research explores the impact Twitter is having on how selected newspaper organizations distribute the news, and then compares on a daily basis what these organizations are putting in print and posting on their Twitter accounts.

With Twitter's impact since it emerged in 2006 and won an award at the 2007 South by Southwest Interactive Festival in Austin, Texas (Arceneaux and Weiss, 2010), communication and journalism scholars have researched the impact Twitter and social media have had on journalism. Research by the Pew Research Center's Project for Excellence in Journalism has analyzed how mainstream media outlets use Twitter, looking at when and how often they tweet and the use of hashtags – which is used to categorize tweets and help facilitate searches within Twitter. Other research includes how social media are changing news and the coverage of crisis (Mishra, 2012), how Twitter expands the two-way and multi-way information flow between news outlets and the public, yielding big benefits for both (Quigley, 2010), and how mainstream journalists who microblog negotiate their professional norms and practices in a new media format that directly challenges their old



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ones, (Lasorsa, Lewis and Holton, 2011), among others.

This research will study four newspapers—*USA Today*, *The Wall Street Journal*, *The New York Times*, and *San Antonio Express-News*—and the main Twitter account of each, to determine the difference between what's posted on Twitter and what goes in print, in order to try to determine the approach each newspaper is taking in using Twitter. While other research analyzes how news organizations use Twitter, this study will compare a week of daily print editions of each publication to its postings on Twitter, to determine how they are using that information to share information, and to what effect.

Theoretical Framework

Lasswell's model of communication

American political scientist Harold Dwight Lasswell stated that a convenient way to describe an act of communication is in the following way: Who (the communicators) says what (the message) in which channel (medium) to whom (receiver) with what effect (Communicationtheory.org)? This linear model is simple and is often suited for all types of communication, particularly mass media.

An example is CNN News finding out that an operator from Tokyo Electric Power Co. said a water leak from Japan's tsunami-crippled nuclear power station resulted in about 100 times the permitted level of radioactive material flowing into the sea. Using Lasswell's model on how CNN reports the news: Who (TEPC operator) says what (radioactive material flowing into the sea) in which channel (television medium, CNN News) to whom (the public) to what effect (alert the people of Japan from the radiation). While CNN might be the first to pick up the story, other organizations will eventually present the story in different channels.

For newspaper organizations, one constant channel (medium) has been newspapers. While organizations like the Hearst Corporation have crossover into other mediums, such as television and magazines, the digital age has introduced another new medium. With Twitter, the newspaper organizations must limit what they say to 140 characters or less through Twitter to their followers, who aren't just the normal public, but those who fit the demographics that have Twitter. At the same time, they must still communicate through the newspaper medium to those who read the newspapers and aren't on Twitter.

Gatekeeping theory

Psychologist Kurt Lewin first proposed a gatekeeping process in his post-World War II research on social change, making the theory one of the oldest in the field of mass communication (Shoemaker, Eicholz, Kim & Wrigley, 2001, p. 233). Though not intended for communication theories, Lewin's suggestions of how items are selected or rejected as they pass through channels is central to the flow of news (Shoemaker, Eicholz, Kim & Wrigley, 2001, p. 233).

Lewin's idea was picked up by communication scholar David Manning White, whose case study of a newspaper wire service editor's selection of the day's news set into motion research on news selection that has taken place since then (Shoemaker, Eicholz, Kim & Wrigley, 2001, p. 233).

With Twitter, editors aren't the only ones in the gatekeeping role anymore. Given the opportunity to share information rapidly with large audiences through Twitter, journalists and others have the ability to include or exclude information as they see fit, filtering news and information frequently without going through the traditional editors (Lasorsa, Lewis & Holton, 2012).



Newspaper editors must now play gatekeeper for different mediums in the digital age. While they choose and select and what goes in print, someone must play the role of gatekeeper on Twitter, selecting what stories get tweeted and how often. This research will analyze if the stories on Twitter are also in print, to see if the gatekeeping strategy is the same for both mediums.

Two-step flow of communication

Research by Paul Lazarsfeld and Elihu Katz in 1944 developed the two-step flow of communication theory. It states that an opinion leader, a leader for a certain group, gives details and information to lesser active persons in the group (Pooley, 2006, p.1). In an office, the managing director is an opinion leader, and in public, a political leader is an opinion leader—and they interpret information to their own groups (Pooley, 2006, p. 1).

For newspapers, editors, as opinion leaders, take that second step: to relay the news through the newspaper medium. Twitter has added a different second step to the equation. Though there is plenty of news for editors to share, relaying it all on Twitter is impractical. Thus, it is the editor's role as opinion leader to decide what information the Twitter followers get at the end of the flow of communication, which as a result now has multiple steps.

Agenda-setting theory

The agenda-setting theory states that the more prominent a news issue is, the more important news audiences will regard the issue to be (McCombs and Shaw, 1972). Researchers Maxwell McCombs and Donald Shaw in their study on the 1968 presidential election showed a strong correlation between what residents of Chapel Hill, North Carolina thought to be the most important election issue and what the local and national news media reported was the most important issue (McCombs and Shaw, 1972). Thus, they determined that the media are successful in telling people what to think about, especially when they are undecided about issues.

Though newspaper organizations have regularly set the agenda for what is in their print publications, a separate agenda must be set for what goes on Twitter. This study seeks to find the news agendas of newspaper organizations' Twitter feeds and to see if they're similar to what is in the publications. This may help determine if the agenda-setting phenomenon is similar for both mediums, or different.

Literature Review

The shift to online journalism

According to the 2012 State of the News Media Report produced by the Pew Research Center's Project for Excellence in Journalism, 27 percent of the population now gets news on mobile devices (Mitchell & Rosenstiel, 2012). The report states that these news consumers, through apps and home pages, are even more likely to turn to news organizations directly rather than search or recommendations from peers or other sites. The report suggests mobile devices are adding to, not replacing, people's news consumption. People still get their news from more traditional sources as well as their phones. Research by comScore finds that mobile devices increased traffic on major newspaper website by an average of 9 percent (Mitchell & Rosenstiel, 2012).

The report also states that while social media are important, they're not overwhelming drivers of news, at least not yet. According to a survey released by the Pew Research Center's Project for Excellence in Journalism, no more than 10 percent of digital news consumers follow news recommendations from Facebook or Twitter "very often." And almost all of those who do are still using other ways, like going directly to the news





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website or app, as well. Some 133 million Americans, or 54 percent of the online U.S. population, are now active users of Facebook (out of 850 million monthly active users globally). American Facebook users spend an average of seven hours there a month, 14 times the amount of time people spend on average on the most popular news sites (Mitchell & Rosenstiel, 2012).

In a 2010 study on how internet and cell phone users have turned news into a more social experience, the Pew Research Center's Project for Excellence in Journalism stated that in the digital era, the days of loyalty to a particular news organization on a particular piece of technology in a particular form are gone:

The overwhelming majority of Americans (92%) use multiple platforms to get news on a typical day, including national TV, local TV, the internet, local newspapers, radio, and national newspapers. Some 46% of Americans say they get news from four to six media platforms on a typical day. Just 7% get their news from a single media platform on a typical day," (p. 2).

This research suggests, in other words, that for a news organization to succeed, it must adapt to reporting the news in multiple ways, and on multiple platforms, just as Donald Shaw laid out over 20 years ago (Shaw, 1991).

The research reported that six in ten Americans (59 percent) get news from a combination of online and offline sources on a typical day, and the internet, behind local television news and national television news, is now the third most popular news platform, ahead of print (Purcell, Rainie, Mitchell, Rosenstiel, & Olmstead, 2010, p. 2).

While reading news online, 57 percent of online news consumers say they use between two and five online news sources, and 65 percent say they have no single favorite website for news. Some 21 percent say they routinely rely on just one site for their news and information (p. 2).

According to the study, 33 percent of cell phone owners now access news on their cell phones. Of all internet users, 28 percent have customized their home pages to include news from sources on topics that particularly interest them. And 37 percent of internet users have contributed to the creation of news, commented about it, or disseminated it via posting on social media sites like Facebook or Twitter (p. 2).

"To a great extent, people's experience of news, especially on the internet, is becoming a shared social experience as people swap links in emails, post news stories on their social networking site feeds, highlight news stories in their Tweets, and haggle over the meaning of events in discussion threads" (p. 2). More than 8 in 10 online news consumers get or share links in emails, according to the study.

While people use social media to filter, assess and react to the news, their mobile connectivity on devices such as smart phones has made news gathering available anywhere and anytime (p. 2-3).

In addition, the study found that 61 percent say they get some kind of news online; 50 percent say they read news in a local newspaper; 17 percent say they read news in a national newspaper such as the New York Times or USA Today.

Over half of American adults (56 percent) say they follow the news "all or most of the time," and another quarter (25 percent) follow the news at least "some of the time." When it comes to specific news habits on a typical day, 99 percent of American adults say they get news from at least one of these media platforms: a local or national print newspaper, local or national television news broadcast, radio, or the internet (p. 3).





Thus, Americans seem still to want their news, just on different platforms. This leads to organizations having to communicate through a multi-step flow of communication, not just two-step.

Online news users skew younger than the general adult population. About two-thirds of online news users (68 percent) are under age 50, including 29 percent who are under age 30 (p. 22). Online news users tend to be employed full-time (50 percent); two-thirds (67 percent) have at least some college education and their annual household income trends higher than American adults “in general” (p. 22). Racially, this group skews toward Hispanics and whites: while 50 percent of non-Hispanic African-Americans get their news entirely offline, the same is true of just 38 percent of non-Hispanic whites and 32 percent of Hispanics (p. 22).

“Because they represent such a large segment of internet users, the demographic profile of online news users mirrors that of the online population as a whole, and it reflects the same characteristics that drive both broadband and wireless use. Yet even among internet users, those who get news online stand out in terms of their high income and education levels, their young age, their racial/ethnic identity, and their use of broadband and wireless,” (p. 22).

Of online news users, two-thirds (67 percent) have at least some college education—including 22 percent with a bachelor’s degree and 15 percent—with advanced degrees (p. 22).

The process of online journalism

Journalism itself can be defined simply as a person witnessing and recording an event (Harper, 2010). The recording of the event used to consist of a written story, sometimes with a photo, to tell the story.

Today, the process of journalism only begins when a reporter writes an article, and continues with the comments and follow-up content made available online (Robinson, 2011).

While the newspaper is printed once a day, if that, journalists have declared the home pages of the website as the newspaper in 24/7 form (Robinson, 2011, p. 57). Any sources outside the website, such as social media outlets, must link back to the website and follow the same standards and be marketed as part of a branded package. The home page represents the ultimate news destination for audiences. Instead of concentrating solely on the print publication, newsroom meetings are filled with debate over size and placement of the logo on the home page of the website and of hyperlinked relationships on each story (Robinson, 2011).

Newspaper organizations—so used to having only to deal with the written text and photos in print—now practice convergence journalism in an effort to engage audience members online (Wise, Bolls, Myers & Sternadori, 2009). This practice involves combining text, audio and video to report and tell stories in an interactive way. Yet, while broadcasting and cable news organizations rely on audio and video, newspaper websites still continue to rely on the written text in presenting story details (Wise, Bolls, Myers & Sternadori, 2009).

Newspaper organizations these days, however, will frequently include a related video clip attached to a story online. An advantage to this is that streamed video clips can often feature graphic and intense scenes related to the reported story (Wise, Bolls, Myers & Sternadori, 2009, p. 533)

As the number of Americans visiting news organizations’ websites grows 20





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to 30 percent each year, more than 80 percent of news organizations had integrated their digital and traditional newsrooms, according to the 2011 State of the News Media report (Robinson, 2011). With this development, journalists have adapted to a new process of journalism that is exclusive to online. Not only does the writer contribute to the story, but so do all of the people who leave comments on the stories and contribute their opinions or facts to the situation, and that is only the beginning.

For the first time, people not working in a newsroom have control over some information on a news organization's website, via comments that they leave at the end of articles, or photos they upload. In addition to the audience, journalists, like all news media, now have to include other things in their process that they didn't when just writing for print, namely hypertext, interactivity, and multimedia (Steensen, 2010, p.105)

Hypertext is a computer-based, non-linear assembly of texts, via written text or images, which are linked together with hyperlinks. The term was coined in a 1965 Association for Computing Machinery conference paper by Ted Nelson as "a series of text chunks connected by links which offer the reader different pathways" (Steensen, 2010, p. 113).

Researchers have found that online journalism and the innovation of hypertexts provide numerous advantages over print journalism. These advantages include potentially no limitations on space, the possibility to offer a variety of perspectives, no finite deadline, direct access to potential sources, personalized paths of news perception and reading, contextualization of breaking news, and simultaneous targeting of different groups of readers—those only interested in the headlines and those interested in the deeper layers of information and sources (Steensen, 2010, p. 114)

A 2004 study of how readers in the United States evaluate links in news stories found that only experienced web users found hypertext-structured news stories valuable. For inexperienced users, the hypertext structure was a disadvantage. However, users seem to be satisfied with relative links, which allow for quick access, by one click of the cursor, to another website or webpage. "According to a survey amongst readers of Flemish online newspapers, the utilization of links to archived material (relative links) is regarded as an important reason to read online newspapers," (Steensen, 2010, p.114).

These studies show that relative hyperlinks (links to other stories within the same online news site) are far more common in online journalism than target links (links within documents), relative links (links to other pages within a site), and external links (links from one site to another site).

Interactivity, like hypertext, is a concept that describes numerous communication processes, particularly online journalism. "Users are allowed to contribute to the content production by submitting photos and videos and by commenting on stories and participate in discussion forums," (Steensen, 2010, p. 117). According to a 1999 article by Jens F. Jensen, interactivity is "a measure of media's potential ability to let the user exert an influence on the content and/or form of the mediated communication" (p.117). Jensen further argues that there are four dimensions of interactivity: transmissional (the user can choose from a stream of information in a one-way media system), consultational (the user can choose, by request, from a stream of information in a two-way media system), conversational (the user can produce and input information in a two-way media system), and registrational (the media can register information about the user and thereby adapt and respond to the user's needs and actions) (p. 117).

Jensen's research questioned to what degree users are allowed to interact with





online newsrooms/online journalists through emails, to what degree online news sites offer discussion forums, and whether users are allowed to comment on stories, or in other ways to be involved in the production process (p. 117).

Because users are allowed to contribute to online publication content by submitting photos and videos and by commenting on stories and participating in discussion forums, it is clear that online journalism and online news sites are becoming more interactive, especially with human-to-human interactivity and displaying a multi-step flow of communication. However, users are seldom allowed to participate in the selecting and filtering of news (gatekeeping), as that duty is still controlled by the journalists and news organizations that practice online journalism (p. 122).

Steensen concluded that online journalists and editors are more eager to interact with readers, but constraints like time pressure and the utilization of freelancers prevent them doing so, to a certain degree. Finally, Steensen's research suggests indifference with interactivity; it seems the audience prefers to be passive consumers, not active producers (p. 122).

Mark Deuze, in the 2004 article "What is multimedia journalism?," argues that the concept of multimedia in online journalism studies generally is understood in either of two ways—as a presentation of a news story package in which two or more media formats (text, audio, video, graphics, etc.) are utilized, or as a distribution of a news story packaged through different media (newspaper, website, radio, television, etc.) (Steensen, 2010, p. 123).

To summarize the findings of the research on multimedia in online journalism, it seems that multimedia remains the least-developed of the assets offered to journalism by Internet technology. Online journalism is mostly about producing, distributing, and consuming written text in various forms, even though some recent studies describe an increase in the use, especially, of video (Steensen, 2010, p. 124). However, the 2009 study by Wise, Bolls, Myers & Sternadori shows the advantages multimedia, primarily video clips, have on an audience reading a story. Participants in their study allocated more cognitive resources to a related video, as indicated by heart rate deceleration, when it was attached to stories written in the inverted pyramid style as opposed to narrative style (p. 542). Thus, it remains vital to practice this tactic.

Social media and their impact on journalism

Social network sites, or social media, have been defined as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (Boyd and Ellison, 2007, p. 211).

Since their introduction, social media sites such as Facebook, MySpace, and Twitter, have attracted millions of users, many of whom have integrated these sites into their daily practices (Boyd and Ellison, 2010). According to Boyd and Ellison (2007, p. 210), "Most (social networking) sites support the maintenance of pre-existing social networks, but others help strangers connect, based on shared interests, political views, or activities. Some sites cater to diverse audiences, while others attract people based on common language or shared racial, sexual, religious, or nationality-based identities. Sites also vary in the extent to which they incorporate new information and communication tools, such as mobile connectivity, blogging, and photo/video-sharing."

The first recognizable social network site, SixDegrees.com, launched in 1997





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and allowed users to create profiles, list their friends, and surf the friends list. While each of these features existed in some form on other sites, SixDegrees was the first to combine these features (Boyd and Ellison, 2007, p. 214). Though the site attracted millions of users, the service closed in 2000 after failing to become a sustainable business. Looking back, its founder believes the site was simply ahead of its time (p. 214).

The first major wave of social networking sites began when Ryze.com was launched in 2001 to help people leverage their business networks. In the end, Ryze never acquired mass popularity, Tribe.net grew to attract a passionate user base, LinkedIn became a useful business service, and Friendster became the most significant of the time (p. 215).

Friendster launched in 2002 as a social complement to Ryze. Friendster grew to 300,000 users through word of mouth before traditional press coverage began in May 2003 (p. 215). As Friendster's popularity surged, the site encountered technical and social difficulties. Friendster's servers and databases were not prepared to handle its rapid growth, and the site frustrated users by faltering regularly, as users began replacing email with the site's services, which allowed users to send private messages to one another (p. 215). Furthermore, the rapid growth meant a collapse in social contexts: users had to face their bosses and former classmates alongside their close friends. To complicate matters, Friendster began restricting the activities of its most passionate users by setting a restriction on viewing profiles of people who were more than four degrees away (friends-of-friends-of-friends-of-friends). Many early users left because of the combination of technical difficulties, social collisions, and a rupture of trust between users and the site (p. 215-216).

From 2003 onward, many new social networking sites were launched, and most took the form of profile-centric sites, trying to replicate the early success of Friendster or target specific demographics. While socially-organized social networking sites solicit broad audiences, professional sites such as LinkedIn, Visible Path, and Xing focus on business people. "Passion-centric" social networking sites like Dogster help strangers connect based on shared interests. Care2 connects activists with each other, Couchsurfing connects travelers to people with couches, and MyChurch joins Christian churches and their members (Boyd and Ellison, 2007, p. 216).

Furthermore, as the social media and user-generated content phenomena grew, websites focused on media sharing began implementing social networking features and becoming social networking sites themselves. Examples include Flickr (photo sharing), Last.FM (music listening habits), and YouTube (video sharing) (Boyd and Ellison, 2007, p. 215).

Social media's growth has led many news organizations to hire a social media editor to create web spaces and manage Facebook and Twitter accounts to spread the brand (Robinson, 2011, p. 155). In addition, many reporters are adapting their reporting skills for social media. For example, most of the newsroom staff at *Austin American-Statesman* use social media every day to interact with readers and sources. (Quigley, 2010, p. 2). These new tools allow journalists to receive instant feedback on their work, gather meaningful tips, track trends and build valuable relationships with the public (p. 2).

Simply making information available is not enough because today's audiences expect to be able to choose what they read, and most believe they should be able to contribute content and opinions, too (Harper, 2010). According to Ruth Harper, "This shift, sometimes called the social media revolution, is not the death of journalism as America always knew it; it's the birth of a democratic movement that emphasizes some





of journalism's key factors: transparency, honesty, and giving a voice to the person who doesn't have one." (p. 1) Social media allow anyone to publish ideas at a relatively non-existent price.

In essay, Gaurav Mishra (2012) stated that social media are playing an important role in shaping news stories in general and crisis situations in particular. As social media make it easy to track an emerging crisis situation, it makes it difficult to effectively manage the crisis situation. He states that social media are playing an important role in shaping the news curve—which he defines as breaking news, context, analysis, and archival—as it is becoming more fragmented and news stories are becoming more viral. Different social media behaviors play different roles across the four stages of the news curve. “News stories are now being broken on the official Twitter channels of news organizations and shared via retweets. Context is being added by sharing links on Twitter using a hashtag. Blogs and video blogs are playing an important role in shaping opinion. Finally, search is making it easier to find and share archived stories that act as context for new stories,” (Mishra, 2012).

At London's Social Media Week in February 2012, Special Projects Editor at the Guardian Paul Lewis identified four main areas in which social media changed journalism for the better. First, social media have made finding people and crowdsourcing the public for information on the whereabouts of witnesses and other key figures in a story as easy as posting a tweet. Second, social media have given a voice to those who self-publish, including activists and bloggers. Third, chaotic events that are too big and too fast-moving for journalists to manage on their own, like the London riots in 2011, are followed and chased down by social media outlets like Twitter. Fourth is the butterfly effect social media create, in which a small action, like a tweet containing valuable information, creates a ripple effect, such as Premier League soccer player Ryan Giggs' super-injunction tweet (Sawers, 2012). In May 2011, a number of the site's users revealed the star allegedly had an affair with model Imogen Thomas (Halliday, 2011).

Twitter and its impact on journalism

Created by a San Francisco startup called Obvious and publicly released in August 2006 (Farhi, 2009), Twitter is a free social networking site that allows users to post micro-blog messages known as “tweets,” comprised of 140 characters or less (Lasorsa, Lewis & Holton, 2012). “Messages are deployed on the user's personal site and to the user's list of “followers,” other users who have opted to receive those messages. Users have the capability to send messages directed to other users (i.e., @username), to “retweet” (or re-broadcast) messages originally posted by others, and to follow or engage in trending topics (i.e., #trendtopic),” (Lasorsa, Lewis & Holton, 2012). Twitter allows users to engage, to post freely, or to engage in discussions using various kinds of media—text, links, and even images. Twitter represents one of the fastest growing social networking sites in terms of audience. The number of Twitter users grew 32 percent last year to around 24 million active users in the U.S. (500 million total accounts worldwide), the company reports. (Lasorsa, Lewis & Holton, 2012; Mitchell & Rosenstiel, 2012).

Twitter attracts users for four main reasons: daily chatter, conversation, sharing information, and reporting the news (Lasorsa, Lewis & Holton, 2012, p. 22).

Twitter can be accessed from any device with internet access, including laptop and desktop computers and cellphones, though the brevity of tweets makes the application particularly suited to mobile devices (Archenaux and Weiss, 2010, p. 1263).

Paul Farhi wrote, “Twitter attracts the sort of people that media people should love — those who are interested in, and engaged with, the news” (Farhi, 2009).





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Unlike social networking sites such as Facebook, to follow someone on Twitter does not mean that person must follow you, or vice versa. A user can follow any other user, and the user being followed need not follow back (Kawk, Lee, Park & Moon, 2010, p.1).

Retweeting involves users taking a post they see from another user and sharing it on their page to their own users. This allows users to spread information of their choice beyond the reach of the followers of the original tweet, adding another step to the flow of communication (Kawk, Lee, Park & Moon, 2010).

Twitter tracks phrases, words and hashtags that are most often mentioned and posts them under the title of “trending topics” regularly by making available a list of top ten trending topics of the moment, whether they are on a computer or mobile device. “A hashtag is a convention among Twitter users to create and follow a thread of discussion by prefixing a word with a ‘#’ character,” (Kawk, Lee, Park & Moon, 2010, p. 1). This allows users to get different feedback or reports from different sources on the same subject.

Two aspects of Twitter make it popular and simple for users: brevity—the 140-character limit of tweets—and speed—the instant relaying of messages (Archenaux and Weiss, 2010, p.1267-8).

The two components allow journalists and news organizations to quickly post breaking news and update stories on their Twitter accounts. Once a news story breaks and is confirmed, a news organization can post a tweet distributing that piece of information to its followers. Once a full article has been written and posted, another tweet can be sent that links to that article of the website. Each developing subplot or story can also be tweeted. *The Oregonian* in Portland may have been the mainstream media pioneer of using Twitter. *The Oregonian* began posting its own links about flooding and road closures during heavy storms in central Oregon in late 2007, when Twitter barely had 500,000 users nationwide. Other newspapers have subsequently used Twitter to post updates following natural disasters in their areas (Farhi, 2009).

Given the opportunity to share information rapidly with large audiences, journalists are using Twitter to create more chances for user-generated content-sharing, through which a journalist’s followers will share the journalist’s tweets with other users and help the journalist gain followers and readers (Lasorsa, Lewis & Holton, 2012). Journalists can also find sources for their stories via Twitter. For example, San Antonio Express-News reporter Francisco Vara-Orta tweeted on May 24, “Looking for SA-area parents whose kids attend Jay HS or Jones MS in NISD to comment on them being tracked in school. Plz call me.”

Farhi (2009) described Twitter’s ability to fact gather, saying it’s a “living, breathing tip sheet for facts, new sources and story ideas” that “can provide instantaneous access to hard-to-reach newsmakers, given that there’s no PR person standing between a reporter and a tweet to a government official or corporate executive. It can also be a blunt instrument for crowdsourcing.”

Users also increasingly retweet and share hyperlinks with each other and engage in the coverage of breaking news. Users relay messages from other Twitter users and news outlets and provide live coverage of events with first-hand accounts and photos (Farhi, 2009; Lasorsa, Lewis & Holton, 2012).

Reporters now routinely tweet from all kinds of events — speeches, meetings and conferences, sports events (Farhi, 2009).

Twitter has made news for its breaking coverage and updates, from journalists and amateurs alike, of catastrophes and big events, such as the earthquake that rocked the Sichuan province of China in May 2008, the 2008 U.S. presidential election, the terrorist





attacks in Mumbai in November 2008, the crash of US Airways Flight 1549 on the Hudson River in January 2009, and the volatile protests after the Iranian election in June 2009 and the 2011 Egyptian revolution (Archenaux and Weiss, 2010, p. 1264; Lasorsa, Lewis & Holton, 2012, p. 20).

Other events have shown Twitter's power to relay messages to the masses.

When James Karl Buck, a U.S. graduate student, was arrested while protesting in Egypt in 2008, he used his mobile device to send a tweet about his plight when he was in transit to the police station. After Buck sent a tweet that he had been detained, his friends contacted the U.S. Embassy and his school, the University of California at Berkeley, which sent a lawyer to get him out of jail (Archenaux and Weiss, 2010).

In February 2009, a federal judge allowed Ron Sylvester of the *Wichita Eagle* to use Twitter to report on a trial of six suspected gang members. This was the first time tweeting had been allowed inside a federal courtroom, and Sylvester tweeted frequently from the trial, providing a nearly simultaneous account of the court's preceding (Farhi, 2009).

When Andrew Joseph Stack III flew a single-engine plane into an Austin office building in February 2011, social media played a big role in helping *Austin American-Statesman* give a more complete picture of the events (Quigley, 2011). Once word of the event hit the newsroom, social media editor Robert Quigley asked the followers of the main Statesman Twitter account, who number 20,000-plus, whether they had seen anything and asked witnesses to call reporter Tony Plohetski. Several people called in and their accounts made it into the online and print versions of the stories. When Quigley asked for photos, Twitter users with camera phones sent their pictures in, and the staff posted their photos on the Statesman website. A private message from one of the organization's followers led the staff to Stack's online manifesto, which allowed the Statesman to be among the first media organizations to host the manifesto online, according to Quigley (Quigley, 2010, p. 1).

All these stories made national or international headlines, with several Twitter users providing first-hand accounts, locations, pictures, and other relevant information (Archenaux and Weiss, 2010, p. 1264).

Twitter is far from perfect, however. Farhi suggested problems relating to the sheer volume of information. Journalists may have to sift through a lot to get to a story idea that's worth a journalist's time (Farhi, 2009).

Some have disputed those who called the Iranian protests a "Twitter Revolution," suggesting the media's Twitter coverage and discussions may have actually stolen coverage away from what was actually happening to the protestors in Iran (Morozov, 2009, p. 54). A survey by the Pew Research Center for the People & the Press showed that more people had heard about Twitter's presence in reporting on Iran than on what was happening in Iran (Pew Research, 2009). Morozov also criticized the reliability. He wrote, "This new media ecosystem is very much like the old game of 'Telephone' in which errors steadily accumulate in the transmission process, and the final message has nothing in common with the original" (Morozov, 2009, p. 11).

A new set of ethical deliberations arises with journalists' use of social media. One of these revolves around a journalist's personal and professional presence on social media and social networking sites (Farhi, 2009). Finding a distinction between when journalists are tweeting as reporters or as average citizens is more difficult when each has only one Twitter account. Many professionals agree that while journalists may post their own opinions, they must keep in mind their news organizations—who they represent as an employee—and the same values that apply to traditional media also apply to social



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media (Harper, 2011, p. 5). According to Kelly McBride, ethics group leader at the Poynter Institute, “For journalists, transparency is one of the most important values. That means you don’t act as an individual, but there should be a caution gate if there’s something that might embarrass your newsroom” (Podger, 2009, p. 34). Since 2010, *The Wall Street Journal*, *The New York Times*, *The Associated Press* and *The San Francisco Chronicle*, have created ethics and etiquette policies surrounding social media to distinguish between work life and personal life (Podger, 2009, p. 33).

Monica Guzman, a 26 year-old news gatherer at *seattlepi.com*, says her tweets are open, reflect her personality, and link to her stories (Harper, 2011, p. 5). Guzman said she enjoys the real-time aspect of Twitter that captures the thoughts, influences and information surrounding an event. “Journalism is about listening,” said Guzman, “so if you’re not listening to people who are talking, then you’re not doing your job” (Harper, 2011, p. 5). By being on Twitter, Guzman is given the opportunity to read tweets of those experiencing events first hand and is able to then follow these up with interviews with people who she would possibly not have heard of if not for the social networking site. Guzman said she never deletes tweets without explaining why she is doing so, and often will post a follow-up tweet with the correct information. “Social media makes us confront that we’re not superhuman and we don’t have all the answers,” Guzman said (Harper, 2011, p.5).

When younger staff members at *The New York Times* tweeted tidbits from an internal meeting where Executive Editor Bill Keller spoke of generating new revenue from the Web, the paper made quick changes. While none of the staffers were reprimanded, they were asked to turn off devices and at the next meeting with Keller told “bear in mind that this is a meeting for us” (Podger, 2009, p. 34). “The older generation understood that these were internal meetings, but to the younger generation, who enjoy being wired in with the outside world, this was news and they wanted to share,” Craig Whitney, standards editor at the Times (Podger, 2009, p. 34).

In March 2009, *The Washington Post* book critic Ron Charles had a conversation that led to some information he thought to share with his followers on Twitter. Without naming his source, Charles tweeted, “Frequent contributor tells me the New Yorker is considering switch to biweekly or monthly. Recession pains” (Farhi, 2009).

“I just threw it out there,” Charles said about the tweet. “It was a careless, journalistically irresponsible thing to do.” He said that within 10 minutes, “it seemed like the whole Internet went crazy. It was terrifying,” (Farhi, 2009).

Charles sent out another tweet a few minutes later retracting his previous tweet after receiving an email that his tip was wrong. By then, however, Charles’ comment had been retweeted by others, picked up by reporters from the *Chicago City Paper* and *New York Observer*, and drawing denials from *New Yorker* Editor David Remnick (Farhi, 2009). While Charles admitted that he shouldn’t have spread the rumor, his action brought up questions that journalists are forced to face about the transparency and immediacy of social networking: “Am I a reporter [when tweeting]? Am I an editor? Am I a critic? Or am I just talking among friends?” (Farhi, 2009).

Mark Briggs, author of “Journalism 2.0,” a book about new digital reporting methods, said reporters are obligated to uphold ethical standards even while casually tweeting. “Whatever you put out there doesn’t have to be triple checked, but it can’t be reckless or inaccurate, either... You also have to respect other people’s work. Don’t take credit for it if it’s not yours,” (Farhi, 2009).

Who would be responsible, though, if someone sues over a tweet? The tweeter’s

employer could be as liable as the tweeter, if tweets are considered an extension of the journalist's work (Farhi, 2009). As Charles noted about policy after his incident, "We have no guidance at all" (Farhi, 2009).

One month after the incident, when Farhi asked Marcus Brauchli, executive editor of *The Washington Post*, about Charles' tweet and the controversy that followed, Brauchli pushed it to the side and said there was no policy in place about what was acceptable for the newspaper's staff and their Twitter accounts (Farhi, 2009). This soon changed:

By mid-May, however, he had a few answers: "When it comes to Twittering for the Post, our senior editors should know beforehand if a reporter plans to Twitter or otherwise live-blog something she is covering," he said. "Anything controversial should be checked with an editor before transmission. Tone is also important: we don't use new media to get into verbal fisticuffs with rivals or critics or to advance personal agendas." Outside of work, "We assume that our journalists won't embarrass the Post or impair their journalistic independence through anything they may publish on Twitter, Facebook, blogs or any other new media. We don't and can't practically monitor everything our reporters might do in their own time, so we rely primarily on their good judgment and common sense." (Farhi, 2009).

Former senior editor for *Newsweek* Steven Levy expressed concerns about the propriety of journalists' mixing friend and audience. "Allowing unrestricted following eventually meant that P. Diddy could share the progress of a tantric sex session with a hundred thousand followers, and the Kennedy family could use Twitter to keep the public informed about developments in Uncle Teddy's funeral" (Harper, 2011, p. 5).

News organizations and Twitter

In 2011, the Pew Research Center's Project for Excellence in Journalism and The George Washington University's School of Media and Public Affairs collaborated on a study of Twitter feeds from 13 major news organizations to answer questions about how those organizations use the technology (Holcomb, Gross, & Mitchell, 2011, p.1). How often do they tweet? What kind of news do they distribute? To what extent is Twitter used as a new reporting tool or as a mechanism for gathering insights from followers?

The research examined more than 3,600 tweets over the course of a single week, and revealed that these organizations used Twitter primarily as a means to distribute their own material (Holcomb, Gross, & Mitchell, 2011, p.1). From the data collected, 93 percent of tweets linked to their own sites, while less than one percent contained no link at all. "This behavior resembles the early days of the web. Initially, news organizations, worried about losing audience, rarely linked to content outside their own web domain. Now, the idea is that being a service—of providing users with what they are looking for even if it comes from someone else—carries more weight. It bears watching whether Twitter use for mainstream news organizations evolves in this same way" (p. 2).

From February 2011 to October 2011, news organizations saw a major hike in the number of followers to their main Twitter feed. Fox News saw an increase of 118 percent, while *The Wall Street Journal* increased by 71 percent, *USA Today* by 66 percent and *The New York Times* by 30 percent (Holcomb, Gross, & Mitchell, 2011, p. 7).

Newspaper organizations aren't just adapting to Twitter with one account, but instead are creating multiple Twitter feeds. *The Washington Post* offers 98 different Twitter feeds, more than twice the average of the other 12 organizations. *The New York Times* offers 81, *The Wall Street Journal* 75 and *USA Today* 41 (Holcomb, Gross, & Mitchell,

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2011, p. 5) On average, the 13 news organizations offered 41 different organizational feeds (Holcomb, Gross, & Mitchell, 2011, p. 1).

As a group, the outlets in the sample averaged 33 tweets a day on their main organizational Twitter feed, though the range was from close to 100 a day to fewer than 10. During the week sampled, the main Twitter feed of *The Washington Post* produced 664 tweets. The next two highest were both newspaper organizations—*The New York Times* produced 391; *USA Today*, 205 (p. 6).

Theoretical linkage to research questions

Harold Lasswell's propaganda model implies a two- or multi-step flow of communication—but generally in a single direction, from influencer to influenced. Gatekeeping theory, too, outlines an effectively single-direction flow of communication, but through which influential editors decide what the public sees. At the interpersonal level, Katz and Lazarsfeld saw a two-step flow of communication, again, usually in a single direction. While agenda-setting initially posited a largely one-way flow of information, from journalists to public, a certain feedback mechanism becomes more evident as researchers looked more closely at the influence of the media agenda on the public agenda (government). They began to see that, whether through government officials or public relations personnel, other powerful influencers might re-shape the media agenda. As must be evident by now, the appearance of Twitter has the potential, at least, to radically change the influence of journalists and Twitter-using members of the audience. But the pace of media evolution is accelerating.

Donald Shaw in 1991 observed that “Major mass media rise to the status of ‘top’ medium, where they may remain for several years, even decades. But inevitably all mass media have found they have to narrowcast to survive. This has been the historical fate of all mass media. There is no escape,” (1991, p. 4). Newspaper organizations have adapted to the online system and to social media, like Twitter—staying true to their legacy by daily publication, but changing in ways that appear to blunt the one-way flow of communication, and promote a multi-way flow. Clearly, these are complicated questions that require study. As a start, this research aims to answer the following questions:

RQ1: How often are the stories that newspaper organizations tweet also in the paper?

RQ2: For those stories also in the paper, is there a difference in content—length of the article or multimedia inclusions—between what's in the paper and what's linked online, that gives insight about a multi-directional flow, rather than one way?

RQ3: What are the functions of tweets that don't include a referenced article?

In answering these questions, I hope to gain a better understanding of how news organizations use Twitter, in comparison to print.

Methodology

Sample

This study analyzes one week of tweets from the main Twitter feed of four select newspapers—*USA Today*, *The New York Times*, *The Wall-Street Journal* and the *San Antonio Express-News*—and the print editions of these newspapers for the same week in 2012 that the tweets were gathered. These newspapers were selected because of their leading nature and because of the convenience of access to their print editions for the researcher.



Because each newspaper has a different print schedule, the number of print editions for each newspaper varies.

For *USA Today*, this research compares the tweets spanning Monday, June 11 to Sunday, June 17, to the print editions of Monday, June 11, Tuesday, June 12, Wednesday, June 13, Thursday, June 14 and the weekend edition of Friday, June 15 – Sunday, June 17.

For *The New York Times*, this research compares the tweets spanning Sunday, June 10 to Saturday, June 16 to the print editions of Sunday, June 10, Monday, June 11, Tuesday, June 12, Wednesday, June 13, Thursday, June 14, Friday, June 15 and Saturday, June 16.

For *The Wall-Street Journal*, this research compares the tweets spanning Saturday, June 9 to Friday, June 15 to the print editions of the weekend edition of Saturday, June 9 – Sunday, June 10, Monday, June 11, Tuesday, June 12, Wednesday, Thursday, June 14 and Friday, June 15.

For *San Antonio-Express News*, this research compares the tweets spanning Sunday, June 10, 2012 to Saturday, June 11, 2012 to the print editions of Sunday, June 10, Monday, June 11, Tuesday, June 12, Wednesday, June 13, Thursday, June 14, Friday, June 15 and Saturday, June 15.

Coding

For each day that a set of tweets was gathered from a Twitter feed, the number of tweets in total and number of retweets were recorded. Then, each tweet was numbered in order of the first tweet to the last tweet. Each tweet was coded and given a comment based on if and where that story was in its print edition on that day or another day. Sample comments include: story on page 1A on same day, story on page 1A in next day's edition, story not in paper.

For stories in the paper, a second comment was made in determining the difference in content of what was in the paper compared to what the story was online. This includes any comments on the length of the article or the inclusion or omission of other content, such as photos or charts or sidebars.

For tweets that did not link to an article, a comment was made as to what the function or purpose of the tweet was. Sample comments include link to multimedia or breaking news update.

This research analyzed each of the four newspaper organizations separately.

Results

The results of the study appear in Table 1 and Figure 1. Table 1 summarizes the total number of tweets, tweets linked to stories in the papers, and tweets linked to stories that did not appear in the papers at all.



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Table 1
“Tweets” Week of June 11, 2012 from main Twitter feeds of
USA Today, The New York Times, Wall Street Journal, and San Antonio Express-
News

	USAT ¹	NYT ²	WSJ ³	SAEN ⁴
Total number tweets in week	334	352	246	135
Tweets linked to a story in the paper				
Number	97	189	64	47
Percent of total number of tweets	29%	53.7%	26.0%	34.8%
Number of tweets linked to <i>same</i> content ^a in paper	34	127	27	20
Percent of total tweets linked	35.1%	67.2%	42.3%	42.6%
Percent of total tweets	10.2%	36.1%	11.0%	14.8%
Number tweets linked to content <i>different</i> from paper	63	62	37	27
from that Percent of total tweets linked	64.9%	32.8%	57.8%	57.4%
Percent of total tweets	18.7%	17.6%	15.0%	20%
Tweets linked to a story that did not appear in paper				
Number	174	114	112	48
Percent of total tweets	52.1%	32.4%	45.5%	35.6%
Tweets linked to no story at all				
Number	63	49	70	40
Percent of total tweets	18.7%	13.9%	28.5%	29.6%

Note. ¹USA Today. ²The New York Times. ³The Wall Street Journal. ⁴San Antonio Express News.
^aContent was similar, but sometimes varying in length, amount of text, and number of photos.

The functions of the tweets that did not link to a story at all appear in Figure 1.

Figure 1
“Tweets” Linked to No Story
Week of June 11, 2012, main Twitter feeds of
USA Today, The New York Times, The Wall Street Journal, and San Antonio
Express-News

For USA Today, of the 63 tweets that linked to no story at all:

- 16 linked to photos or video multimedia
- 16 asked for user feedback
- 14 were news updates
- 9 linked to a blog giving updates of an event
- 5 linked to one of the paper’s social media outlets
- 2 linked to an interactive feature
- 1 thanked a contributing writer who wrote a letter for the editorial section

For *The New York Times*, of the 49 tweets that linked to no story at all:

- 15 were news updates
- 15 linked to a webpage giving updates of an event
- 12 linked to photo or video multimedia
- 6 linked to one of the paper’s social media outlets
- 1 linked to an interactive feature

For The Wall Street Journal, of the 70 tweets that linked to no story at all:

- 31 linked to photos or video multimedia
- 13 linked to a webpage giving updates of an event
- 11 were news updates
- 5 linked to one of the paper’s social media outlets
- 4 linked to an interactive feature
- 3 linked to a live chat forum
- 2 asked for user feedback
- 1 linked to an online poll

For the San Antonio Express-News, of the 40 tweets that did not link to a story at all:
24 linked to the paper’s Newswatch blog, which tracks news, trends and ideas of the day

- 5 linked to photo or video multimedia
- 5 were news updates
- 3 were traffic updates
- 1 asked for user feedback
- 1 promoted an event
- 1 was a retweet of a journalist promoting an article to read in the paper



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Discussion

Of the four newspapers studied, *The New York Times* had the highest percentage of tweets that linked to a story in the paper with 53.7 percent. The percent of tweets that linked to a story in the paper for *USA Today*, *The Wall Street Journal*, and *San Antonio Express-News* all don't top 35 percent.

Of the tweets that linked to a story in the paper, 67.2 percent of those had the same content, in terms of varying length, text, or photos, for *The New York Times*, which is substantially higher than the other three. While two-thirds of the tweets that linked to a story in the paper for *The New York Times* had the same content, this wasn't the case for even half of the tweets that linked to the paper for the other three. Out of the total number of tweets for each paper, 36.1 percent of *The New York Times'* had the same content that you would find in the paper. This is more than triple the percentage of *USA Today* and *The Wall Street Journal*, which is at 10.2 percent and 11 percent respectively, and more than double the percentage of *San Antonio Express-News*, which is at 14.8 percent. These numbers show clearly that *The New York Times* uses Twitter for a completely different function than the other three papers. For the *Times*, Twitter seems to be a tool through which to promote its main product. The organization is staying true to their legacy form by linking their Twitter followers to stories found in their print publication in two-thirds of their tweets, while the other three appear to be experimenting with Twitter in a different way.

For tweets that linked to a story in the paper with different content in terms of varying length, text, or photos, the percentages out of the total number of tweets for each paper were all within 5 percent. The percentages were 18.7 percent, 17.6 percent, 15.0 percent, and 20 percent for *USA Today*, *The New York Times*, *The Wall-Street Journal*, and *San Antonio Express-News*, respectively. This particularly category does not give an outlier when comparing to the total number of tweets for each paper, but their comparison to the number of tweets that linked to a story in the paper does vary. These percentages are 64.9 percent, 32.8 percent, 57.8 percent, and 57.4 percent for *USA Today*, *The New York Times*, *The Wall Street Journal*, and *San Antonio-Express News*, respectively. While these numbers are mirror images of the percentages of stories with similar content, it's worth noting that for all the papers except *The New York Times*, the majority of stories had different content between what was linked and what was found in the paper. This suggests that two different audiences—those reading the paper and those following the Twitter feed—while reading the same story, would be presented with varying content over half the time. Thus, someone reading the story online after being linked via Twitter might read an extra quote or see a different photo than someone who reads the story in the paper.

All four newspapers had at least 32 percent of their total number of tweets link to a story that was not in the paper, with the highest percentage being 52.1 percent for *USA Today*. These numbers suggest that the newspapers are not just reporting for their daily publications anymore, but are also writing stories that will be distributed solely online. *The Wall Street Journal* in particular uses blogs, hosted by the newspaper's website, to share information gathered by the paper's journalists and uses Twitter to attract an audience to the blogs and update readers when there is a new post.

The proportion of tweets that linked to no story for *The Wall Street Journal* (28.5 percent) and *San Antonio Express-News* (29.6 percent) was substantially higher than that of *USA Today* (18.7 percent) and more than double that of *The New York Times* (13.9 percent). While the results suggest that *The New York Times* uses Twitter largely to market its legacy publication, *The Wall Street Journal* and *San Antonio Express-News* seem to be using the





new medium to experiment more with the tools and services that are available online. Of the 70 tweets for *The Wall Street Journal* that linked to no story at all, 31 linked to photo or video multimedia on its website, promoting its online product through Twitter. When it came to tweets that linked to no story, each newspaper used Twitter in different ways, demonstrating not only the different services available online, but how each newspaper has its own style in using Twitter. For example, of the 63 tweets that linked to no story at *USA Today*, 16 asked for user feedback, while only three tweets for the other three newspapers combined used this function. This suggests that the *USA Today* is using Twitter to reach out to its audience and taking advantage of the social media's ability to receive immediate feedback. Of the 70 tweets that linked to no story for *The Wall Street Journal*, four linked to an interactive feature; the other three papers combined had only three links to an interactive feature. The *Journal* used three of its tweets to link to a live chat forum and one to link to an online poll, which none of the other three papers did. The *Journal* used Twitter to serve in eight different functions besides linking to a story, the most out of the four newspapers and the highest percentage and highest number of the total number of tweets. This suggests that in one week, the *Journal* experimented more with Twitter in finding other ways to report the news and interact with users.

San Antonio Express-News is unique out of the four newspapers studied in that it is primarily sensitive to the local community. Of its 40 tweets that linked to no, 24 linked to its Newswatch blog, which gives a short paragraph or two on a developing story and then links to the source, usually an area television news station. Three of its tweets were traffic updates; one promoted an event taking place in the city. Neither, of course, was present in the other three papers' tweets.

The study further supports the findings by Wise, Bolls, Myers and Sternadori (2009) that newspaper web sites continue to rely on the written text in presenting story details, as each newspaper's tweets 70 percent of the time linked to a story. Twitter is another agenda setting medium for newspapers, as McCombs and Shaw (1972) suggest. While *The New York Times'* agenda for print and Twitter is similar, the agendas for *USA Today*, *The Wall Street Journal*, and *San Antonio Express-News* are different. The study also supports the claims by Steensen (2010), which news organizations must include hypertext, multimedia, and interactivity in their process as journalism shifts to online. Almost all the tweets included hypertext, linking users from the tweet to the destination the organizations' want the users to go. A total of 64 tweets from all four newspaper organizations linked to photo or video multimedia with no story attached. Interactivity was the least of the three utilized through Twitter, with only a total of 7 tweets linking to an interactive feature with no story attached. However, the interactivity feature is still practiced, which supports Steensen, who said that news organizations include the feature in their online processes.

While the theories presented—Lasswell model, gatekeeping, two-step flow, and agenda setting—generally suggested a single-direction or one-way flow of communication, perhaps with intervening steps, media are evolving rapidly. Donald Shaw (1991, p. 4) suggests that each succeeding medium rises to the status of 'top' medium, when it comes to distributing news. If that's true, neither Twitter, nor the Internet, are there, yet. However, this study suggests that newspaper organizations are recognizing an evolution in how people are getting their news, beyond daily newspapers. Such organizations are sharing more information and in different ways. While *The New York Times* uses Twitter to promote the *Times'* legacy product, it wouldn't be surprising if it soon follow in the steps of *USA Today*, *The Wall Street Journal*, and *San Antonio Express-News*, experimenting more with the different tools available online to reach and serve audiences.



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Beliefs about Causation of Autism in a Hispanic and Anglo Cohort



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Abstract

In 2012, 1 in 88 children in the United States were diagnosed with autism which is a developmental disorder characterized by impairments in social interaction and communication and by behavior patterns that are repetitive and restrictive. Although the cause(s) of autism is unknown, parental surveys have been conducted to assess beliefs about causation of autism as it hypothesized that these beliefs influence decisions about health care. These surveys have been conducted on largely Anglo populations which is interesting as epidemiological studies show that Hispanic children are diagnosed with autism at lower rates than Anglo children. Reasons for lower diagnostic rates for Hispanic children may be due to language barriers, lowered utilization of health services, and/or lack of awareness about symptoms and causes of autism within Hispanic populations. The purpose of this exploratory study was to investigate the causal beliefs of autism within



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the general population and to investigate whether beliefs differed between Hispanic and Anglo groups. Participants responded to an online survey and reported their degree of agreement to nine different proposed causes of autism which ranged from biological causes to environmental causes. Results showed that both Hispanics and Anglos were similar in their causal beliefs about autism and that both groups agreed more with biologically-based causes than environmentally-based causes.

Autism is a pervasive developmental disorder characterized by impairments in social interaction and communication and by behavior patterns that are repetitive and restrictive. According to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000), symptoms due to autism delay normal behavior and/or result in abnormal behavior which is most often apparent by age three. In 2012, 1 in 88 American children were diagnosed with autism, an increase of 78% from 2002 and a 23% increase from 2006 (Insel, 2012). It is unclear why rates have risen though several authorities suggest it is most probably due to the increased awareness of autism and the broadening of criteria used by health providers for diagnosis (Insel, 2012; Rice, 2009).

The cause of autism remains unknown. However, numerous theories have been proposed to explain the cause of autism. Some theories have focused on biological events that occur during prenatal stages. Genetics has been implicated as the key causal factor. Evidence supporting this theory lies in findings from both family and twin studies regarding autism inheritance (Perko & McLaughlin, 2002). Another prominent theory implicates prenatal brain complications such as “delayed myelination, elevated sensitivity of the amygdala to [glucocorticoids], and abnormal development of the dopaminergic system” (Kinney, Munir, Crowley, & Miller, 2008). Genetic and prenatal neurodevelopmental theories currently receive substantial support from the scientific community (Kinney et al., 2008; Perko & McLaughlin, 2002). Other biologically-based theories suggest that perinatal events of complications/illness during pregnancy and during childbirth are risk factors for autism. Such factors as bleeding during pregnancy, consumption of prescription medications, intrauterine viral infections (Perko & McLaughlin, 2002; Wilkerson, Volpe, Dean, & Titus, 2002), induced delivery, caesarian delivery, and vaginal bleeding during delivery (Brimacombe, Ming, & Lamendola, 2007) have been implicated.

Other theories have focused on postnatal events, suggesting that autism is caused by environmental factors. One early environmental theory, promoted by Kanner in 1943, claimed that emotional trauma experienced early in the child’s life was the cause of autism (Comer, 2012). Emotional trauma could be caused by the so-called “refrigerator mother”; that is, a mother who emotionally neglects her child (Comer, 2012). Other environmentally-based theories have implicated exposure to vaccinations, environmental toxins, and/or physical trauma during early childhood (Goin-Kochel & Myers, 2005). Due to lack of sound research evidence, theories relating causation of autism to environmental events such as these have been largely rejected by the scientific community (Dardennes et al., 2011; Gross, 2009).

Given the numerous theories for the cause of autism, it would be interesting to determine which are most accepted by the general population. Yet only a few studies assessing causal beliefs have been conducted and, of these, results have been mixed. In one survey (Goin-Kochel & Myers, 2005), mothers of children who were diagnosed with autism were asked about their causal beliefs. The most prevalent belief was genetics (25.1%) followed by early childhood factors such as vaccines, immunizations, and environmental

toxins (16.8%) and a combination of genetic and external causes (14.1%). Yet another study (Russell, Kelly, & Golding, 2010) found that the majority of participants who had direct contact with an individual diagnosed with autism believed that autism was linked to environmental risk factors. It should be noted that these studies have been conducted with Anglo/Caucasian groups and that there have been no published investigations of causal beliefs of minority groups. This is problematic given that one minority group, Hispanic children, are diagnosed with autism at significantly different rates than Anglo children. On the national level, for example, out of every 1,000 children, 12 Anglo and 7.9 Hispanic children are diagnosed with autism (Autism and Developmental Disabilities Monitoring Network, 2008). And in Texas, in 2000, of children diagnosed with autism, 53% were Anglo and 26% were Hispanic (Seay, Becker, & Morrison, 2006). Various reasons for these ethnic differences in diagnosis have been hypothesized, ranging from true existing differences in the prevalence of autism between ethnic groups to external factors that could impact diagnostic rates such as parent's level of education, income, and availability of medical services (Rice, 2009). For example, the lower diagnostic rates of autism within Hispanic populations may be due to language and cultural barriers that could make communication and understanding between parents and health professionals difficult which may result in misdiagnosis (Seay et al., 2006). In addition, lower diagnostic rates of autism could reflect lack of awareness of autism symptoms found within minority groups (Mandell et al., 2009).

Given that beliefs about causes of autism are associated with help-seeking and treatment choices of those in care of autistic children (Dardennes et al., 2011) and given the importance of obtaining health services in the diagnosis and treatment of autism, it would be helpful to determine which causal theories of autism are accepted by the general population. The purpose of this study is to explore the beliefs about the causation of autism in both Hispanic and Anglo population.

Method

A survey was developed by the investigator to access beliefs about the causation of autism. Survey respondents reported the degree of their agreement with nine possible causes of autism on a five-point Likert scale. These causes were gleaned from contemporary reviews on autism (Comer, 2012; Gupta, 2004; Reynolds & Dombeck, n.d.) and ranged from environmental to biological causes. Survey respondents also reported their gender, age, ethnicity, education level, and personal knowledge of an individual diagnosed with autism. The survey was posted online and participants were recruited from McNair summer program scholars of St. Mary's University and from Facebook. The URL for this survey was distributed through student email for McNair program scholars and was posted on the investigator's Facebook page for Facebook participants. To increase sample size, participants were asked to share the survey URL with 5 other people in a "snow-ball" methodology. Only data collected from Anglo/Caucasian and Hispanic/Latino participants were analyzed. All participants were 18 years or older.

Results

A total of 101 surveys were completed by participants who identified themselves as Hispanic/Latino ($n = 66$, 65%) or Anglo/Caucasian ($n = 35$, 35%). Of these, 65 were female (64%) and 36 were male (36%). The majority of participants were 18-25 years of age ($n = 61$, 60%). Over half of the participants reported that they had some level of college

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education ($n = 55, 54\%$). Slightly over one-fourth ($n = 28, 28\%$) were college graduates or held advanced degrees and 18 received a high school diploma or their GED (18%). Almost two-thirds of the sample ($n = 64, 63\%$) knew an individual diagnosed with autism.

To assess differences between Hispanic and Anglo groups as to causal beliefs about autism, an independent samples t-test was conducted using ethnicity and causal beliefs as variables. The belief “bad luck” was deleted from the analysis as it was determined that this belief was subject to misinterpretation. There was no significant differences found between ethnic groups with the exception of one belief, ($t(94) = -2.33, p = 0.02$, and $d = 0.49$), with Anglo participants agreeing more with failure in parenting as a cause of autism than Hispanic participants. As shown in Table 1 and Table 2, both Hispanic and Anglo participants believed that causes of autism involved genetics ($M = 3.15$), brain abnormalities ($M = 3.12$), and complications/illness during pregnancy ($M = 3.01$). The cause of failure in parenting had the least agreement ($M = 1.40$) for both ethnic groups. The cause that was most unknown to survey participants was childhood vaccinations. This is interesting in that this potential cause has generated considerable attention and, according to Gross (2009), has resulted in a vaccine-scare across the United States and the United Kingdom.

Table 1- Reported Causal Beliefs: Hispanic/Latino

Causes	Hispanic/Latino ($n=66$)				
	Completely Disagree	Somewhat Disagree	Somewhat Agree	Completely Agree	Never Heard of This
Childhood Vaccinations	26	12	12	4	12
Genetics	3	4	37	21	1
Complications/Illness During Pregnancy	4	3	39	18	2
Brain Abnormalities before Birth	5	2	32	20	7
Traumatic Experiences Early in Life	28	15	18	1	4
Failure in Parenting	52	8	3	0	3
Physical Factors (brain injury, toxins, etc.)	8	9	32	14	6
Complications during Birth	5	12	29	15	5

Table 2- Reported Causal Beliefs: Anglo/Caucasian

Causes	Anglo/Caucasian ($n=35$)				
	Completely Disagree	Somewhat Disagree	Somewhat Agree	Completely Agree	Never Heard of This
Childhood Vaccinations	13	8	6	2	6
Genetics	2	2	20	10	1
Complications/Illness During Pregnancy	2	6	16	7	4
Brain Abnormalities before Birth	1	5	17	10	2
Traumatic Experiences Early in Life	12	8	8	3	4
Failure in Parenting	23	3	5	2	2
Physical Factors (brain injury, toxins, etc.)	4	5	15	7	4
Complications during Birth	4	5	19	4	3

Causation variables were grouped into biologically-based (genetics, brain abnormalities before birth, complications/illness during pregnancy, and complications during birth) and environmentally-based (childhood vaccinations, traumatic experiences early in life, failure in parenting, and physical factors) causes. A paired samples t-test was conducted to determine the degree of agreement with biological versus environmental causes of autism. Results demonstrated significant differences between biological and environmental causes and showed that both Hispanic and Anglo participants agreed more with biologically-based causes. Data are presented in Table 3.

Table 3- Agreement of Cause: Hispanic/Latino & Anglo/Caucasian

	Mean	N	SD	Std. Error Mean	Correlation	Sig.
Biological	12.62	101	2.33	0.23	0.44	0.00
Environmental	9.18	101	3.45	0.34		

Discussion

Although the cause of autism is unknown, the consensus within the scientific community is that the cause of autism is biological. In this study's survey, the majority of participants agreed that the cause of autism is biologically-based. There were no significant differences in causal beliefs between Hispanic and Anglo groups with the exception that Anglo participants agreed more with the belief that failure in parenting as a cause of autism than did Hispanic participants. This finding was unexpected and is difficult to explain.

More than half of the participants knew at least one individual diagnosed with autism which illustrates the high rates of autism in the United States. today. Limitations of this study—include the limited amount of time (two months) to complete the research process, unbalanced ethnic group numbers, sampling only participants with Internet access, and failing to assess participants' knowledge about autism. Suggestions for future research include assessing the causal beliefs of autism in other ethnic groups, especially those of minority populations such as African Americans, Asian Americans, Pacific Islanders, and Native Americans.

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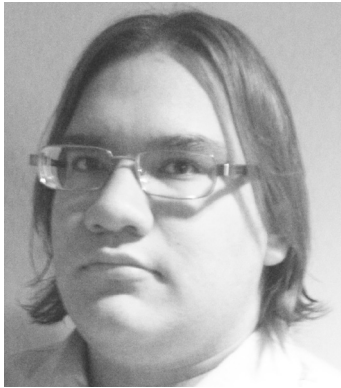
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A Smile for a Favor, A Compliment for your Self- Esteem: A comparison of inauthentic affection in children's and adults' television programming



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Abstract

While aggression in the media has received considerable attention, less attention has been paid to other forms of antisocial behaviors, and even less has been paid to inauthentic forms of pro-social behaviors, such as inauthentic affection. This is problematic as subtler forms of antisocial behavior may be equally influential, yet often go unchallenged by critics of media violence and aggression. The present study addresses this limitation by examining differences in the frequency of inauthentic affection in children's and adults' television programming. We define inauthentic affection as a behavior that is meant to be aesthetically similar to affectionate behavior, but is driven by a goal other than the expression of genuine liking. Results indicate that children are subjected to much more inauthentic affection than adults are. Possible implications for long-term exposure to inauthentic affection and future directions for additional research are discussed.



We Americans have a longstanding relationship with television that seems to be growing more feverish by the day. Fifty years ago, more than half of US households had at least one television, suggesting that even back then most of us had incorporated television into our daily routines. Those sentiments have only intensified with time. As of 2011, 99% of households have at least one television set (Nielsen Online, 2011). Clearly, television is not a temporary crush; all indications are that it is a media form that will remain widely available to almost all of us.

Although television is most likely here to stay, popular culture actually has something of an odd relationship with its iconic pastime. It is seen as a mundane “part of life” by most people, but certain elements within society have taken great strides to denounce it. Anti-television campaigns have portrayed our love of the tube as a far-reaching scourge that wreaks havoc on our minds and bodies. It is not our position that television in and of itself is bad. After all, television is an excellent means by which the government, corporations, and public service agencies communicate their messages to the masses. But, as is true of our potato chip habits, we do a woefully poor job of moderating our consumption. As of 2001, the average American household had 2.4 television sets (Roberts & Foehr, 2008). A decade later, we were watching television an average of 59 hours and 28 minutes a week (Nielsen Online, 2011). These data substantiate the claim that television occupies a great deal of our attention, and has for quite a while.

The issue that we are addressing in this study is a little more focused than the broad strokes painted by most of the previous research on television viewing. We are primarily interested in the availability of certain types of messages contained within children’s programming. Therefore, it is important that we first establish that children are significantly impacted by our cultural love affair with television. To this end, there are several statistics that assuage any concern that children are not able to watch television throughout the day. According to 2008 data, over 99% of households with children had at least one set, and even more impressively, 68% of children 8-18 had a television set in their bedroom (Roberts & Foehr, 2008). It is definitely not lack of access that would be a logical objection to our basic premise that kids watch a lot of television.

There is also little reason to believe that the results of our research will become dated or irrelevant in the near future. Technological and market advances, such as the proliferation of personal computers and improved access to the internet, have had little to no effect on children’s television viewing habits. Kids simply make room for television watching in their increasingly burdened schedules. Research has shown that media multitasking is on the rise, with children 8-18 still watching an average of 4.5 hours of television and other screen media per day (Rideout, Foehr, & Roberts, 2010). Despite having more and more opportunities to distract themselves with other electronic devices, they are able to find creative ways to work in their television fix regardless of whatever else is going on at the moment.

Having established that a vast amount of time is being spent viewing television and other screen media, it is incumbent upon researchers such as ourselves to identify what is contained within the shows they are most fond of watching. Theoretically, if children are exposed to pro-social messages, we should expect them to behave in more pro-social ways in the future. The cumulative effect of having watched a tremendous amount of pro-





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social television could be very beneficial to society. Of course, if they are primarily being inundated with negative messaging, the effects could be far more disconcerting.

The bulk of research on television content has explored the harmful effects of violence, with far less examining pro-social messages, such as helpfulness and affection. Virtually none has looked into the hazy area between the two. This study fills a gap in the existing knowledge base by investigating the extent to which children's programming differs from adults' programming with respect to the portrayal of inauthentic affection. As you will see, children are subjected to this type of hostile and manipulative messaging far more often than their parents and other adults.

Theoretical Perspective

Because children watch so much television, it is prudent to carefully consider the messages they are receiving and the behavioral implications of those messages, good or bad. One of the most powerful theories for studying media content is Bandura's (1976) social learning theory. The theory posits that much of what people learn comes from observing the rewards and punishments that follow from the actions of others. Thus, we would expect that children who observe rewards being paired with a behavior are more likely to engage in the behavior in the future whereas children who observe a pairing between a punishment and a behavior are less likely to engage in a similar behavior at a later time (Bandura & Walters, 1963).

This idea has had a significant impact on how we think about the effects of television on child development, whether as a low-cost substitute for a babysitter or as a means of delivering quality educational material. We assume that if a little boy sees a rabbit being rewarded for acting violently toward a coyote, he is more likely to engage in a similar behavior in the future. Although this may seem a bit trite, the general point is consistent with extant research. 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. Based on these findings, it appears as though children's behavior is affected in the immediate aftermath of exposure to negative messaging.

A study by Huesmann, Moise-Titus, Podolski, and Eron (2003) revealed that these effects are not limited to the short-term. Their longitudinal study explored the relationship between media violence in childhood and aggressive behavior in early adulthood using a sample of people who had grown 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. They 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 pointed to a relationship between early exposure to aggression in the media and violent tendencies later in life. Bushman and Huesmann's (2006) meta-analysis of 431 studies corroborated the basic finding that children suffer long-term effects from exposure to aggressive media.





It is important to note that children’s programming is not just a steady stream of negative messaging, even if the majority of research has focused on that component. In one study, Susan Hearold (1986) found that the effects of viewing positive messages were stronger than exposure to antisocial messages. In two follow-up studies, Paik and Comstock (1994) and Mares and Woodard (2005) found similar results. These results offer hope that producers and writers can effect positive change when they are motivated to do so.

On the other hand, a rather frightening caveat to this research is that producers and writers are adept at conflating pro-social messages with anti-social ones. Oftentimes, this is done to evoke laughter, as the audience is “in on” the joke that is made by one actor/actress at the expense of another. Other times, children are subjected to carefully crafted schemes that are successfully hatched because one actor/actress has been fooled into believing that a pro-social act has emanated from a place of authenticity. The field desperately needs to disambiguate the labeling of pro- and anti-social behavior when actors mimic positive inter-personal behavior, but do so in order to deceive or manipulate another person. In previous research, we took a step in that direction by exploring a concept we called “inauthentic affection.” We elaborate on that point now.

Inauthentic affection

We proposed that there are two categories of affectionate behavior: authentic and inauthentic (Dunn & Sperling, 2011). Although both categories share the same specific acts (e.g., smiling, hugging, complimenting), there is a difference in the motivation underlying the acts. More specifically, inauthentic affection differs from authentic affection because it emanates from a motivation other than a desire to express liking for another person. In formulaic terms we define it as:

$$| \text{Expected motivation of behavior based on definition} - \text{Motive of specific behavior} | = \text{Relative inauthenticity of behavior}$$

This formula approximates a null hypothesis whereby the closeness of the two elements renders them closer to zero, which would correspond to authenticity. The relative disagreement yields a higher number, which would point toward a lack of authenticity. In other words, to the extent that underlying motive and the expressed behavior are synchronized, we consider the behavior to be authentic.

In order for the formula to be operationalized for our purposes, what is meant by “affection” must be firmly established. According to the *Merriam-Webster Dictionary*, affection is a “tender attachment: fondness,” (“Affection,” n.d.). Elsewhere in the literature, Perot and Schubert (1977) define affection as a “warm” and intimate behavior, in their examination of affection modeling in children. They list 19 physical behaviors and 19 verbal phases that they defined as affectionate. Informed by this literature, we operationally define affection as a behavior that expresses the actor genuine liking for the recipient(s), whether it be a person, animal, or inanimate object.

For inauthentic affection to occur, there must be an ulterior motivate. In other words, unless the expression of affection is deemed to be disingenuous, the action would





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merely be treated as authentically affectionate in nature. Detection of the true motive of most behaviors in real life can be complicated because it requires the actor to openly confess to the motive or the observer to make accurate inferences. The latter almost requires magic, or at the very least, more faith than is usually acceptable in scientific circles. Essentially, an observer can only be informed in real life situations if the subject discloses their thoughts, or the examiner has a close enough relationship with the subject where the context makes the behavioral intent fairly obvious. Fortunately, televised media tends to reveal the motives of characters for dramatic or comedic effect through diegetic materials, or things the characters and viewers can sense (e.g., dialogue, behaviors), and non-diegetic materials, or things only the viewer can sense (e.g., canned laughter, sound effects). By examining the diegetic and non-diegetic material, researchers can be confident that they are making much more accurate inferences about the motivation underlying affectionate acts than would be the case in the majority of naturalistic situations.

In our previous study, we noted several forms of inauthentic affection commonly that appear in televised media (Dunn & Sperling, 2011). One of those is “manipulation.” This occurs when the actor intends for the recipient to act a certain way in direct response to the actor’s affectionate behavior. An example of this might be a character complimenting the physique of the recipient, so that he or she will do a favor for the actor that s/he would otherwise not do. According to most scripts, the recipient is expected to be so flattered by the compliment that s/he will put aside any misgivings about the task or the actor and help with the request.

Another form of inauthentic affection is “deception.” This occurs when the actor uses affectionate behavior to disguise or keep secret some truth from the recipient. For example, an adolescent who wants to keep her mom from looking at her report card might offer a compliment in order to direct attention away from the matter. The mom is supposed to be so enthralled by the positive feedback that the report card slips from her mind and the adolescent escapes punishment.

Yet another form of inauthentic affection is “reaction formation.” This usually manifests in the “kill them with kindness” form whereby an actor offers positive feedback about the recipient, the recipient’s behavior, or the recipient’s possessions when it is obvious that that s/he does not have affectionate feelings for the recipient. Again, the recipient is thought to be so pleased to be receiving praise from the actor that s/he will not act on her/his more global negative sentiments.

As you can see, inauthentic affection mostly requires that the recipient be sufficiently unintelligent to allow the strategy to work. If they are wise to it, they are unlikely to give in to the wishes of the actor and the strategy of inauthentic affection would be a failure. Thus, to the extent that inauthentic affection is rewarded, it teaches children that people are easy to fool and that using affection instrumentally is a good strategy for getting what they want.





Hypotheses

The goal of this study is to examine the frequency of inauthentic affection in televised media. The frequency will be examined for both children's and adults' programming and comparisons will be drawn between the two genres. This approach will allow us to assess the extent to which inauthentic affection is present in children's television shows, and determine whether kids are being subjected to it more frequently than adults.

Hypothesis 1: We will find examples of inauthentic affection in children's media. We anticipate that this hypothesis will be supported because previous research has shown that these types of behaviors are actually quite common in this genre.

Hypothesis 2: Children's programming will portray more inauthentic acts than adults' programming. Because adults are able to grasp a wider array of aggressive, violent, and otherwise anti-social behavior, there is not as much of a need to use inauthentic affection in adults' programming to accomplish the same goals.

Method

Sample

In an effort to collect a sample representative of the two conditions (children's and adults' programming), we recorded two weeks' of television content. Disney Channel was recorded from Monday to Friday during the hours of 7:00 to 9:00 p.m. of the first week resulting in 10 hours of television content. TBS was recorded during the same days and times of the second week resulting in 10 additional hours.

Only the storyline of the programming was coded. After removing the advertisements, promotions, opening sequences, and end credits – except when programming ran concurrent to credits –, the sample of children's programming consisted of 485 minutes and 42 seconds of programming over 600 minutes of recorded televised content. The sample of adults' programming consisted of 398 minutes and 5 seconds of programming over 600 minutes of recorded televised content. Therefore, the total amount of television programming analyzed in this study was 883 minutes and 47 seconds.

Procedure

For this study, we define affection in the media as a behavior expressed by a character in the media that depicts genuine fondness for at least one other character, which can be perceived by a viewer, either visually or audibly. Inauthentic affection in the media is similar to affection in the media, with the exception that the intent of affectionate behavior is not genuine, but is instead an act done to accomplish some other motive. This motive could be to manipulate or deceive someone, or to hide one's own feelings from the recipient (i.e., reaction formation).

The following variables were coded: target audience of the episode, network, date the episode was recorded, name of the series, start and end times of the specific act of inauthentic affection, duration of screen time the specific act received, name, gender, and age group of both the actor and the recipient(s) of the act, as well as the relationship between the two, and description of the act of inauthentic affection itself. Each of the two researchers coded the programming separately. The two datasets were then combined to create a master list for data analysis. Any discrepancies between the two lists in the combination process were resolved via dialogue between the researchers. Once the data were labeled and compiled into one list, we tallied the frequency of inauthentic affection in both conditions (children's and adult's television programming).



Results

The data support H1, as we found many examples of inauthentic affection in our sample (see Table 1). Most of these examples were driven by the motivations discussed earlier, including manipulation, deception, and reaction formation. However, an additional motivation was identified in the data analysis process, which we refer to as “taunting.” Taunting, unlike the other motives, is intended to be overt. The actor wants the recipient to see through their inauthentic affection and become upset. An example of this might be a character sarcastically commending an idea presented by the recipient, which the actor authentically believes to be vacuous, so that the recipient will feel foolish. Following this act, the recipient is expected to understand the inauthentic intent and experience a negative emotional consequence.

In response to the identification of this previously unidentified motivation of “taunting,” and the relative similarity in definition of the three previously mentioned motives, a new theory is suggested for the motives behind actions of inauthentic affection. We propose that the initial three motives be combined into one higher-order motive, now called “manipulation.” Each of the previous motives at its core is used to increase the likelihood that the recipient will act in a way that the actor desires. Taunting, on the other hand, is used to change the recipients’ emotional state.

With respect to H2, a total of 246 acts of inauthentic affection were found in the sample. The children’s programming contained 160 acts while 86 acts were found in the adults’ programming. A chi-square test of association revealed that there was a statistically significant difference in frequency between adults’ and children’s programming ($\chi^2(1, N=246) = 22.26, p < 0.001$) supporting H2.

Based on the results of H1, a follow up test compared the frequency of the two motives, manipulation and taunting, across genres. The results of this test revealed that the ratio of manipulation to taunting was statistically similar for children’s and adults’ programming ($\chi^2(1, N=246) = 1.64, p = .2$).

Discussion

The significant difference between the frequency of inauthentic affection in children’s and adults’ programming is worthy of attention. In the current sample, the amount of inauthentic affection in children’s shows is almost double that of adults’ programming. This could lead to the conspiratorial interpretation that it is the intent of the creators to teach our children how to manipulate and taunt others. However, although there were examples of sarcasm being overtly taught in each condition, the idea of a conspiracy seems highly unlikely. Another possibility is that this push could stem from the desire to make dramatic and comedic material without the use of the more heavily criticized “violent” scenes and slapstick comedy.

Before over-interpreting the results, it is important to note that there were several limitations associated with this study. First, we used a convenience sample of programming that aired over a two-week period. In this digital age of online video streaming and downloading, future research could give more consideration to the programs children and adults are actually watching the most. It should be noted, however, that this would require the assistance of a ratings company and the acquiring/purchasing of the sampled programs, both of which can be very costly. Since funds for this study were extremely limited, we



were restricted to sampling from available media.

The inclusion of feature films in the Disney Channel sample also may have obscured some of the results, even though the films were produced by the Disney Company and its subsidiaries. Nevertheless, the films' content was coded and included in this study, but their presence may have skewed the data, as Disney Channel television programs had a tendency to have more inauthentic affection.

Future research could also consider the consequences of inauthentic affection as portrayed in these genres. As Bandura's social learning theory states the vicarious learner must see the modeled behavior either be reinforced or punished to determine if they will reproduce this behavior in the future. Due to time limitations and the nascent stage of our theory on inauthentic affection, we decided that this component should be omitted from this study and pursued in future endeavors.

In summary, the concern with the amount of violence and aggression in television programming is pertinent and valuable. That being said, we must be sure not to restrict our focus to solely violence and aggression. There may be a plethora of negative behaviors children may be learning, some of them more covert than others. Inauthentic affection is simply one example. It should also be noted that, as previous research has shown, authentic pro-social behaviors are also present within children's programming. We must be careful not to throw out the baby with the bathwater and condemn all media directed towards children.



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Table 1

Examples of Inauthentic Affection displayed on the Disney Channel and TBS

Day	1 st Quarter	2 nd Quarter	Children		Total
			3 rd Quarter	4 th Quarter	
M	23	10*	7*	6*	46
T	15	0*	2*	2*	19
W	8	12	18	9	47
Th	11	7*	7*	7*	32
F	3*	6*	3*	4	16
<i>Total:</i>					160
Adults					
M	3	1	5	4	13
T	2	7	12	8	29
W	3	2	5	5	15
Th	4	4	7	4	19
F	5	0	1	4	10
<i>Total:</i>					86

Note. The quarters indicate which 30-minute segment of the 2-hour recording the occurrences were displayed.

* The content displayed was not television programming, but a feature length film.

Table 2

Frequency of Motives of Inauthentic Affection

	Motives	
	Manipulation	Taunting
Children	108	52
Adults	51	35
Total	159	87



Vicarious Social Undermining and Negative Workplace Outcomes: An Exploration of the Moderating Role of Perceived Organizational Support



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Abstract

Social undermining is a covert and chronic type of workplace aggression that deliberately hinders a person's positive reputation and/or relationships in the workplace. Targets of social undermining experienced negative outcomes such as decreased job satisfaction and reduced psychological well-being. Victims of social undermining are also more likely to retaliate and engage in counterproductive workplace behaviors than employees who have not been victimized. Vicarious social undermining occurs when one observes social undermining but is not the direct target of the aggression. Employees who experience





vicarious social undermining report increased job withdrawal, greater intention to quit and decreased supervisor satisfaction, compared to employees who do not experience vicarious social undermining. The present research investigates the possibility that perceived organizational support moderates the relationship between vicarious social undermining and these negative outcomes. Full-time and part-time employees (n=164) from a diverse set of industries completed an online questionnaire assessing their experience of vicarious social undermining, employee job withdrawal, intention to quit, supervisor satisfaction, organizational commitment and perceived organizational support. The results indicate that although vicarious social undermining is clearly related to harmful outcomes for the employee and the organization, these relationships do not appear to be moderated by perceived organizational support.

Workplace aggression is defined as “efforts by individuals to harm others with whom they work, or have worked, or the organizations in which they are presently, or were previously, employed” (Neuman & Baron, 1998). 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 incidences, 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 time at work than almost any other activity. In addition to earning a salary to provide for themselves and their families, a person’s job is often an important part of his or her social identity. When an employee is the target of workplace aggression, all of these benefits can be threatened. Essentially, the necessity of working becomes a problem for the person when he or she is the target of aggression.

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 because it can be witnessed by others and has prompt results. 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. Covert aggressive behavior is typically easy for the specific target to detect, but difficult for others to recognize as aggressive.



Vicarious Social Undermining and Negative Workplace Outcomes

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, a covert and chronic form of aggression, appears to occur more frequently than other aggressive acts (Pool & Birkelbach, 2011). Covert forms of aggression can be easily disguised and may only be noticeable to the victim and perpetrator. In short, any single act of undermining can be explained away by the source and may even be perceived as normative behavior within a group. 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 its true negative impact on the target only after some time has passed and the target perceives the source’s behavior as intentional.

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. al., 2002). A serious limitation of this study is how applicable these findings are 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 manager in the United States.

Pool and Birkelbach (2011) 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, 2011). 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.

One 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 realize that a person's perception and interpretation of the social undermining they experience can have negative effects (such as revenge and avoidance) that may impact those around them.

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 play in their subordinates' job satisfaction. 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.

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. 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; a victim of vicarious social undermining is one who is indirectly, rather than directly, exposed to social undermining.

One area that is conceptually similar to the idea of vicarious social undermining is ambient sexual harassment. Sexual harassment and social undermining are both deviant workplace behaviors and may be classified as job-related stressors. 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,



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hear about, or are mindful of the sexual harassment of others (Glomb, Richman, Hulin, Dragsow, Schneider, & Fitzgerald, 1997). 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. al., 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. 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.

In the first study to investigate the impact of vicarious social undermining in the workplace, Fonseca and Pool (2011) evaluated whether vicarious social undermining was related to negative workplace outcomes including job withdrawal, intention to quit, organizational commitment and supervisor satisfaction. To measure vicarious social undermining the authors modified Pool and Birkelbach's (2011) *Social Undermining Questionnaire* to assess how frequently participants witnessed a supervisor socially undermine a coworker. Participants included 164 full-time and part-time employees across a broad spectrum of industries, ranging from construction to software.

A hierarchical multiple regression analyses revealed that vicarious social undermining does lead to negative workplace outcomes. Specifically, Fonseca and Pool (2011) found that vicarious social undermining was positively related to job withdrawal, meaning that the more vicarious social undermining an employee experienced, the more likely they were to engage in job withdrawal behaviors. Vicarious social undermining was also positively related to intention to quit. That is, those who experienced vicarious social undermining reported greater intentions to quit their jobs than those who did not experience vicarious social undermining. A negative relationship was found between vicarious social undermining and supervisor satisfaction. The more vicarious social undermining a witness experienced, the less satisfied he or she reported they were with their supervisor. Organizational commitment was not found to be related to vicarious social undermining.

Perceived Organizational Support

Even within the same organization, some employees may feel supported and valued, but other employees may believe that the organization doesn't care or value them. The perception of organizational support can have an impact on many different aspects of an employee's worklife. Perceived organizational support (POS) is defined as an employee's global belief concerning the extent to which the organization values their contributions and cares about their well-being (Eisenberger, Huntington, Hutchinson, & Sowa, 1986). Previous research has shown both negative and positive impacts on employees due to the amount of perceived organizational support they experience. One study found that perceived organizational support reduces absenteeism (Eisenberger, et. al., 1986). This study also found that for those employees with a strong exchange approach, the relationship between perceived organizational support and absenteeism was greater. Another study

found that perceived organizational support is related to felt obligation to care about the organization (Eseinberger, Armeli, Rexwinkel, Lynch, & Rhoades, 2001). This study also found that felt obligation mediated the relationships between perceived organizational support and affective commitment, organizational spontaneity, and in-role performance. The purpose of this study was to test the reciprocation of POS, and results supported the hypothesis that perceived organizational support strengthens affective commitment and performance by a reciprocation process (Eseinberger, et. al., 2001).

Both perceived organizational support and actual organizational support cause employees to feel a sense of obligation to the employer. One study researched the buffering effect of organizational support (instrumental and informational) on the negative consequences of workplace aggression (Schat & Kelloway, 2003). This study found that instrumental organization support moderated the effects of workplace violence on emotional well-being, somatic health, and job related affect; while informational organizational commitment moderated the effects of workplace violence on emotional well-being.

Present Research

Previous research has shown that the experience of vicarious social undermining has negative effects for individuals. The present research will expand our understanding of vicarious social undermining by investigating whether perceived organizational support moderates the relationship between vicarious social undermining and negative job outcomes including job withdrawal, intention to quit, supervisor satisfaction, and organizational commitment.

We hypothesize that the relationships between vicarious social undermining and job withdrawal, intention to quit, supervisor satisfaction and organizational commitment will change across levels of perceived organizational support.

Specifically, we believe that as perceived organizational support increases, the relationship between vicarious social undermining and job withdrawal will be weakened. So, the more perceived organizational support participants feel the less likely they will engage in job withdrawal behaviors after experiencing vicarious social undermining.

Our second hypothesis is that as perceived organizational support increases, the relationship between vicarious social undermining and intention to quit will be weakened. The more perceived organizational support employees have, the less likely they are to want to quit after experiencing vicarious social undermining.

As perceived organizational support decreases, we hypothesize that the relationship between vicarious social undermining and supervisor satisfaction will be strengthened. The less perceived organizational support employees have, the less satisfied they will be with their supervisor after experiencing vicarious social undermining.

Finally, because our previous research did not reveal a significant relationship between vicarious social undermining and organizational commitment, we are unable to form a clear hypothesis about how perceived organizational support may influence the relationship.

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%, $n =$

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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). 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.

Perceived Organizational Support. Organizational Support was measured using a condensed version of the *Survey of Perceived Organizational Support* (Eisenberger, et. al., 1986). The scale consists of 36-items, but due to the length of our survey we chose to use only 9 items. Participants were asked to answer to what extent they agreed or disagreed on a 7-point Likert scale ranging from *Strongly Agree* (1) to *Strongly Disagree* (7). The items included made both positive and negative reference to the organization, ranging from "the organization strongly considers my goals and values" to "the organization shows very little concern for me".



Table 1.
Vicarious Social Undermining Questionnaire

Items
<i>How often have you observed your SUPERVISOR intentionally do the following to a COWORKER?</i>
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).



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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, of the three types of organizational commitment, affective commitment consistently has the strongest association with other work-related variables. Given this, we chose to use only affective 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 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 *Leadership and Knowledge Management Index* (Federal register; rules and regulations, 2006) followed by the *Positive and Negative Affect Scale* (Watson, et. al., 1988). Finally participants completed the 9-item *Survey of Perceived Organizational Support* (Eisenberger, et. al., 1986).

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.

Results

A six step hierarchal multiple regression analysis was used to test whether perceived organizational support (POS) moderates the relationships between vicarious social undermining and 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 entered as the next control variable 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 and perceived organizational support to test the unique contribution of vicarious social undermining and the moderator variable perceived organizational support. Step 6 tests the interaction between vicarious social undermining and perceived organizational support. In order to test for moderation, we followed guidelines set by Baron and Kenney (1986). Both VSU and POS were centered and a product term was created by multiplying the centered variables together. A significant moderator effect indicates that the relationship between a predictor and criterion variable changes across levels of the moderator. 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). Table 2 shows the results of the hierarchical regression analyses for job withdrawal, intention to quit, supervisor satisfaction, and affective organizational commitment as well as the *B* weight estimates for the full regression models.

Job Withdrawal

In Step 1, negative affect was found to be positively related to job withdrawal, $R^2 = .103$, ($p < .01$). The more negative affect an employee had, the more likely they were to engage in job withdrawal. Participant sex was not found to be related to job withdrawal. Step 3 yielded a negative relationship between the amount of hours worked per week and job withdrawal, $\Delta R^2 = .037$, ($p < .05$); meaning the less hours the participant worked, the more likely they were to engage in job withdrawal. Neither the number of employees that report to the supervisor nor the supervisor's sex was significant. Vicarious social undermining showed a positive relationship to job withdrawal in Step 5. The more vicarious social undermining a participant experienced, the more job withdrawal they engaged in, $\Delta R^2 = .057$, ($p < .01$). No relationship was found in Step 6 and our hypothesis was not supported. Table 2 shows the results of the hierarchal regression analysis and *B* weight estimates for the full regression model for job withdrawal behavior.

Intention to Quit

In Step 1, positive affect explained unique variance and was found to be negatively related to intention to quit, $R^2 = .224$, ($p < .01$). The more positive affect a participant had the less likely they were to report intending to quit their jobs. Steps 2, 3 and 4 yielded no significance for intention to quit. Step 5 showed that vicarious social undermining was positively related to intention to quit, $\Delta R^2 = .094$, ($p < .05$). The more vicarious social undermining a participant experienced, the more they reported intentions of quitting their job. No relationship was found in Step 6. Table 2 shows the results of

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the hierarchical regression analysis and *B* weight estimates for the full regression model for intention to quit.

Supervisor Satisfaction

In step 1 positive affect was found to account for some of the variance of supervisor satisfaction, $R^2 = .113$ ($p < .01$). The more positive affect a participant had in the past few months, they were likely to report more satisfaction with their supervisor. Step 2 yielded no significance for participants' sex. Step 3 found a relationship between the amount of hours an employee worked and supervisor satisfaction, $\Delta R^2 = .066$ ($p < .01$); the more hours an employee worked, the less satisfied they reported being with their supervisor. Neither the number of employees that report to the supervisor nor the supervisor's sex was found to be significant. In Step 5 both vicarious social undermining and perceived organizational support were found to be related to supervisor satisfaction. Vicarious social undermining, was found to be negatively related to supervisor satisfaction $\Delta R^2 = .289$, ($p < .01$); the more vicarious social undermining one experiences, the less satisfied he or she reported being with their supervisor. Perceived organizational support was found to be positively related to supervisor satisfaction, $\Delta R^2 = .289$, ($p < .01$); the more POS a participant experienced, the more satisfied they reported being with their supervisor. Now in step 6 we were studying to see if POS had a moderator effect on SS; unfortunately it did not. Table 2 shows the *B* weight estimates for the full regression model for supervisor satisfaction.

Affective Organizational Commitment

In Step 1, positive affect was found to be positively related to affective organization commitment, $R^2 = .175$, ($p < .01$). The more positive affect an employee had, the more affective commitment they had. Participants' sex, tenure, or number of hours worked per week did not predict affective organizational commitment. In Step 5 the number of employees that report to the supervisor appeared to be negatively related to organizational commitment and perceived organizational support was associated as well, $\Delta R^2 = .178$, ($p < .01$). The greater the number of employees that reported to a supervisor the less organizational commitment an employee had. The more perceived organizational support one had, the more affective organizational commitment they reported having as well. The interaction of vicarious social undermining and perceived organizational support did not reach significance, $\Delta R^2 = .016$, ($p = .080$). Table 2 shows the *B* weight estimates for the full regression model for affective organizational commitment.

Table 2
Summary of Hierarchical Regression Analysis for Vicarious Social Undermining and Perceived Organizational Support Predicting Job Withdrawal, Intention to Quit, Supervisor Satisfaction, and Affective Organizational Commitment.

Variables	JW	ITQ	SS	AC
	<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
Step 1				
Negative Affect	.282**	.018	-.026	-.109
Positive Affect	-.133	-.472**	.333**	.396**
Step 2				
Negative Affect	.261**	.002	-.037	-.109
Positive Affect	-.118	-.461**	.341**	.397**
Sex	-.124	-.110	-.064	.000
Step 3				
Negative Affect	.246**	-.009	-.058	-.104
Positive Affect	-.129	-.473**	.328**	.399**
Sex	-.118	-.108	-.053	-.003
Tenure	-.097	.009	-.044	-.004
Hours Worked per Week	-.178*	-.086	-.224**	.050
Step 4				
Negative Affect	.243**	-.008	-.032	-.084
Positive Affect	-.137	-.480**	.323**	.416**
Sex	-.114	-.111	-.020	.000
Tenure	-.093	.013	-.056	-.018
Hours Worked per Week	-.172*	-.083	-.205*	.043
Employees that report to supervisor	.051	.045	-.056	-.162
Supervisor Sex	.016	-.001	.129	.016
Step 5				
Negative Affect	.218*	-.070	.049	-.033
Positive Affect	-.128	-.385**	.182*	.266**
Sex	-.129	-.154	.043	.047
Tenure	-.084	.016	-.046	.011
Hours Worked per Week	-.192*	-.138	-.092	.142
Employees that report to supervisor	.018	.017	.005	-.149*
Supervisor Sex	.047	-.007	.094	.031
Vicarious Social Undermining	.256**	.236*	-.397**	-.005
Perceived Organizational Support	.027	-.165	.349**	.460*

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Step 6	Variables	JW	ITQ	SS	AC
		<i>B</i>	<i>B</i>	<i>B</i>	<i>B</i>
	Negative Affect	.226**	-.056	.045	-.043
	Positive Affect	-.119	-.354**	.176*	.254**
	Sex	-.130	-.159	.043	.048
	Tenure	-.082	.020	-.046	.010
	Hours Worked per Week	-.183*	-.120	-.097	.131
	Employees that report to supervisor	.024	-.007	.001	-.158*
	Supervisor Sex	.060	.010	.086	.014
	Vicarious Social Undermining	.358**	.396**	-.458**	-.140
	Perceived Organizational Support	.050	-.177	.336**	.431**
	Moderator	.136	.220	-.082	-.181

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

Discussion

Workplace aggression is an important topic of research. It is important to understand the different types of aggression there is in order to be able to address different problems, and, hopefully, work toward solutions. Vicarious social undermining is a newly discovered type of workplace aggression and there is a lot that is unknown about it. What we do know is that it has clear negative effects on those who experience it, which is bad for both the employee and the organization. Perceived organizational support was positively associated with supervisor satisfaction and affective organizational commitment. Unfortunately, this study did not find that perceived organizational support acted as a moderator for the negative outcomes of social undermining.

Limitations

Although our hypotheses were not supported, this study did have some limitations. Our first limitation was the size of our sample. Also, some control variables included in our analysis could have been replaced or omitted because they had no effect on the criterion. For example, sex of participant never emerged as a significant predictor of any of our criterion variables. A majority of our participants were part-time employees, which may allow for our study to be more applicable to those with part-time jobs.

Future Research

The next step in our research will be to investigate other variables that could act as moderators to the relationships between vicarious social undermining and the negative outcomes. It is also important to investigate the factor structure of vicarious social undermining. We know that social undermining is comprised of two underlying factors: interpersonal hostility and obstructionism. We do not know if vicarious social influence has a similar structure.

Conclusion

Although we were unable to support our hypotheses that perceived organizational support acts as a moderator on the negative outcomes of vicarious social undermining, this research contributes to our understanding of vicarious social undermining.

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Product Placement in Spanish Language Telenovelas Broadcasted in the United States



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Abstract

Product placement has been present in American, English-language films and television since the early 1900s (Newell, Salmon, & Chang, 2006). Over the past ten years, product placement has steadily strengthened its presence in Spanish language programming, including the popular telenovelas, broadcasted in the United States. It has evolved from separated features in programs to a more sophisticated presence in storylines as demonstrated in the recent production of "Eva Luna" by Univision and Venevision in 2010 (Vega, 2011). This article reviews the evolution of product placement in the Spanish language programming broadcasted in the United States and compares the frequency and types of product placement in Spanish language telenovelas broadcasted in Primetime over the course of a week. Noting the mass exportation of telenovelas from various countries of production, the article explores the international implications of product placement on a brand.



Product Placement in Spanish Language Telenovelas

The first section of the paper provides a review of the literature on the origin of the telenovela, the audience reach of the telenovela, the history of product placement and the development of product placement in the Spanish language telenovelas, with a focus on telenovelas broadcasted in the United States. The second section explains the methodology used to identify and compare product placement in two different telenovelas over a specific period of time. A section on the production and exportation of telenovelas on a global scale follows. This section is followed by an analysis of the findings of the comparisons. A summary of the findings and suggestions for further research on this topic are provided in the conclusions.

Introduction

In 2011, Univision, the largest Spanish media network in the United States, reported commercial sales between \$1.7 billion and \$1.8 billion (Vega, 2011). The president of advertising sales and marketing for Univision, David Lawenda, attributes the dollar volume sales growth to partnerships with ad agencies that incorporate their products into its programming (Vega, 2011). An example of such a partnership is 2010's telenovela, *Eva Luna*, produced by Univision and Venevision. In the novela, the protagonist is an executive at an ad agency. Her team produces a commercial for Buick that is aired during the telenovela and on other network media channels apart from the program with ad agencies aiming for integration rather than presentation in sponsored programs. Telemundo, the principal rival to Univision in the United States Hispanic market, also reported an increase in upfront sales to \$400 million in 2011 (Vega, 2011). The trend of product placement in media programming is set to increase. A representative of Telemundo noted an ultimate goal of producing an entire program in collaboration "with an advertising partner" (Vega, 2011). Arguably the most popular work of fiction in Latin America, the telenovela actively participates in the reality of its viewers (de la Barrera, 2009). As modern technology continues to develop commercial-free alternatives, an evaluation of modern product placement strategies in telenovelas is warranted in order for advertising agencies to successfully connect with their designated markets. Furthermore, inorganic product placement may alienate viewers. A study of product placement in Spanish language telenovelas may yield effective product placement integration that evolves and includes the latest technological advances such as virtual product features online and mobile applications (Wentz, 2010). An example of a recent virtual product feature is Telemundo's online platform for virtual test drives of Ford vehicles (Wentz, 2010).

The purpose of this research study is to identify and compare the frequency and types of product placements that are trending in modern Spanish language telenovelas in the United States. Stemming from the mass exportation of telenovelas by various countries, the implications of product placement for corporate sponsorships are explored from an international exportation perspective. Telenovelas broadcasted in Primetime on Telemundo were analyzed to identify the frequency and types of product placements that are trending in modern Spanish language programming in the United States.

Methodology

Articles published within the last ten years were reviewed to understand the published trends of product placement in television prior to this study. Patterns and paradigms in telenovela production and exportation are noted in this paper. Over a five day period, the telenovelas broadcasted on Telemundo during Primetime, "Corazon Valiente" and "Pablo Escobar" were recorded and viewed to establish the appearance and were reviewed.

The History of the Telenovela

Telenovelas are limited to a specific number of episodes and have a definitive ending (Matelski, 2010). As an instrument of education, the telenovela enjoys immense success. In Cuba, the telenovela has been used to promote awareness of issues such as “AIDS and homophobia” (Matelski, 2010, p. 186). Telenovelas usually cast high-profile actors and actresses that the audiences recognize and favor as protagonists. The approach to production is similar to Hollywood in that it is very theatrical and similar to cinema versus the the English language television shows that are modeled after “New York style stage techniques” (Matelski, 2010, p. 187). The modern telenovela actually originated during the late 1800s in Cuban cigar factories (Matelski, 2010). In the 1800s when Cuba was still a Spanish colony producing cigars in factories, the work conditions of the factory workers and the long hours rolling up cigars drove administrators to find ways of maintaining the work morale and energy of workers throughout the monotonous work day (Matelski, 2010). Consequently, literate employees called “lectores de tabaco” were hired to read novels, often translations of classics by Alexandre Dumas and Victor Hugo to the workers as a form of entertainment (Matelski, 2010, p. 188). In the 1920s, the radio provided an outlet through which the activity of reading novels could reach a mass audience. This gave birth to the radionovela which involved the reading of novels and scripts on the radiowaves with suspense and romance projected through pitch changes in voice (Matelski, 2010). The radio waves were “easily accesible, required only one sense”, and was limited solely by “one’s imagination” (Matelski, 2010, p. 188). The origins of the modern telenovela reveal consistency in reaching a heterogenous audience (Matelski, 2010). Between 1951 and 1958, Brazil, Mexico, and Cuba produced and aired their first novelas to a television audience (Matelski, 2010). Hence, this period saw the birth of the modern day telenovela. In the early 1950s, Fidel Castro was a supporter of the telenovela in Cuba, seeking its influence to persuade the audience in favor of his revolutionary ideals (Matelski, 2010). He encouraged Cuban scriptwriters to promote the revolutionary ideals in the telenovelas. By 1959, the reality of Castro’s ideals were not seen as beneficial to the country by many and hundreds fled Cuba. Most of Cuba’s prolific screenwriters fled and settled across Latin America writing for production companies in Mexico, Venezuela, and Brazil (Matelski, 2010). This exodus exported the creative storytelling from Cuba to the television screens across Latin America. Despite a paradigm shift from radio to television, the essence of the telenovela generally remains the same. Notable modifications include the “aesthetic packaging” and “technological outreach” available through modern techonological advances (Matelski, 2010, p. 191).

Audience Reach of Telenovelas

Telenovelas are “melodramas that oppose two conflicting views to which the audience can either accept or oppose” (Pumarejo-Lopez, 2007, p. 201). Ryerson once said that “romantic fiction is as powerful in its ability to attract as it is in its ability to formulate national cultures” (Pumarejo-Lopez, 2007, p. 202). After the fall of the Soviet Union, Latin-American produced telenovelas rose in demand in Spain, Italy, Russia and countries within the former Soviet bloc. The tragedies portrayed in the telenovelas coincided with tragedies that had occurred to many of the countries viewing the telenovelas (Pumarejo-Lopez, 2007). Thus the viewers could vicariously express their sorrow through the sorrow present in the telenovela storylines. Telenovelas typically revolve around a storyline that presents a clash between “tradition and modernity” or justice and injustice (Pumarejo-Lopez, 2007). Telenovelas are “consumed in over 130 countries” (Acosta-Alzuru, 2010,

p. 185). They have the strategic advantage of reaching all audiences regardless of socio-economic status and gender with the purpose of entertaining (de la Barrera, 2009). The simultaneous combination of “identification, recognition, and aspiration” power telenovelas to international success (Acosta-Alzuru, 2010, p. 198). It has been noted that the telenovela is a powerful tool for “entertainment and education” (de la Barrera, 2009, p. 65). This is due to the fictional aspect of telenovela; it allows for the exploration of various themes, values, social issues, and characters relevant to reality in a fictional arena (Fuenzalida, 2011). The consumer markets seek “ideals and templates” for real life in telenovelas (Kjeldgaard & Nielsen, 2010, p. 30). To an extent, telenovela audiences expect telenovelas to “mirror reality” (Acosta-Alzuru, 2010, p. 198). However, telenovela viewers are highly sensitive to the messages in the storylines and “turn away from telenovelas that are overt public service announcements” (Acosta-Alzuru, 2010, p. 199). Telenovelas promote family values and tolerance, in a sense establishing a national identity through the process (Pumarejo-Lopez, 2007). Telenovela producers, Globo in Brazil and Televisa in Mexico “developed methodologies to link the audience to characters with desired values and behaviors” (Pumarejo-Lopez, 2007, p. 200) In the 1980s, English language television aimed at a mass audience. But soon after, a paradigm shift occurred transferring the target of viewership to a more focused group of viewers. Contrary to English language television shows, telenovelas have continued to be aimed at a mass audiences while keeping the stronghold in female viewership. Recently there have been productions aimed at segmented groups of viewers (Pumarejo-Lopez, 2007). This again hints at a time lag in trends between English language television shows and the traditional Spanish language telenovela. The largest audience of telenovelas are clearly feminine (Orozco and Vassallo in Gomez Orozco & de Lopes, 2010). Brazil, Mexico, and the United States stand out as the countries with the largest range of viewers from the ages of 24 to 49 years (Gomez Orozco & de Lopes, 2010). The telenovelas with the highest rating worldwide are the telenovelas produced and exported by Televisa, Mexico’s media giant (Medina & Barron, 2010). Television consumption increased in Iberoamerica to four hours of television viewing per day with the exception of Brazil, which is experiencing a shift to Internet viewing (Gomez Orozco & de Lopes, 2010).

Historical Overview of Product Placement in Telenovelas

Product placement is “the practice whereby manufacturers of goods or service providers gain exposure for their products by paying for them to be displayed, mentioned, or used in the media” such as in films and television programming (Oxford University Press, 2012, p. 1). The term “product placement” did not come into use in the United States until the 1980s (Harmetz in Newell, Salmon, & Chang, 2006). Historically, branded products provided by manufacturers were welcome in production because it reduced the costs of production by supplying props through cash free arrangements. Newell, Salmon and Chang, note the collaboration between art and commerce in American filmmaking as early as 1896 under other terms such as “tie-ins” and “tie-ups”. “Tie-ins and tie-ups” in motion pictures were a combination of on screen appearances of a product and off screen endorsements by the network talent (personalities) at promotional events for the film (Newell, Salmon, & Chang, 2006, p. 576). The collaboration between filmmakers and product advertisers was considered mutually beneficial. However, the collaboration with television did not receive the same reception. Initially, product placement in television created an opposed encounter between “networks and sponsors and product promoters” for several reasons (Newell, Salmon, & Chang, 2006, p. 584). At the time, broadcast



networks had agreed to limit commercial time and product placement qualified as on screen advertising, reducing the amount of advertising available for sale (Newell, Salmon, & Chang, 2006). Nonadvertisers that allowed their products to be used as props were getting access to what other advertisers were paying for (Newell, Salmon, & Chang, 2006). Also, the offscreen publicity opportunities available in the film industry were less competitive in the television industry where there was a lower cost of production (Newell, Salmon, & Chang, 2006). Product placement in television began as discrete arrangements between product promoters and on-screen talent in which cash was paid to talent for on-screen promotion (Newell, Salmon, & Chang, 2006). Following establishment of product placement into television, concerns over “taste in programming and advertising” appeared in NBC’s Continuity Acceptance reports from the 1950s (Newell, Salmon, & Chang, 2006, p. 585). Instances of cutting product features and brand names from scripts began to occur, accompanied by a mandate requiring props to be without brand labels. However, script lines with brand names that slipped through the sensors produced outcries from product promoters that mentioned products had an unfair advantage. It became clear that separation of programming from advertising opportunities was unfeasible. The aim at advertising revenue from product placement was attempted “at least since the 1950s” (Newell, Salmon, & Chang, 2006, p. 590). Nevertheless, most product placement occurred as a result of cash-free arrangements in which production received free branded props that ranged from household products to real estate, reducing the cost of production (Newell, Salmon, & Chang, 2006). While reality shows debuted much later on the Hispanic screen than the general market (English language) television screen, product placement similarly found easy involvement because brand names support characters that “the audience can relate to” (Baar & Flass, 2003). Reality shows provide an effective product placement location because interaction with brands is an interaction that happens in real life. The telenovela is the most popular TV fiction format in Iberoamerica particularly during the primetime segment (Gomez Orozco & de Lopes, 2010). It’s precisely in the fiction genre of television that the most experimentation in advertising occurs (Gomez Orozco & de Lopes, 2010). In the midst of a global economic slowdown, producers of Spanish language programming have been innovative in advertising models for clients (Gomez Orozco & de Lopes, 2010). Auto industry advertisement have traditionally been highly represented in Spanish language programming (Gomez Orozco & de Lopes, 2010). Advertising is a key stream of revenue for the television producers. The 2008 crisis did result in a decrease in advertising in the United States due to the trouble in the auto industry. Advertising and propaganda have increased their presence in telenovelas beyond mere product placement; they are becoming more “naturalized” (Gomez Orozco & de Lopes, 2010, p. 32). Telenovelas occupy the primetime slots in the majority of Iberomamerican countries (Gomez Orozco & de Lopes, 2010). Advertisers have long known that telenovelas are highly favored and consumed. To capitalize on the opportunity, advertisers have increasingly been establishing product integration in telenovelas. Product placement is becoming more “naturalized” (Gomez Orozco & de Lopes, 2010, p. 38). A decrease in commercial investments in Iberoamerican television observed in 2008 is relative because while commercials may have been down, innovation was seen in product placement, site placement and script lines that subtly advertised (Gomez Orozco & de Lopes, 2010). There is a noticeable trend in “site placement”, that is a feature of a particular touristic site in a telenovela paid by the local organizations to promote tourism to the location (Gomez Orozco & de Lopes, 2010). The most popular brands to be placed in television fiction are those of household



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products and cosmetics (Gomez Orozco & de Lopes, 2010). However, new technologies and automobiles are growing in presence as well (Gomez Orozco & de Lopes, 2010)

Benefits of Product Placement in Telenovelas

The innovations in product placement play an important role in the development of viewers. For example, a small survey conducted in the United States among those within the age group of 18-25 showed that those that are attached to a television program have their identity shaped by product placements stances in the program. This age group was targeted because according to Rowe, individuals at this stage are still forming their identities (Rowe 2012). Telenovelas can project values, experiences, social topics, and even brands. The integration of branded products into a telenovela naturally supports the realistic element of a storyline and its characters. Latino and African-American purchasing power in the United States is growing faster than that of Caucasian households, yet these growing markets are under represented in advertising investments (Albert, 2008). The Latino market is spending more and more time on modern media platforms such as Internet and mobile phones. It is becoming increasingly important for media companies to attract the attention of these markets, formerly considered “niche”, and deliver ratings in order to compete for shares in advertising sales (Albert, 2008). A 2008 nationally represented survey by Albert demonstrated ethnic differences in the “adoption of technology and television programming” (Albert, 2008, p. 235) In addition, TV types, categories of interaction with TV, appeared to be set. Initial research found that Latinos tended to be “more satisfied” with television “than Caucasians, preferred radio over newspapers, and most enjoy soap operas, movies, and game shows” (Albert, 2008, p. 237). Rios and Gaines established that “Latinos differ in their use of general market (English language) and Spanish language media” for cultural preservation (Albert, 2008, p. 237). In the study by Albert, over “30 percent of Latino audiences were TV innovators”, making them highly attractive to broadcasting companies. TV innovators are characterized by an interest in “new technologies, research programming, are more likely to subscribe and are sought for advice in using new technologies” (Albert, 2008, p. 238). According to the characteristics described by Albert, Latino audiences become highly involved in programs that are aligned with their values. TV innovators seek television that is “fun-oriented” (Albert, 2008, p. 244). Positive interaction with programming can be achieved by involving the Latino audience in the program development process (Albert, 2008). Brand relationships thrive off of the same characteristics as personal relationships (Brennan, 2009). Sponsorships are “deliberate attempts to make friends, to establish relationships” (Brennan, 2009, p. 250). If a brand stands beside a program that is viewed by a market it wants to reach and does so in a way that compliments the nature of the program, positive interaction with the brand will occur (Brennan, 2009). In a study sponsored by Thinkbox, it was confirmed that television sponsorship’s “greatest effect is on the implicit and emotional mind” (Brennan, 2009, p. 252). Therefore, it is more important for a television sponsorship to establish association than to convey information. The study also found that a brand had more success with viewers that have a strong relationship with the program being sponsored (Brennan, 2009). Fans of programs are “more likely to like sponsors than normal viewers” (Brennan, 2009, p. 252). Optimum results occur when “sponsorship bumpers” introduce the brand to a viewer that already has a strong relationship established with the program (Brennan, 2009, p. 252). Where there was an “obvious link between sponsorship bumpers and the program, brands performed well across various measures such as fame and intent to purchase” (Brennan, 2009, p. 252). Sponsorship needs to be creative to relate to the program or at



least be repetitive so as to establish the relationship over time. Sponsorships that take on a longer term perform better than short term sponsorships because they have time to “nurture the relationship” (Brennan, 2009, p. 253). Short term sponsorships do not result in optimal rewards but are still successful when the link between the brand and the program is obvious and natural (Brennan, 2009). Brands that do not have a natural link to a program may still benefit from longevity in its association due to what Thinkbox terms “brand rub” (Brennan, 2009, p. 253). Brand rub is the phenomenon in which a brand can take on personalities of a program and vice versa (Brennan, 2009). Brand rub is more likely to follow when longevity in a program takes place. In a qualitative study by Thinkbox, respondents were unable to identify a sponsorship in the program but used similar phrases and words to describe the sponsored brand and the program (Brennan, 2009). This indicates that, to the fans of the program, the personalities of the brand and the program “had morphed” (Brennan, 2009, p. 255). Sponsorship increases brand fame due to “fantastic perceptions” that if a brand is able to sponsor a program they have clearly grown and are strong forces in the market (Brennan, 2009). Television is the strongest vehicle in perceptions of fame (Brennan, 2009). In a study by Les Binet and Peter Field, fame was found to be a major factor in “business profitability and success” (Brennan, 2009, p. 255). The fame aspect favors a brand because even viewers that are not fans and do not follow a program will perceive the brand to be famous (Brennan, 2009). Viewer interaction with a brand is driven more by implicit and emotional factors than explicit reaction to information. Thus, Brennan recommends that a brand seek ways to enter a social relationship with viewers (Brennan, 2009). In responses to the growth in Hispanic audiences, public relations groups are increasingly advised to translate media, conduct research on the Hispanic market, and embark on campaigns tailored to the Hispanic audience (Mateas, 2007). Telenovelas lend themselves to the integration of a political, social, and commercial propaganda through the inclusion of such in the actual storyline (Gomez Orozco & de Lopes, 2010). Sponsorship of a Spanish language telenovela with a strong viewership is a perfect opportunity for relationships.

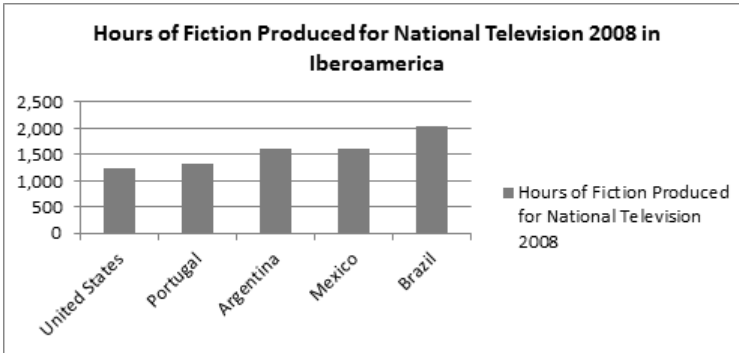
Implications of Product Placement Through Telenovela Production and Exportation

Since the 1970s, major producers of telenovelas in Latin America have flooded international television with their content (Medina & Barron, 2010). The trend has continued to accelerate due to the privatization of networks beginning in the 1990s around the world that increased the amount of channels available and the demand for programming (Medina & Barron, 2010). The economic growth of the Latin American region strengthened the capital investment in the audiovisual industry and development the distribution process (Medina & Barron, 2010). Globalization resulted in the diffusion of Latin American culture to other regions such as Europe, increasing the demand for Latin-American telenovelas (Medina & Barron, 2010). The interest in the Spanish language has also contributed to the demand for telenovelas at the global scale (Medina & Barron, 2010). By 1975, telenovelas were being aired in China and in 1980, Televisa began exporting its telenovelas to Europe. Over the past ten years, approximately 200 telenovelas of Mexican, Brazilian, Argentinian, and Colombian origin have been exported to Russia and Eastern Europe bringing in about 200 million dollars of revenues a year (Medina & Barron, 2010). Televisa, the largest Spanish language broadcaster in the world with headquarters in Mexico City, produces about 50,000 hours of telenovela programming each year for export to over 50 countries (Dias, 2012). In 2008, Brazil was the nation that produced the most fiction for television followed by Mexico, Argentina, Portugal, and the United States (Gomez Orozco & de



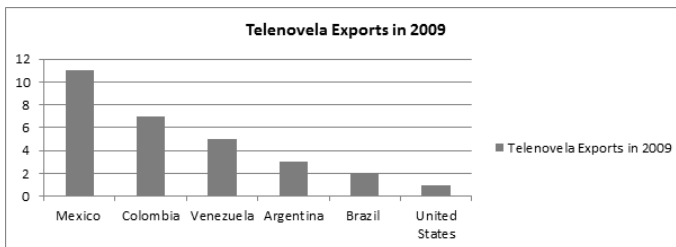
Product Placement in Spanish Language Telenovelas

Lopes, 2010). From 2006 to 2008 the United States was the largest importer of Spanish language fiction for television in terms of hours (Gomez Orozco & de Lopes, 2010). Mexico and Brazil were the countries that had the least amount of imported hours of programming in Iberoamerica (Gomez Orozco & de Lopes, 2010). The programs by Brazil and Mexico tended to be longer in lengths and speak to the capacity of production of both countries (Gomez Orozco & de Lopes, 2010). The popularity of telenovelas has prompted the production of telenovelas within countries that normally import telenovelas (Medina & Barron, 2010). It should be noted that telenovelas that produced with a local focus tend to be more difficult to export (Waisbord in Medina & Barron, 2010). Programming produced in Iberoamerica at the national level occupied the primetime segment, considered the most commercial time in television (Gomez Orozco & de Lopes, 2010). In an observation by Orozco Gomez and de Lopes, telenovelas were the most popular productions by Iberoamerican countries with the exception of Spain who emphasized miniseries in their productions (Gomez Orozco & de Lopes, 2010). Brazil, Mexico, and Argentina are the biggest producers of telenovelas in Iberoamerica (Gomez Orozco & de Lopes, 2010).



Source: (Gomez Orozco & de Lopes, 2010)

A growing trend in the process of telenovela production is the importing of telenovela scripts (Gomez Orozco & de Lopes, 2010). Approximately fifty percent of Mexico's scripts are of foreign source although the telenovela itself is produced locally (Gomez Orozco & de Lopes, 2010). While Rede Globo in Brazil and Televisa in Mexico continue to be the major producers of television fiction such as telenovelas, a decentralization of production is being pioneered by small production companies as is the case in Argentina (Gomez Orozco & de Lopes, 2010).



Source: (Medina & Barron, 2010)

The following chart lists the largest telenovela exporters with established distribution systems in Latin America and their country of origin.

Largest Telenovela Exporters in Latin America

Company	Country of Origin
Televisa	Mexico
TV Globo	Brazil
Telefe	Argentina
RCN	Colombia
TV Azteca	Mexico
Telemundo	United States
Venevision	Venezuela

Source: (Medina & Barron, 2010)

The remaking of telenovelas creates opportunities for international brand exposure. According to demand, telenovelas may be exported and then dubbed in the language of the importer. Or the script may be exported for production in a foreign. Once the production of the remake is under the direction of the importing country, the producers may negotiate sponsorships with local brands or international brands seeking to connect with their markets. Due to political and cultural differences, scripts are often rewritten when remade abroad. For example, for the Chinese version of ‘Ugly Betty’, the script had to be rewritten to remove Betty’s multiple siblings due to the one-child policy present in China (Madden, 2008). The rewriting of scripts facilitates the inclusion of brands in the rewritten script for the country of production. Settings such as ad agencies and production companies allow for a variety brands to be included as part of the storylines. Audiences will expect brands to be mentioned if the setting is a media outlet itself. Brands such as Unilever’s Dove, Clear, and Lipton’s Milk Tea are planned to integrate in a production of the classic telenovela, “Yo soy Betty, la Fea” in China (Fitzsimmons, 2008, p. 8). This new production is expected to “inject renewed vigor” into the brands (Fitzsimmons, 2008, p. 8). In the production characters will “be associated with products” in the program and in publicity events for the telenovela (Fitzsimmons, 2008). An example of this character association with the products are the products branded Dove and Clear. Dove is perceived as gentle and tender (Fitzsimmons, 2008). Therefore, Betty’s character which is also gentle will be associated with Dove (Fitzsimmons, 2008). Clear, an anti-dandruff shampoo will be associated with Fernando, Betty’s boss because that product is aimed at a male, urban audience (Fitzsimmons, 2008). Lipton’s Milk Tea will be featured as product that impacts the mood of the characters as they tend to be more relaxed after tea breaks in which they drink Lipton Milk Tea (Fitzsimmons, 2008). Sponsorship of a telenovela requires a strong budget as evidenced by the recent sponsorship of ‘Ugly Betty’ in China featuring brands Dove, Clear, and Lipton tea by Unilever. The media director at Unilever disclosed that the sponsorship of ‘Ugly Betty’ in China would take “a large proportion of the media budgets for the three brands” (Madden, 2008).

Frequency and Type of Product Placement

Product placement varies from the mere inclusion of a specific product in a scene that allows the viewer to become familiar with the product to the showcase of product features throughout the storyline. A recent example is Ford's collaboration with Telemundo in the telenovela, *Perro Amor*. One of many scenes with product placement presents two characters entering a Ford vehicle. The male character then turns on the different hues of light to see which one matches the female characters skin tone best (Wentz, 2010). These types of scenes not only present the vehicle to the public, but showcase the features of the model. Viewers are receiving the demonstration of features that would normally occur at a dealership through scenes in the telenovela. Capitalizing on the onscreen presence in telenovelas, the Ford vehicle can be test driven as a telenovela character through webisodes in which the viewer can take the vehicle for a virtual test drive (Wentz, 2010). Types of product placement in this study were divided into the following categories: visual placement, verbal placement, and hands-on placement (Ayman & Kaya Kemal, 2012). Visual placement consisted of a branded product appearing in a scene but not touched by a character. Verbal placement is the mentioned of a branded product in dialogue. Hands-on placement occurs when characters are touching the branded product and using it to carry their scenes. Over a five day period two telenovelas airing on Telemundo during Primetime were analyzed for frequency of product placement. Some of the most common branded products were drinks, particularly beer, and household products such as detergent. Appearances were as long as a few seconds. Brands included the network itself through onscreen appearances in the fictional news reports. The most frequent type of product placement was visual placement, appearing sixty percent of the time in this short study.

Frequency of Product Placement

	Frequency	Percent
Visual Placement	3	60%
Verbal Placement	0	0%
Hands-On Placement	2	40%
Total	5	100%

Conclusion

Product placement has a more recent history with Spanish language television in the United States than English language television. However, the articles in periodicals suggest that the integration of product placements in Spanish language programs are much more naturalized than those initially included in English language television. Although product placement was not as frequent in the telenovelas analyzed, the short time span of this study limits this result to a small insight into the product placement trends in Spanish language telenovelas broadcasted in the United States. In addition, one of the telenovelas, by its historical theme, limited opportunities for product placement. While visual placement appeared more frequently in this study, recent articles suggest that producers will be aiming at diversifying the product placements and seek more hands on placements, particularly in the advertising for the automotive industry. Product placement will continue to be a tool used to connect with international markets at a national level.

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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



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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





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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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Production Techniques in Children's Television Commercials

Table 1

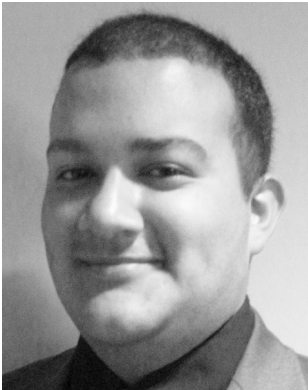
Production Techniques in Girl-Oriented and Boy-Oriented TV Commercials

	Boy and Girl <i>M</i> (N/s)	Boy and Girl <i>SD</i>	Boy <i>M</i> (N/s)	Boy <i>SD</i>	Girl <i>M</i> (N/s)	Girl <i>SD</i>
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.

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

Assessing Refugee Camp Characteristics On The Occurance Of Sexual Violence Against DADAAB Camp Residents: A Preliminary Analysis



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Abstract

Rape in war has received increased attention over the years, first given its proclivity, and second because of variation in its occurrence across conflicts. We observe one particular context of rape in conflict zones – that which takes place in and around refugee camps. Although much of the existing literature has focused on the perpetrators of rape for explaining its variation, we shift the focus to refugee camp characteristics and their effects on rape proclivity. IGOs and NGOs contend that camp characteristics, including the provision of fuel resources, gender-sensitive camp design, the provision of police patrols, and use of community patrols, may reduce the incidence of rape, although these factors have received little attention in the scholarly literature. In order to assess and compare the effectiveness of these four camp characteristics for reducing the incidence of rape, we conduct a qualitative analysis of reports provided by the United Nations High Committee

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on Refugees (UNHCR), noting rape frequency and particular camp characteristics, for four Dadaab camps in Kenya. Ultimately, we find that the most effective means of protecting women from rape in refugee camps are camp design and the use of a local patrol unit, while the provision of resources is found to have little to no effect in reducing the incidence of rape overall. We hope this study will prompt further research of this phenomenon, as well as prescribe policies for developing safer living conditions for refugee camp residents.

INTRODUCTION

Referring to the sack of Rome and St. Augustine's reference to rape in wartime as an "ancient and customary evil," an article in *The Economist* depicts rape in war as old as war itself. It is somewhat expected given the lawless environment created by war. As argued by Henry et al. (2004), war provides not only an opportunity for individuals with predispositions to rape to engage in this act, but it also presents a situational context that might lead even those who would be less inclined to rape in peacetime to be more likely to do so in wartime. The situational context of war, they argue, allows individuals to justify their behaviour, and in-group behaviour of combatant groups to use rape as a means to enhance camaraderie.

Most studies examining rape in war and its variation focus on characteristics of the *perpetrators* of collective rape (Henry et al. 2004, Woods 2006; Woods 2009; Cohen 2011; Humphreys and Weinstein 2006). Where previous scholars focus on *victims or civilians*, it is often at the general level, where they emphasize sociocultural factors pertaining to patriarchal society, gender roles, and more direct measures of gender empowerment in society and politics (Henry et al. 2004; Jefferson 2004). In this study, we also focus on civilians -- potential victims of rape as a result of war and other war crimes -- but examine a lower level of analysis.

For the purposes of this study, rape is treated as a form of civilian abuse as a result of war. Rather than focusing on societal level factors, we identify ground-level factors that might enhance or mitigate the prospects of rape as a result of war. The purpose behind this focus is to be able to suggest stop-gap measures that might decrease the likelihood or prevalence of rape as a result of war. These are short-term measures intended to complement grander goals of peace-building, state-building, and nation-building. Particular emphasis is placed on the living circumstances of those living in and around refugee camps, as the potential for experiencing sexual violence for these civilians is high, particularly when they leave the camp for the bush in search of fuel sources and construction materials, travel between camps, and/or travel unaccompanied by male companions (UNIFEM 2010; Ward and Marsh 2006; Crisp 2000). Policy experts, IGOs, NGOs, and scholars have highlighted the prevalence of sexual violence experienced among refugees across countries and camps, and although the numbers are difficult to ascertain, the stories pertaining to rape severity and effects highlight the sense of urgency to develop measures to mitigate its occurrence.

We narrow the focus to the Dadaab camp complex in Kenya, which is made up primarily of Somali inhabitants, followed by Ethiopians and Burundians in numbers. Given that living circumstances and habits (e.g., leaving the camp for the bush in search of materials) enhance the likelihood of experiencing sexual violence, we assessed the effects of camp characteristics that encourage or discourage certain habits on the frequency of rape. Although accurate information pertaining to sexual violence in and around the camps is wanting, and camp characteristics are difficult to determine solely from secondary



resources, close examination of the Dadaab camp complex and reports pertaining to this complex provided by the UNHCR and various NGOs have enabled us to assess the effect of camp characteristics on sexual violence in and around refugee camps, as well as the effectiveness of measures implemented to mitigate sexual violence.

The results of the study reveal that the habits of civilians (leaving the camp for various reasons and traveling unaccompanied) are the greatest determinants of their proclivity for experiencing sexual violence, given the insecure state outside the camps. Yet, civilians are forced by need of resources to leave the camp and expose themselves to this risk. Furthermore, measures to implement more gender-sensitive camp design and provide resources have been found to be only partially effective.

We use the findings of this study to suggest other avenues of research, highlighting in particular the need for more accurate data pertaining to the frequency and severity of rape in a conflict context, as well as the need for cross-camp analysis. The ultimate goal of this research is to suggest more effective measures for reducing the incidence and severity of sexual violence in and around refugee camps, as well as in other field contexts.

The next section presents existing literature pertaining to rape as a result of war, including studies which emphasize societal, conflict, and combatant characteristics associated with the prevalence of rape in war. This section is then followed by a theoretical argument which focuses on ground-level factors that mitigate or enhance the likelihood that a civilian, particularly a refugee living in or around a refugee camp, will be a rape victim, shifting the focus from high-level societal factors and combatant characteristics to potential victims and their living circumstances. The research design, analysis, and discussion of findings are then presented, in turn.


LITERATURE REVIEW

Numerous scholars have examined the prevalence of rape as a result of war, given the frequency of its occurrence and the atrocities committed. These studies have enhanced our understanding of this phenomenon, first by discounting the notion that rape in war is “inevitable,” given its variation in occurrence across conflicts. Some have highlighted specific factors associated with combatants and the conflict itself that affect the prevalence of rape in war, while others focus on latent societal factors. These are addressed in turn.

Conflict and Combatant Characteristics

In examining variation among the prevalence of rape in war, Farr (2009) identifies four patterns of rape – field-centered/opportunistic, field-centered/woman-targeted, state-led/ethnic-targeted, and state-led/enemy targeted. The most extreme war rape, which Farr defines as “regularized, war-normative acts of sexual violence accompanied by intentional serious harm, including physical injury, physical and psychological torture, and sometimes murder,” (2009:6) is more prevalent in field-centered/opportunistic and state-led/ethnic-targeted patterns. The former pattern is characterized by a weak (nearly “failed”) state, very low levels of economic development, including perpetrators from government and rebel forces. Aggressors use rape not only as a tool of terror, but also use the lawlessness of the environment to rape with impunity. These rapes occur in homes, villages, refugee camps, detention camps, and barracks. Examples of conflicts demonstrating this pattern have taken place in Angola, Burundi, Chad, Congo, Dominican Republic, Cote d’Ivoire, Liberia, Sierra Leone, and Uganda.





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State-led/ethnic-targeted patterns also display high levels of extreme war rape, yet they are distinct from the field/opportunistic form in that these rapes are purposefully conducted by the state, often in detention centers or barracks, and reflect a more intentional strategy of terrorizing a specific group. States are generally stronger in this pattern. Examples of conflicts demonstrating this pattern include those that have taken place in Bosnia, Cambodia, Chechnya, East Timor, Guatemala, Kosovo, Myanmar, Rwanda, and Sudan.

These patterns reveal that in conflicts where the state is either extremely weak and unable to exert its authority, or very strong but purposefully utilizing rape as a tool against specific groups, extreme war rape is more prevalent. Not all conflicts share these characteristics. Furthermore, some have argued that the nature of the issue over which parties are fighting and the ultimate goals are important determinants of the prevalence of war rape. Where conflicts are ideological in nature with the ultimate goal of gaining control of the state apparatus, war rape is less prevalent, as parties are generally concerned with perceived legitimacy of their governance (Humphreys and Weinstein 2006). Even in the case of state-led/ethnic targeting patterns, state actors rape civilians associated with the enemy, not their own, as this would diminish their legitimacy in the eyes of their supporters. Furthermore, rebels in conflicts such as that which occurred in El Salvador and Sri Lanka were not frequent perpetrators of rape in war, as they were concerned both with legitimacy and were reliant upon civilian populations for maintaining the war effort. In field/opportunistic patterns, it is argued that parties are less concerned with ideology and legitimacy and are instead motivated by short-term goals associated with obtaining the spoils of war. In these scenarios, such as that which took place in Sierra Leone, Liberia, and Congo, war rape is more prevalent. In addition to these conflict contextual factors, particular characteristics of the combatants determine the prevalence of war rape, including command structure, ethos, socialization, and the nature of service (voluntary or involuntary).

Command Structure

The strength or weakness of command structure determines the level of accountability individuals have for their actions during their time in the service of the group. Combatants forming part of a group with a strong and legitimate command structure are more likely to be held accountable for their actions, indicating there may be a higher cost associated with partaking in activities not sanctioned by central authorities. This however is a double-edged sword; while combatants may restrain themselves in the use of violence when a legitimate authority does not sanction it, they are just as likely to wield extreme violence when commanded to do so by that same authority (Milgram 1974; Grossman 1996).

One important factor that may contribute to or mitigate the frequency of rape in a conflict is whether the leadership believes that the use of sexual violence is consistent with their goals or counter-productive. Elizabeth Woods argues that a strong hierarchy that does not believe that sexual violence is productive to their end goal should be strong enough to stunt the level of sexual violence (2009). Although state security forces with the command structure described above are less likely to engage in acts of sexual violence, it is still possible that some deviant soldiers will engage in such acts. According to Butler, Gluch, and Mitchell (2007), the level of deviance “is more likely to be attributable to the selfish motivations of agents, and it is an act that is likely to be hidden...these acts are most likely to occur as conditions of conflict, system-wide slack bureaucratic control, and where

there are constraints on information and organization” (669).

Alternatively, when there is little to no clear command and leadership structure, the level of accountability drops dramatically. These types of groups are usually non-state actors who operate in cells or splinter groups and often have their own agenda independent from that of the far-removed headquarters. These groups act as a wild card in that the independent norms and culture of a group will govern whether or not they engage in sexual violence, regardless of what the weak command structure asks of them (Woods 2009).

The findings of Humphreys and Weinstein (2006) further support the idea that the command structure within a group matters. In their examination of conflict in Sierra Leone, for example, they find that variation in levels of civilian abuse can be explained by membership and structure of units. “Fighting units composed of individuals motivated by private goals, with high levels of ethnic diversity, and weak mechanisms to maintain internal discipline commit the highest levels of abuse” (444). Furthermore, individual combatants may commit acts of violence to establish their place within the organization, as is observed among prison mates (Humphreys and Weinstein 2006).

Combatant Recruitment and Socialization

Aside from the structure of the combatant group, recruitment and socialization within the group also determines the likely use of rape in war. Darah Cohen argues that when combatants are recruited by force, the level of cohesion within the group is non-existent. Combatants do not know each other, may not share the same ideological principles, and may come from different cultural backgrounds. Those who do join local militias may be members of society who were marginalized during peacetime, making the group a mix of members with little to no cohesion. This creates a key problem: when engaging in conflict the group must be able to act as a cohesive unit in order to succeed; this cohesion does not exist when combatants do not know each other and/or have no specific loyalties to one another. Cohen argue that a group can become more cohesive by participating in costly group behavior such as rape to signal to their peers that they are willing to take risks for the group (Cohen 2011).

Correspondingly, Henry et al. (2004) highlight a previous study (Otterbein 1979) that associated societies based on fraternal interest groups with higher incidence of rape in general. “Fraternal interest groups refer to ‘groups of related men who aggressively defend each other’s interests’ (Grubin, 1992, p. 209). Likewise, platoons of soldiers symbolize fraternal interest groups; subsequently, this may provide further explanation for why many men engage in rape when they would not in peacetime contexts” (545).

Female Participation

The degree to which females participate in an organization has been cited by some scholars to be a key factor in determining whether a group will engage in sexual violence. Some of the literature states that leaders may prohibit sexual violence against civilians for fear that the violence may evolve into sexual violence against fellow female group members (Woods 2009). Additionally, females who aspire to become combatants may be deterred from joining an organization that subjugates the female civilian population, pushing that potential recruit away from one organization and into the hands of another group who does not necessarily engage in sexual violence against female civilians. The literature presents examples of the female-intensive insurgencies in El Salvador, Sri Lanka, Peru and Colombia, all associated with lower levels of sexual violence than their male-dominated counterparts (Woods 2006).

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Offender Psychology

The studies described above emphasize the collective nature of rape while downplaying an individual's propensity for rape. Yet, certain factors associated with one's ability to empathize, early development, and attitudes toward women may also decrease the likelihood a soldier participates in rape (Henry et al. 2004). Jeanne Haskin, for example, notes that some Serbian forces ordered to rape Muslim women in Bosnia *pretended* to do so in order to avoid the appearance of defying orders; this is only known to be true because Muslim victims of rape by Serbian soldiers indicated this happened, and given they were frequent rape victims by Serbian perpetrators, they had no incentive to falsely portray the actions of those who did not rape (2006).

Henry, Ward, and Hirshberg (2004) provide a possible explanation for an individual soldier's engagement in rape, whether ordered from above or not, highlighting the development of appropriate social constraints on behavior during childhood, as well as inhibitory controls against aggression and attitudes toward relationships, early family interactions, abusive home environments, sexual promiscuity, and hostile masculinity. Where individuals have a propensity to commit rape in general, they are all the more likely in war environments. They go even further in arguing that even those unlikely to commit rape in peacetime are more likely to do so during war:

"The emphasis on hypersexuality is typically characteristic of war environments. For example, a long-standing history of institutionalized prostitution and the saturation of sexual imagery in wartime illustrates how the construction of the male soldier is often based on notions of virility and exaggerated heterosexuality...Power and dominance motives for sexual aggression are consistent with feelings of inadequacy and powerlessness as experienced by soldiers when confronted with the challenges of war. Arguably, sexual aggression is used as a means of overcoming or compensating for these underlying insecurities...In war contexts, virulent misogyny and the rejection of femininity may mean that individuals will use rape as a means of expressing hostility and frustration against either a particular woman or all women. Often, the victim has not caused or provoked the hostility, but the offender displaces his frustration onto her because she represents woman... Wartime contexts represent military subcultures of exaggerated sexuality and hostile masculinity; thus, both sexual promiscuity and hostile masculinity constructs have potential predictive validity for wartime rape" (541-542).

Henry et al.'s work thus provides a depiction of the offender's psychology and why the context of war might increase a soldier's propensity to commit rape.

Gender Empowerment

War rape literature has a strong foundation in feminist literature examining the treatment and role of women in society as strong indicators of the likelihood of rape in war, whether examining them as passive members of society to be protected, or active, empowered members of society to be treated as equals (Henry et al. 2004; Jefferson 2004). Jefferson (2004) argues that the degree of rape in war generally reflects societal norms pertaining to women's rights and their treatment as second-class citizens, or worse. As



a solution, she advocates training “civil society monitors” on international humanitarian law and conveying the idea that “sexual violence is a crime that should be prevented and punished even during peacetime” (5). Jefferson provides some optimism in highlighting some of the initial steps taken by international tribunals and the International Criminal Court, but there is still much to be improved in adequately processing rape cases. Finally, she advocates the pursuit of methods to reintegrate post-conflict rape victims into society and reform discriminatory laws.

The goals presented by Jefferson are laudable and highly supported. They represent long-term measures to deal with the fundamental issue of women’s rights more generally. In the interim, however, civilians in conflict-prone zones need means to mitigate the likelihood they will be victims of abuse. International peacekeeping forces are lagging in either the will or capacity to be able to protect citizens in conflict zones.

This leads one to believe that citizens have little control over their situations and portrays a sense of hopelessness. Yet, if there is variation in the degree of civilian abuse in conflict, including rape, as has been demonstrated by numerous studies, is it possible that there are measures citizens can take to decrease the likelihood they will be victims of rape or other forms of abuse as a result of war? The prospects seem unlikely given that they are faced with armed combatants in a lawless environment. Furthermore, most studies have demonstrated that characteristics of combatant groups determine the proclivity of rape as a result of war. Yet, no known studies examine the role citizens might play in minimizing the likelihood they will be victims. The next section develops a theoretical argument emphasizing that the living circumstances and routines of civilians largely determine the likelihood they will be victims of rape or other forms of abuse as a result of war.

The literature offers a vast array of information concerning the act of rape in conflict but there is little substantial research about mitigating the effects of rape as a direct or indirect result of conflict. The research that we propose here will contribute to the academic community by opening up a new avenue of research and possibly a future policy prescription that would mitigate the effects of rape as a result of war.

THEORETICAL ARGUMENT

“Within both refugee camps and IDP settlements (where the great majority of residents are women and children), rape takes place with relative impunity, perpetrated by soldiers, guards, invading bandits and fellow refugees. Women often must go outside of camps to search for firewood, food or other resources, and here their vulnerability increases. In fact, in recognition of this danger, programs to provide alternative sources of firewood in refugee camps in Kenya and other places have had some success in reducing rates of rape among camp women” (Farr 2009: 12).

As described by Farr above, the simple act of providing firewood for refugee camp inhabitants reduced the rate of rape among camp women in Kenya. This finding supports the notion that small measures can have a great effect on the likelihood civilians will be victims of rape, at least in the short term. These small measures should be coupled with longer term methods for ending conflict, providing law and order, and establishing enduring peace. In the interim, any reduction in rape is preferable.

The Kenyan example above also illustrates that existing understandings of



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rape in war are somewhat misleading, as they tend to place disproportionate emphasis on combatant behavior resulting from group incentives and individual motives, and less emphasis on small deterrents that might not even be consciously recognized on the part of combatants. This overwhelming focus on combatants most likely reflects the fact focusing on small measures would require scholars to highlight potential deterrents; that is, it would require a shift of attention toward cases where there is a lower incidence of rape in war and *non-action* on the part of potential perpetrators that centers not on the motives of perpetrators themselves, but on factors of which they may not even be cognizant.

To provide an analogy, it is commonly known that locking one's car decreases the probability something will be stolen from it. This is a small, costless measure taken by the car-owner that significantly decreases the potential for theft. It is also non-confrontational, thus minimizing risk of harm to the car owner in protecting his assets. Likewise, modifications in routine on the part of potential victims may decrease the likelihood they will be victims of crime. These actions on the part of potential victims do not eliminate crime altogether, but they do reduce the potential they will be victims. Similarly, by providing firewood to camp inhabitants in the Kenyan example, this altered the routine of women who had previously gone to gather firewood, thus altering the likelihood they would be victims of rape.

In order to prescribe appropriate stop-gap measures, it is imperative to examine the living circumstances and routines of those living in conflict societies where war rape has been more prevalent and compare them to those living in conflict societies where war rape was less prevalent. These examinations should begin from the bottom-up, however, rather than observing society as a whole, given that rape and civilian abuse tends to be more exacerbated in some areas than in others. The method for assessing these differences is examined in the next section.

Examination of existing studies reveals that many war-related rapes occur in and around refugee camps rather than in the midst of combat zones. Perpetrators include militants (both current and former) living within the camp, as well as bandits outside the camp. We have argued that the design of the camp itself and various deterrent measures may affect the incidence of rape among camp residents. Correspondingly, in a report entitled *Addressing Conflict-Related Sexual Violence: An Analytical Inventory of Peacekeeping Practice* UNIFEM has called for gender-sensitive design of refugee camps, including the most basic deterrents:

- Uniformed peacekeepers to guard aid-distribution points, hospitals and other static positions in camps.
- Physical distance between male and female latrines.
- Live thorn bushes planted around camp perimeters to deter night attackers and sexual predators (as in Kenya). "This serves a defensive purpose without militarizing camp appearance through the use of defensive stores like barbed wire and corrugated iron."
-
- Joint UN/national police walking patrols in and around camps (as in Haiti).

- “Without compromising the civilian character of camps, military have contributed to the safety of populations through coordination with police and humanitarian counterparts, by patrolling camp perimeters and intervening in emergency situations” (UNIFEM: 32). Military escorts to facilitate access of humanitarian and police to populations, as with the MINURCAT in eastern Chad.
- Distress call systems – “Where the reality in the field permits, a distress call system (“911 Helpline Concept”) can be established to activate a Quick Reaction Force to dispatch to the scene, as attempted in eastern DRC where phone numbers were given to camp leaders/IDP representatives (as part of “Operation Night Flash”). Civilians under threat of physical violence, including sexual violence, can access this number and call for help. Efforts are underway to add evacuation of victims in critical condition to this concept and transfer responsibility to government authorities. Distress call systems have also helped to ensure that women in camps are insulated from civilian-on-civilian attacks” (UNIFEM:31-32).

RESEARCH DESIGN

In order to assess the effectiveness of deterrent and basic security measures on the incidence of sexual violence, we examine the profiles and reports of the Dadaab refugee camp complex in northeastern Kenya. Using the list of potential deterrents provided by UNIFEM above as a starting point, we identify measures implemented to mitigate the occurrence of sexual violence in the Dadaab camps, particularly those associated with the provision of fuel resources, gender-sensitive camp design, police patrols, and community watch groups. The UNHCR provides some detailed information regarding the profiles of the camps and reporting of sexual violence. These reports are available through the UNHCR’s Statistics and Operational Data (<http://www.unhcr.org/pages/49c3646c4d6.html>).

Challenges: The greatest challenge is that there are very few existing studies examining the effects of deterrents such as those described on the proclivity of sexual violence. Furthermore, data on sexual violence are provided irregularly and vary depending on the source. Some reports are more informative than others, and so we attempted to contact the institutional representatives specifically tasked with assessing gender-based violence in the respective refugee camps. In most cases, this duty is performed by the International Rescue Committee, CARE, and the Lutheran World Federation and contact information for field representatives is provided on the UNHCR website. We have not received responses from requests for information from these organizations.

Expectations: We expect that where deterrent measures have been implemented, there will be lower rates of sexual violence, and summarize these as four main hypotheses:

- H1. An increased Kenyan Police presence will reduce the number of rape incidents in the Dadaab refugee camps.
- H2. A presence of community patrols will contribute to decline in the over all number of rapes in the Dadaab refugee camps.
- H3. Fuel provision programs will reduce rape by preventing women from going out into the bush in the Dadaab refugee camps.
- H4. Gender sensitive camp design will decrease the over all number of rapes in the Dadaab refugee camps.

RESULTS

In the research design, we indicated that in an effort to understand the incidence of sexual violence in war and its proclivity, we would focus on sexual violence taking place within a “field-opportunistic” context, and specifically within and around refugee camps. Refugee camps present one of several contexts in a conflict zone, the very existence of which is determined by conflict, persecution, or natural disaster. As such, sexual violence in this context reflects another form sexual violence in war.

Rather than focusing on the perpetrators of rape in conflict zones for explaining variation in its occurrence, we focus instead on the physical security of refugee camp residents, assessing the argument that physical security deterrents mitigate the incidence of sexual violence in and around refugee camps. In particular, we examine the following Dadaab camps in Kenya, established for those fleeing conflict and persecution in Somalia, Ethiopia, and other proximate countries: Hagadera, Dagahaley, Ifo, Kambioos and Ifo 2.

In examining various reports pertaining to sexual violence in refugee camps, most incidents of sexual violence by a non-family member occur (a) while women go out to the bush to collect firewood, and (b) while women are in transit from one part of the camp to the other, unaccompanied by a male companion.

Agencies have recommended various deterrents that might mitigate the proclivity of sexual violence in and around refugee camps. These can be characterized as follows: **(1) the provision of goods** (such as firewood) that women would seek in the bush; **(2) gender-sensitive camp design**; and **(3) camp policing** (e.g., patrols, community watch groups). We assess the implementation of these different types of deterrents in the Dadaab camps, and their effects on the incidence of sexual violence.

The primary focus of this study is to assess the relationship between refugee camp characteristics and the incidence of rape in and around refugee camps. Unfortunately, a comprehensive database containing information about rape incidents across refugee camps is not currently available. Given the lack of existing comprehensive research examining this phenomenon, we conduct a case-study analysis of the Dadaab camp complex in Kenya, given that it is both the largest refugee camp complex in the world with nearly 500,000 inhabitants, and the availability of information pertaining to this camp. Furthermore, the prevalence of sexual violence in this camp has been noted early on: in February 1993, “a UNHCR representative documents 192 rape cases of sexual assault in the first 7 months of her assignment” (Crisp 2000). The numbers have fluctuated somewhat since: According to the Kenya Human Rights Commission, “the number of reported rapes in Dadaab area stood at 200 in 1993 and subsequently dropped to between 70 and 105 in the following four years... Statistics compiled by the UNHCR protection unit in Dadaab suggest that the number of reported rapes (actual and attempted) increased to 164 in 1998 but dropped again to 33 in the first six months of 1999” (Crisp 2000). More recently, the UNHCR noted in its 2010 Global Report that there were 419 reported instances of sexual violence against refugees in Dadaab, though it is not clear from the report how many of these occurred in and around Dadaab camps and how many occurred within the city of Dadaab itself, where a number of refugees are also living.

What is clear is that not much has improved overall since the problem of sexual violence in and around camps was first highlighted in the 1990s. This is despite the fact that a number of measures have been taken to reduce the incidence of rape, per recommendations of UN agencies and NGOs. We explore the effectiveness of each of these measures in turn,

but first explain the method used in this study for gathering information, which has been somewhat challenging.

We examined reports provided by the UNHCR and NGOs pertaining to the four camps within the Dadaab complex in order to gather information about camp characteristics and incidence of rape in an attempt to identify common characteristics associated with rape across the four camps. This is particularly challenging because these reports are not provided regularly in a systematized format on the UNHCR or NGO websites, and data pertaining to the incidence of rape varies between reports. Furthermore, attempts to contact representatives of offices associated with gender-based violence in the camps have not been successful. We were able, however, to extrapolate some information from existing reports.

First, we were able to assess the number of rapes by Dadaab camp from the Firewood Project for the 7-month period between January and July of 1998, as well as data by camp from five distinct weekly reports published between August 2011 and April 2012. A comparison of the number of incidents with corresponding population and female populations of the camps is displayed below. Although it is not ideal to compare different timeframes (weeks versus months), these are the data readily available which depict rapes by camp within the Dadaab camp complex.


Camp where survivor lives	Total in 7-month time period Jan-Jul 1998	Pop. size after 1998 revalidation exercise	Total in 5-week time period Aug2011-Apr-2012	Female Pop. size April 2012 UNHCR Report
Hagadera	19	37,745	11	68,785
Ifo	46	39,788	0	58,446
Dagahaley	25	31,158	5	62,838

Interestingly, one may observe that although Ifo had the highest number of rapes in the 1998 time period, it had the lowest in the 2011-2012 reports when compared to Hagadera and Dagahaley. Observation of population statistics reveals why this is the case. The incidence of rape appears to be rudimentarily correlated to population size, as one would expect. Although this would normally be treated as a control in more comprehensive, quantitative studies, it is in and of itself important for this study, as it serves as a constraint on other measures employed to reduce rape, a point to which we return later. In the next few sections, we assess the effectiveness of various measures on the incidence of sexual violence in the Dadaab camps based on reports provided by the UNHCR and NGOs.

Provision of Fuel Sources

The Dadaab firewood project was an attempt to reduce rape in the bush while women were out gathering firewood. An evaluation of the project by the UNHCR (2001) revealed various problems with this project in terms of both implementation and effectiveness.

First, the project provided firewood to families based on family size and income, and was funded through donations that totaled \$3,005,240.89. During the project there were several attempts at scamming the aid workers out of giving out more firewood by reporting a higher amount of children than were actually present in the household. The



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ultimate costs of the project were hard to determine because of the pay that had to go to the transportation for the firewood, the employees that distributed the firewood and the wood itself. Many critics argued that the firewood was being bought at three to four times the local market price.

Second, the UNHCR evaluation revealed that although rapes occurring while women were out gathering firewood decreased, the total number of rapes did not decrease, as women continued to go out to the bush for other materials related to construction. Finally, observation of camp maps also reveals that Hagadera and Daghaley are the only camps with firewood stores, yet also have higher frequencies of rape (though controlling for population might mute this effect).

Ultimately the project did not serve its purpose, as rapes during firewood gathering activities declined, but were offset by rapes during non-firewood gathering activities. In addition to the ineffectiveness of the project, critics claim that the idea that firewood keeps one safe from rape may drive the price of firewood up and make it even less affordable for the individuals in the camp.

Camp Design

Thorn bush fences. Some efforts have been taken to increase the security of camps by preventing raids into the camps at night. Prior to the installation of thorn bushes, rapes occurred more frequently at night within the camps. After installation of these fences, rapes were more likely to occur in the bush in daylight while women were collecting firewood and other building materials (Crisp 2000). Although the installation of thorn bushes has reduced the incidence of rape at night within dwellings, it has not reduced rates of rape overall, as women must continue to venture out into the bush to gather materials.

Latrines. Latrines pose a particular problem in that they are one of the locations where women are most vulnerable and often alone. The latrines present in refugee camps are often not separated by gender, have poor lighting, have no locking mechanism and are shared by both men and women. The ratio of inhabitants to latrine also ranges from 20-30, depending on the camp, indicating they are not necessarily proximate to a family's dwelling. These factors present a danger to women in that during the night they often have to venture to the latrine alone and may be walking into situation that presents the perfect conditions for a rape incident to occur.

Efforts to build new latrines and improve lighting have been undertaken by the UNHCR and NGOs, but there is still much needed development in this regard (UNHCR). In one recent initiative implemented in the Ifo 2 camp, the Lutheran World Federation, the NGO responsible for camp management at Ifo 2, has constructed pit latrines per family (rather than community latrines). This is designed to improve sanitation, but it will most likely also reduce the incidence of sexual violence that takes place on the way to and around community latrines. In fact, observing the incidence of rape in the 2011-2012 time period reveals that Ifo 2 had one reported rape across the five weekly reports, despite the fact that it is a newly constructed camp with little police protection.

Kenyan Police Patrols

In his 2000 study, Jeff Crisp stated that the use of Kenyan Army and police patrols around the Dadaab camp complex had proven effective at reducing crime around the camps (including sexual violence). However, new issues have emerged that have made reliance on Kenyan Army and police less effective for protecting citizens. In addition to

the expanded population of the camps making security more difficult to manage, Kenyan police have suffered numerous attacks by members of the Somali terrorist group Al Shabab. As a result, police are suspicious of Somali refugees and often retaliate by raiding the camps and abusing inhabitants. According to a report from Human Rights Watch, Kenyan police are distrusted among refugee camps because of the repertoire they have with the local refugee population. Refugees accuse police of extorting them, threatening them and a variety of other abuses of power. In incidents where police officers are hurt in the Dadaab complex the police have been known to go around pulling refugees out of their homes and beating men, women and children indiscriminately in an effort to get revenge. Local police are feared and are not a trusted channel to report rape incidents to. Thus, the effectiveness of Kenyan police patrols in decreasing the incidence of rape and other crimes against refugees in the Dadaab camps is unlikely.

Community Watch Programs.

Community Peace and Security Teams (CPST) have been formed within the Dadaab camps and is organized by refugees in attempt to provide security to camp inhabitants. Lennart Hernander, representative of The Lutheran World Federation (LWF) for the Kenya-Djibouti program, an NGO responsible for camp management within the Dadaab complex, describes the role of CPSTs as follows: "The teams patrol the camps day and night, and are called in to solve various problems ranging from queue jumping to attempted rape, from theft to encroachment on allocated plots... They are a vitally important part of the LWF's work and operation in Dadaab, especially in providing protection for vulnerable people like young women" (LWF 2012).


While community policing programs such as CPST do appear effective, according to LWF, they are not without problems. Two CPST leaders from two camps were shot within a week's time -- Ahamed Mahmoud Mohamed, CPST chairperson for the Hagadera refugee camp, and CPST section leaders at the Ifo camp. It is unclear who was responsible for the killings, but it is clear that the CPST leaders were specifically targeted. Thus, the incentive refugees have to play such roles within the camps puts them in a precarious situation.

Discussion of Findings

As described above, various measures have only been partially effective in reducing the incidence of sexual violence in and around refugee camps. This is discouraging, both because women in Dadaab camps continue to live under very unsafe conditions and because the amount of resources poured into these programs by international donors has not brought about desired results. The latter is problematic, as donors may limit the funds they provide in the future should they determine these programs to be ineffective, only worsening the security situation of refugees in Dadaab camps. Our analysis reveals several irritants that mitigate the effectiveness of measures taken to reduce sexual violence, described below.

Population

The first irritant pertains to population pressures. Refugees from Somalia, Ethiopia, Burundi, and other origins continue to pour into the camps, though this number has decreased substantially since registration has ceased (and those who are not registered are not able to receive aid). Those who are not allowed to attain residency at the camp



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because it has reached capacity often settle outside the camp. These are citizens most likely to become victims of bandits, as they do not have access to some of the basic security provisions camp residents have. In addition, increasing population in the camps also presents strains on existing resources.

General Insecurity in the Region

As Jeff Crisp (2000) explains, the Dadaab region of Kenya was fairly insecure prior to the establishment of refugee camps. It is a desolate area where native residents have poor living standards (oftentimes worse than that of refugees). The presence of al-Shabaab, a Somali insurgent group, also makes the situation precarious. Local Kenyan police forces are more inclined to suspect Somali refugees as insurgents rather than be concerned with protecting them.

Distance between Camps

Residents will often travel between camps to visit relatives and markets, while also venturing into the bush for construction supplies and fuel sources. Although projects have been implemented to provide fuel sources, these are not sustainable, and it has been found that inhabitants will venture into the bush for other reasons. It is the area outside these camps where most instances of sexual violence occur. Crisp (2000) contends that deploying Kenyan Army and patrols to these areas did in fact reduce banditry, but recent abuse of Kenyan authorities of Somali refugees may inhibit the effectiveness Kenyan patrols.

CONCLUSION

The UNHCR has found the most durable solution to the insecurity faced by refugees in Dadaab to be resettlement in other countries. This is a long and uncertain process, however, and is not plausible for nearly 500,000 refugees. Given the amount of funding spent on existing measures that have proven largely ineffective, it appears that a viable solution for improving security for camp residents is one that recognizes most incidents of violence occur in the area outside the camps. This suggests that the presence of patrols in the area – not made up solely of Kenyan forces but of others potentially provided by UN member countries or mercenaries funded by UN – might temporarily mitigate the incidence of violence. Any proposed solution, however, will present political and economic challenges, however, as they are merely stop-gap measures.

Another solution could become apparent if there were were a transformation in the perception. Although it is perceived to be a temporary “camp” setting, it is considered home to many residents. There are now three generations living in the Dadaab camps, indicating it is more of a long-term community rather than temporary dwelling. Despite insecurity in these camps, refugees continue to gravitate to the camps, as it is still perceived as more secure than their residence of origin. In addition, social network sites exist where educated camp residents share stories and news, similar to any other community in the world. These camps have clinics, schools, churches, and markets. Although rudimentary, they do have the appearance of a community. Perhaps more viable solutions begin with the recognition that the Dadaab refugee camp complex is a long-term community, and developments can be made accordingly.

There is much to be explore in terms of further research on this topic. First and foremost, data inconsistency warrant the creation of a database that collects information



pertaining to rape in a systematized manner and makes it easily available to the scholarly community. Understanding the phenomenon of rape in the field-opportunistic context is difficult without adequate information.

Furthermore, this database should contain information pertaining to the severity of rape, as the rape numbers are not found to be much different from those of a mid-size city in the United States (most likely due to underreporting). It is the severity of the rape incidents that makes them particularly horrific, and this should be explored.

The UNHCR has also advocated means for diminishing impunity through the use of “mobile courts” to process those charged of rape and other crimes against refugees. However, there is still much room for improvement in administering the rule of law in these camps and processing criminals accordingly. Research assessing impunity and the proclivity of rape in and around refugee camps is also worthwhile.

Returning to the proposal of a database created to gather information pertaining to crimes against civilians in conflict contexts would also allow for comparison across refugee camps and in other field-opportunistic contexts. Thus, it appears that the scholarly community has only just begun to adequately assess this pattern of rape, and there is a wealth of knowledge to be gained through a collective effort to develop a centralized database.



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Observations of Silicon Cracking in Dual Interfaces



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Abstract

Experiments are carried out to observe the effects various fluids have on fractures in elastic silicon stretched at a constant interval. The interfaces studied were air/water, water/water, and air/ferrofluid. Data was accumulated using high speed photography and analyzed using Matlab. Results are plotted, focusing on velocity profiles for the former two. For ferrofluid (kerosene based), the path of propagation is traced out; noting the appearance of branching during propagation. Its velocity profile is also analyzed. As expected, the air/water and water/water interface do not exhibit irregular propagation. However air/ferrofluid was quasi-periodic and longest to propagate. Possible mechanisms are mentioned. Discussion of future research includes the viability of ferrofluid to induce Gaussian curvature on silicon.



Observations of Silicon Cracking in Dual Interfaces

Introduction:

Cracks are an everyday appearance. One views them in earthquakes, broken glass, and even the breaking of an egg. These examples are usually taken to be involved with only the stresses needed to induce fracture. To develop a more realistic understanding of this phenomenon, there must be inclusion of different variables and parameters usually neglected. For the present study, this will mean observing the effects (if any) of the surrounding media on the propagation of the crack. So where one may see how cracking is usually a straight line, perhaps exposure to some fluid may produce a sinusoidal crack or reduce crack speed. These will be the main lines of observing propagation.

Experimental Procedure:

The experiment consisted of four distinct phases: Material preparation, Stretching, Sample Removal, and Cracking.

Material Preparation:

The silicon used was Zhermack Elite Double 8. A vacuum mixer was used to remove the appearance of micro-bubbles that would appear if unassisted. Batches were placed into an acrylic mold (11"x11") with a top plate to provide uniformity in thickness of silicon. Holes and outer edges were then made using a laser cutter.

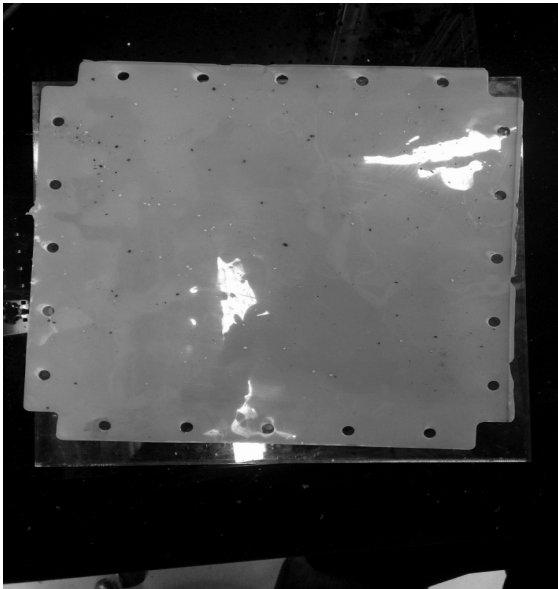


Figure 1: Silicon Sheet with 20 holes and cut edges.



Stretching:

Custom acrylic tabs are attached via the holes along the perimeter of the silicon sheet. They are later attached to a T-Slot based stretching apparatus that would be allowed to move along two perpendicular axes. The sheet is stretched along a given side further than the other.

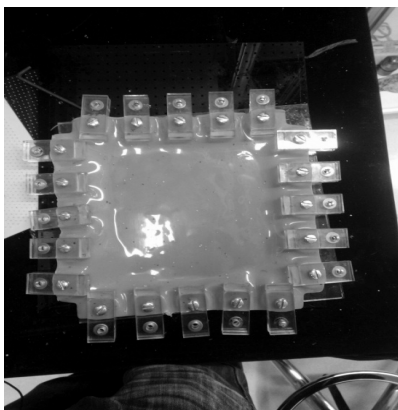


Figure 2: Silicon Sheet with acrylic tabs attached.

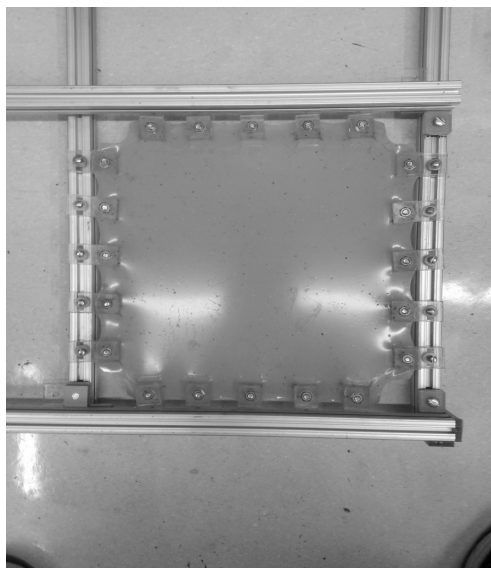


Figure 3: Silicon Sheet stretched rectangular more so in the vertical.

Sample Removal:

After the sheet has been stretched, one uses a two part aluminum frame to extract the center piece of silicon. This is performed to avoid edging effects and distortion along the perimeter of the sample.



Observations of Silicon Cracking in Dual Interfaces

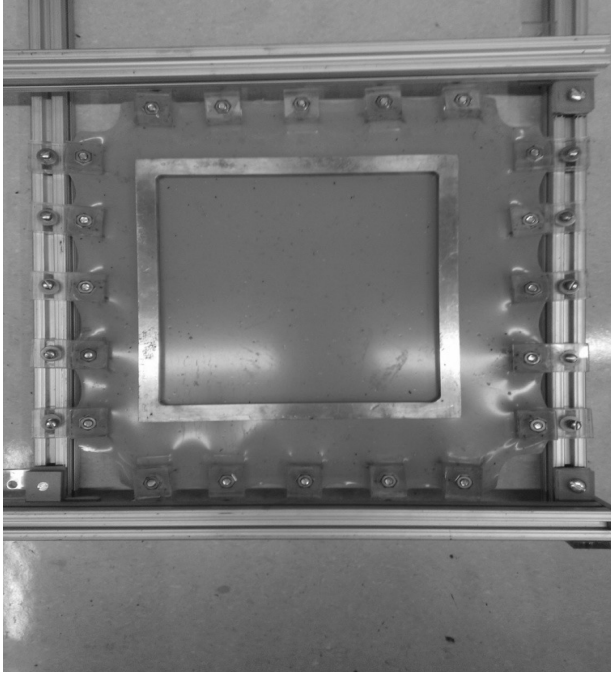


Figure 4: Silicon Sheet pre-stretched with aluminum plate. Two interlocking plates are placed in the center and used to extract a sample sheet that is pre-stretched.

Cracking:

Depending on the media, the crack is usually caused by a razor blade tip. For water/water, it is done by a flat-head screwdriver to minimize interfering waves produced when puncturing the sample. A high speed camera is used to capture the crack.

Data Analysis:

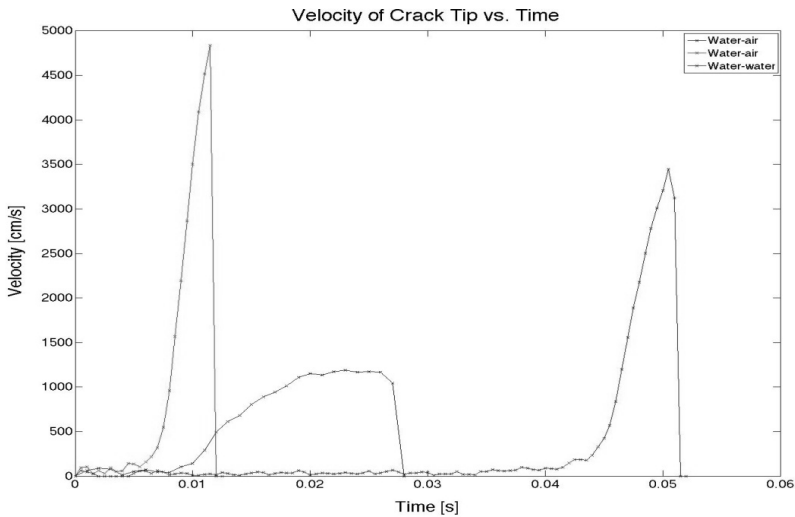
The images taken by the high speed camera are converted to TIF files. They are then analyzed in Matlab with a program that measures crack speed and path. Because of different placements of the camera and sample between experiments, one has to take into account the number of pixels with respect to each sample to maintain consistency of observations. The length of a crack is defined as between the initial crack point and its travel to the opposite side of the sample.

Results:

Air/Water:

Compared to [1] which provides a base case of air/air, there is no change in behavior. The second instance shows a more constant velocity. The only consequence may be a slightly slower crack tip speed due to water.

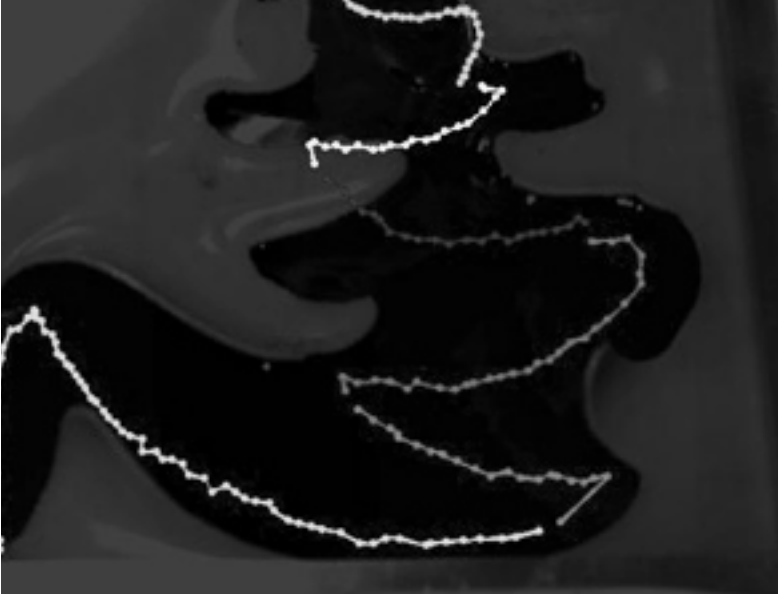
Water/Water: Propagation was delayed compared to the air/water interface. However, it maintains likeness to the air/water crack speed, as noticed in the below image.



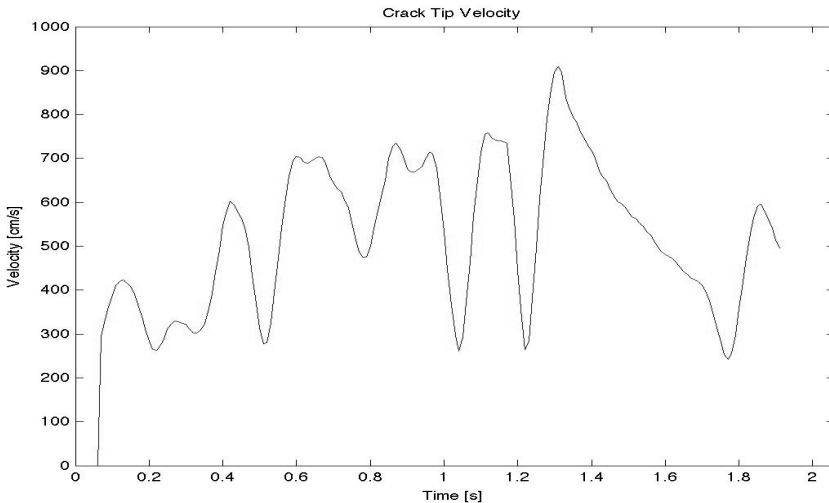
Air/Ferrofluid (Kerosene based):

The cracking exhibited by this interface is highly irregular. Compared to the former experiments, it is not only the longest crack in duration but by length as well. Further observation indicates the presence of crack branching (six moments in total), which is evident in the following image.

Observations of Silicon Cracking in Dual Interfaces



During propagation, it was observed that as a branch began to take place, the original crack would slow down and lose energy as a new crack appeared. Also, the silicon appeared to roll in itself during cracking but it is a result of the non-uniform stretching in one direction. Plotting its velocity profile, there appears to be some periodicity.



Compared to the image, each minima of the velocity represents a branch point where a slight dip indicates a change of direction. The maximum velocity is also far slower than that of the water cases.



Discussion

Air/Water and Water/Water do not exhibit any effects on the crack propagation aside from slower speed. It is not comparable to the speed of sound in the material. In further trials of air/ferrofluid, it was found that the fluid affects only the propagation and does not deform the material. As mentioned above, the silicon does appear to show curling being exposed to the ferrofluid. Interestingly, the branching is not unlike that of thermally induced cracking in water [2].

Future Prospects:

Although the ferrofluid does affect the propagation of the crack, it may be due to the viscosity of the substance. Experiments in the future will include viscosity as a variable, possibly with other forms of ferrofluid suspensions such as silicon oil. Further investigation will develop the question if curved surfaces can be produced using such a liquid while minimizing the effects on material and propagation from the fluid itself. In addition there may be effects on the fluid due to static charge build-up in silicon during preparation.

Conclusion:

It is apparent that water does not affect the silicon itself and during its fracture aside from crack tip speed slowing. However, given that the ferrofluid is organic based (kerosene) and has higher viscosity, the fluid does affect the propagation.

Acknowledgements:

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Solution Approaches to Facility Location Problem



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Abstract

Facility location decision is a strategic decision in supply chain and logistics management. The decision involves optimal selection of sites to setup facilities and optimal assignment of customers to these facilities. In this context, we consider the uncapacitated facility location problem and evaluate the computational efficiencies of two well-known solution methods namely, the Branch-and-Bound method and the Explicit Enumeration method. Our goal is to evaluate the two solution methods in terms of their computational run-times to obtain an optimal solution for randomly generated problem instances. For each problem instance, we record the number of decision variables, constraints, optimal sites, solution run-times, and optimal costs associated with the two solution methods. We infer that the Branch-and-Bound method determines an optimal solution in a relatively short time-span in comparison to the Explicit Enumeration method. Moreover, the size of the problem instances has a minor impact on the runtime of the Branch-and-Bound method, unlike the case of the Explicit Enumeration.



Introduction

In this research, we survey and evaluate computational performance of the solution approaches available in the literature for solving the *Uncapacitated Facility Location Problem* (UFLP). In the facility location problem, we consider a set of candidate sites for locating facilities such as factories, warehouses or retail stores to satisfy the demand requirements at a given set of customer locations.

The location problems, in general, lead us to the following questions: “How do we assign retailers to factories?” and “where are these factories being located and how many need to be placed in a certain area?” These questions can be answered based on the customer demands for the supplies, potential sources for the supplies, relevant costs and associated distances between the factories and the customers. In the supply chain management literature, the facility location problems are modeled as 1-Median Problem, 1-Center Problem, Covering Problem, n-Center Problem, and Capacitated/Uncapacitated Facility Location Problem (CFLP/UFLP) (Francis, Ginnis, White, 1992).

In the 1-Median Problem, we locate a single facility to serve a set of demand locations by minimizing the total cost of transportation. Depending on the transportation costs and the demand, the 1-Median facility will be located in the proximity of the customer with the highest cost-to-serve. Whereas, in the 1-Center Problem, we locate a new facility by minimizing the maximum weighted distance traversed between the new facility and the customers. In other words, it is meant to service customers within a shortest amount of time, distance, or cost. In the Covering Problem, we determine the facilities in a certain area to service businesses or people, based on the time-to-serve or distance-to-serve criteria. For example, Post Office facilities have to be located within a certain distance from each neighborhood. The problem is also applicable for locating facilities such as gas stations and fast food outlets to provide service to customers by having a facility that would cover certain areas surrounding its neighborhood. In the case of n-Center problem, we open exactly n-facilities based on the total transportation cost between the facilities and the customers (Francis, Ginnis, White, 1992).

The CFLP and UFLP are well-known problems in the supply chain management literature (Francis, Ginnis, White, 1992 and Ghiani, Laporte, Musmanno, 2004). The objective of these problems is to determine the optimal configuration of location of the facilities and the assignment of the customer demand for products to the facilities by minimizing the total cost of facility setup and the transportation cost incurred due to customer assignments. The uncapacitated version of the problem imposes no capacity limitation on the number of customers that a facility can serve, whereas the capacitated version restricts the supply of products that a facility can serve to its customers (Krarup and Pruzan, 1983).

The UFLP can be formulated as a mixed integer linear program and solved to optimality using the relevant techniques such as the branch-and-bound (Hillier and Lieberman, 2010, Akinc and Kumawala, 1997, and Balas, 1965), dual-based (Erlenkotter, 1978), Bender’s decomposition (Magnanti and Wong, 1981, Van Roy, 1986, Wentges, 1996, Üster et al., 2007, and Easwaran and Üster, 2009 and 2010), Lagrangian relaxation (Geoffrion, 1974 and Fisher, 1981) and explicit enumeration (Francis, Ginnis, White, 1992). Due to the inherent computational complexity of the uncapacitated facility location problem, the solution methods require prohibitively large computational time (or computing resources such as processing speed/memory) in determining an optimal solution (Francis, Ginnis, White, 1992). In particular, we may not obtain an optimal solution for the problem

Solution Approaches to Facility Location Problem

in reasonable timespan. Nevertheless, the solution algorithms can be used to determine solutions characterized by total costs that are very close to the optimal total cost. Such solutions are called as the near-optimal solutions.

The goal of this research is to survey, implement and evaluate the computational performance of two solution algorithms for the UFLP in terms of the solution runtimes (time taken to determine an optimal solution or a near-optimal solution) and the optimality gap (an estimate of the percentage deviation of the total cost of the solution determined by a technique to that of an optimal solution). We select the Branch-and-Bound method and the Explicit Enumeration method for this purpose. We generate a random set of data to facilitate this study. We use the C++ programming language and the CPLEX software application for implementing the solution methods.

Methodology

For the UFLP, we consider a set of retailer locations, set of factory sites, fixed costs to setup factories, transportation costs between the factory sites and retailers, and the demand at the retailer locations. Opening a factory at a site incurs a fixed cost, which is added to the sum of the product of the transportation costs and the demand at the retailers assigned to the factory resulting in the total cost of the facility location. We now present the mathematical formulation for the UFLP.

Sets and Indices

f a factory

r a retailer

$FAC = \{1, 2, \dots, m\}$, the set of factory sites

$RET = \{1, 2, \dots, n\}$, the set of retailer locations

Input Parameters

F_f fixed cost to open a factory at site f

C_{fr} transportation cost for shipping a product from site f to retailer r

D_r demand at retailer r

Decision Variables

y_f set to 1 if a factory is opened at site f , 0 otherwise

x_{fr} set to 1 if a retailer r is assigned to factory f , 0 otherwise

Mixed-Integer Linear Program

Objective Function

$$\text{minimize } z = \sum_{f=1}^m f_f y_f + \sum_{f=1}^m \sum_{r=1}^n D_r c_{fr} x_{fr} \tag{1}$$

Subject to constraints

$$\sum_{f=1}^m x_{fr} = 1, \quad r = 1, \dots, n \tag{2}$$

$$x_{fr} \leq y_f \quad r = 1, \dots, n; \quad f = 1, \dots, m \tag{3}$$

$$x_{fr} \in \{0, 1\}, \quad r = 1, \dots, n; \quad f = 1, \dots, m \tag{4}$$

$$y_f \in \{0, 1\}, \quad f = 1, \dots, m \tag{5}$$

The first term in the objective (1) represents the total cost of setting up factories. The second term represents the transportation costs to retailers to factory sites. The third term represents the demand at the retailer. Constraint set (2) ensures that each retailer is assigned to a factory. Constraint set (3) forces setting up a factory location if a retailer is assigned to it. Constraints (4) and (5) are the binary restrictions on the decision variables. The mixed integer linear program can be programmed using the C++ language and can be solved using the Branch-and-Bound method implemented in software such as CPLEX.

Explicit Enumeration Method

First step in finding the optimal solution is evaluating the given setup costs of facilities and choosing the locations that will have the least cost to service the demand location. Each facility has an associated fixed setup cost that depends on the site at which the facility is to be located. It may be that one facility can service all demand locations or a subset of facilities have to be located to service the demand locations. To determine the assignment of retailers, if there is more than one opened facility then the one with the minimal cost is chosen to service the demand.

Solution Approaches to Facility Location Problem

Pseudo-code

- Step 1: Input $RET, FAC, F_f, C_{fr},$ and D_r .
- Step 2: Set the optimal cost $z^* = \infty$ and optimal open sites as $Y_{f^*} = 0 \forall f \in FAC$ and optimal assignments $X_{f^*r} = 0, z = 0$.
- Step 3: Determine the power set $\mathbf{P}(FAC)$
- Step 4: For each subset $\mathbf{S} \in \mathbf{P}(FAC)$ do
- Step 4.1: Set $Y_f = 0 \forall f$ and $X_{f^*r} = 0 \forall f, r$
 - Step 4.2: Set $Y_f = 1 \forall f \in S$
 - Step 4.3: Set $X_{f^*r} = 1 \forall r \in RET, f^* = \underset{f \in S}{\operatorname{argmin}} \{C_{fr}\}$
 - Step 4.4: Compute $z = \sum_{f \in S} (F_f + \sum_{r=1}^n D_r c_{fr} X_{fr})$
 - Step 4.5: If $z < z^*$ then set $z^* = z, X_{f^*r} = X_{fr}$ and $Y_{f^*} = Y_f$ for each f in FAC and r in RET .
- Step 5: Output the optimal solution $(X^*, Y^*, \text{and } z^*)$

Description of Pseudo-code

In step 1, we input the set of retailer locations, factory sites, fixed costs, transportation costs, and the demand values. In Step 2, we set the optimal cost to infinity in order to find the minimal cost by replacing it with the total cost of solutions we obtain by enumeration. Since we have not yet opened any factories or assigned any retailers, we set the associated decision variable values equal to zero. In step 3, we generate a power set from the given set of factory sites and we perform the following steps for each element set of the power set. In step 4.1, for all the potential factory sites, we set the location decision equal to zero. In steps 4.2 and 4.3, we open the factories listed in the given element of the power set and determine the assignments of the retailers based on the minimal transportation costs, respectively. In Step 4.4, we compute the associated total cost. After the total cost is computed, we compare the total cost to optimal cost and if the total cost is less than the optimal cost, then we set the total cost to be our new optimal cost. Finally, in Step 5 we output the optimal decision variables.

We implement both the solution methods using the C++ programming language for evaluating their computational efficiencies.

Computational Experimentation

In this section we analyze and compare the computational performance of the two solution methods. The following results are obtained through CPLEX using C++ programming language in order to find an optimal solution for each randomly generated problem instance. For each test instance, we varied the number of retailers n from 90 to 120, and the number of factories from 5 to 10. We summarize the results of the Branch-and-Bound algorithm implanted using CPLEX in Table 1 and the Explicit Enumeration in Table 2. We depict the variations in the runtimes in Figure 1.

Table 1: Computational Results using the Branch-and-Bound Method

Problem Instance	m Factories	n Retailers	Variables	Constraints	Optimal Locations	Run-time (s)	Optimal
1	5	90	455	540	1,2,3,4,5	1.17	1.64E+08
2	6	90	546	630	1,2,3,4,5	1.19	1.64E+08
3	7	90	637	720	1,3,4,5,6,7	1.2	1.47E+08
4	8	90	728	810	1,4,5,6,7,8	1.22	1.38E+08
5	9	90	819	900	4,5,6,7,8,9	1.2	1.04E+08
6	10	90	910	990	5,6,7,8,9,10	1.22	1.06E+08
7	5	120	605	720	1,2,3,4,5	1.53	3.39E+08
8	6	120	726	840	1,2,3,4,5	1.41	3.39E+08
9	7	120	847	960	1,2,3,5,6,7	1.5	3.22E+08
10	8	120	968	1080	1,3,4,5,8	2.01	2.52E+08
11	9	120	1089	1200	1,3,4,5,8,9	2	2.28E+08
12	10	120	1210	1320	3,4,5,7,8,10	1.5	1.89E+00
13	5	120	605	720	1,2,3,4,5	1.7	5.43E+08
14	6	120	726	840	1,2,3,4,5,6	1.55	3.71E+08
15	7	120	847	960	1,2,3,4,5,6,7	1.52	2.31E+08
16	8	120	968	1080	1,2,4,5,6,7,8	1.59	2.07E+08
17	9	120	1089	1200	1,2,3,6,8,9	1.55	1.90E+08
18	10	120	1210	1320	1,2,3,6,8,9	1.77	1.09E+08
19	5	120	605	720	1,2,3,4,5	1.61	4.20E+08
20	6	120	726	840	1,2,3,4,5,6	1.63	3.38E+08
21	7	120	847	960	1,2,3,4,5,6,7	1.72	3.02E+08
22	8	120	968	1080	1,2,3,5,6,7,8	1.56	2.60E+08
23	9	120	1089	1200	2,3,5,6,7,8,9	1.77	2.17E+08
24	10	120	1210	1320	2,3,5,7,8,10	1.52	2.00E+08
25	5	120	605	720	1,3,5	1.73	1.52E+08
26	6	120	726	840	3,5,6	1.61	1.15E+08
27	7	120	847	960	3,5,6,7	1.56	1.13E+08
28	8	120	968	1080	3,5,6,7	1.91	1.13E+08
29	9	120	1089	1200	3,4,6,7	1.92	1.13E+88
30	10	120	1210	1320	3,5,6,7	1.8	1.13E+08

Solution Approaches to Facility Location Problem

Table 2: Computational Results using the Explicit Enumeration Method

Problem Instance	m Factories	n Retailers	Variables	Constraints	Optimal Locations	Run-time (s)	Optimal
1	5	90	455	540	1,2,3,4,5	1.42	1.64E+08
2	6	90	546	630	1,2,3,4,5	1.78	1.64E+08
3	7	90	637	720	1,3,4,5,6,7	3.38	1.47E+08
4	8	90	728	810	1,4,5,6,7,8	8.55	1.38E+08
5	9	90	819	900	4,5,6,7,8,9	24.14	1.04E+08
6	10	90	910	990	5,6,7,8,9,10	84.06	1.02E+08
7	5	120	605	720	1,2,3,4,5	1.69	3.39E+08
8	6	120	726	840	1,2,3,4,5	2.53	3.39E+08
9	7	120	847	960	1,2,3,5,6,7	4.44	3.22E+08
10	8	120	968	1080	1,3,4,5,8	11.19	2.52E+08
11	9	120	1089	1200	1,3,4,5,8,9	31.19	2.28E+08
12	10	120	1210	1320	3,4,5,7,8,10	99.42	1.89E+08
13	5	120	605	720	1,2,3,4,5	1.83	5.43E+08
14	6	120	726	840	1,2,3,4,5,6	2.5	3.71E+08
15	7	120	847	960	1,2,3,4,5,6,7	4.23	2.31E+08
16	8	120	968	1080	1,2,4,5,6,7	11.34	2.07E+08
17	9	120	1089	1200	1,2,3,6,8,9	30.7	1.90E+08
18	10	120	1210	1320	1,2,3,6,8,9	99.75	1.90E+08
19	5	120	605	720	1,2,3,4,5	1.72	4.20E+08
20	6	120	726	840	1,2,3,4,5,6	2.25	3.38E+08
21	7	120	847	960	1,2,3,4,5,6,7	4.89	3.02E+08
22	8	120	968	1080	1,2,3,5,6,8	11.33	2.60E+08
23	9	120	1089	1200	2,3,5,6,7,8,9	31.11	2.17E+08
24	10	120	1210	1320	2,3,5,7,8,10	99.94	2.00E+08
25	5	120	605	720	1,3,5	1.77	1.52E+08
26	6	120	726	840	3,5,6	2.59	1.15E+08
27	7	120	847	960	3,5,6,7	4.11	1.13E+08
28	8	120	968	1080	3,5,6,7	11.55	1.13E+08
29	9	120	1089	1200	3,5,6,7	30.67	1.13E+08
30	10	120	1210	1320	3,5,6,7	99.52	1.13E+08



Figure 1: Run-time Comparisons

From the results, we can compare the time it takes for each method to solve the test problems for an optimal solution. The results in Figure 1 show that the Explicit Enumeration takes a considerably longer time to solve a problem, especially if the number of factories is large, compared to the branch-and-bound method. Each method results in the same optimal solution with the same number of factories being opened, but the branch-and-bound method determines optimal solutions in a significantly short time-span.

Conclusion

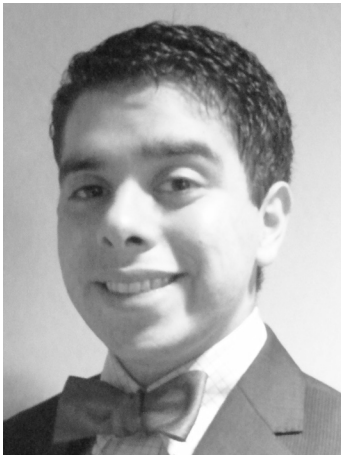
For this research, we surveyed and evaluated the performance of two solution approaches, namely the branch-and-bound and the explicit enumeration methods, for solving the Uncapacited Facility Location Problem. For the branch-and-bound method, we used the CPLEX software to obtain optimal solutions. We inferred that this method is more efficient in obtaining an optimal solution. The Explicit Enumeration method is found to be efficient in obtaining an optimal solution but as more factory sites were considered, it took a longer time to obtain an optimal solution. These approaches were compared by solving randomly generated problems with varying the number of factories and retailers. For future research, we recommend the implementation of the Bender's decomposition, Lagrangian relaxation, and dual-based methods.



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Cinco de Mayo: Political Propaganda, Conflict, Treason, Alliance and Victory from 1861-1867



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Abstract

Border interactions between the United States and Mexico are a political and policy practice that has recently made international headlines. However, conflict, commerce, military and diplomatic alliances between both nations are something that has been part of the borderland since the inception of New Spain, present day Mexico. On May 5, 1862 the Mexican people and government were tested against their will and democratic values when the French, led by Emperor Napoleon III, launched a military attack on the City of Puebla. The Mexican forces, seen as the underdogs, undermined the odds and defeated the French Imperial military. The conflict gave birth to what we know now as the celebration of El Cinco de Mayo. The battle gave birth to a conflict that lasted most of the 1860's. The United States aided the liberal government, which was the recognized governing body, led by Benito Juarez. Juarez sent special agents to the United States to collect combat materials, men and financial support from the residents of the United States. The Mexican people suffered treason from their military, filibustering attempts from American and Mexican nationals, along with secret societies whose main target was to exploit the Mexican people during French rule.

Introduction

Benito Juárez, former Mexican President and patriarch of Mexican Liberalism once said, “Among individuals as among nations, respect for other people’s rights is peace”. Juárez saw Mexico’s rights trampled by an invading French army. War broke out on May 5, 1862 as Liberals struggled to defend Mexican sovereignty and their president. Mexicans won that first battle at Puebla, a victory now celebrated under the name of “Cinco de Mayo,” though it took Mexico 5 more years to oust the French and the emperor they installed.

This year, 2012, marks the sesquicentennial of “Cinco de Mayo,” but ironically this triumph of Mexican liberalism and sovereignty is celebrated with much more zeal here in the US than in Mexico. Cinco de Mayo wins acclaim from the high-ranking politicians—the President of the US and Congress—to corporate America (Corona and Taco Bell)—to small towns and classrooms and chat-rooms throughout the nation. The question is why? Most people assume that it is just an occasion for Latino pride, and it is. Latinos are proud of what Mexico accomplished. But what people do not realize is that Latinos living in the United States in the 1860s also made significant contributions to Mexico’s struggle for freedom. Two scholars, Miller publishing in the 1970s and Hayes-Bautista who just published his findings last month, have traced those contributions for Latinos resident in California and surrounding areas, mostly in the gold-mining communities. In reviewing the material contributions (weapons, supplies, men, money, etc.) documented in the primary sources, I discovered a major contradiction which became the focus of my research. I argue that in order to defend Mexico, Mexicans and Latinos, resorted to tactics that threatened Mexico. For the purposes of this paper, I examine the ways in which Mexico’s war to oust the French forced them into collaboration with filibusterers, Confederates colonists, warlord generals, secret agents and others based in the United States who also threatened Mexico’s territorial integrity and national sovereignty.

The French Intervention in Mexico: Historical Background

Thanks to the bravery of the Mexican soldiers and the leadership of General Zaragoza, the Mexican army won the first battle against the French. The First Battle of Puebla catalyzed a fraternal bond between Mexico’s liberals and Latinos living in the United States. From 1862-1867, French Emperor Napoleon III, sent nearly 30,000 troops and installed an Emperor, Maximiliano, a project antithetical to the Republican form of government that had just triumphed in Mexico under the leadership of Benito Juárez. The Mexican government and people suffered a bloody war thanks to the imperialistic ambitions of the French who allied with conservatives in Mexico, led by disgruntled elites. Mexico’s large economic deficit and foreign debt, which had amounted to \$82,315,446, led President Juárez to declare a moratorium on debt repayment. European countries that were owed money included France, Spain and Great Britain. The four European powers met in London on October of 1861, which led to the Treaty of London, calling for military intervention in response to Mexico’s moratorium decree. Though England and Spain also sent warships, they accepted the terms negotiated by Juárez’s government and withdrew. By April of 1862, the only country that remained in Mexico was France. The French army marched on the capital, Mexico City, only to be defeated at the city of Puebla on May 5, Cinco de Mayo.

These Mexican forces organized as el Ejército del Norte, or Army of the North, were led by General Ignacio Zaragoza Seguín. The triumph of the Mexican army came with great admiration of the Mexican people. Celebrations erupted, thus conceiving the

holiday Cinco de Mayo, across the country. Zaragoza was looked upon as a hero, as were the men he fought alongside with. Clusters of Liberal party supporters, which was the political party of Juárez, formed across the country to help fund and support the cause. News quickly spread to the United States. Mexican emigrants and Americans of Mexican descent joined the cause to liberate Mexico from the French and defeat the Imperial government subsequently installed. Throughout the southwestern United States groups of newspapers and community organizations, known as Juntas Patrióticas, were formed to help the Mexican people attain freedom.

San Francisco and Los Angeles galvanized support in the hinterlands of California by publishing Spanish-language newspapers condemning the injustices of the imperialists in Mexico. The Juntas Patrióticas spread rapidly across the region. Between the years 1862-1867 total membership is estimated to have been 13,831. Women joined the cause and formed similar groups. The functions of these organizations were to help fund the cause against the French, recruit men to fight and, galvanize political support throughout the United States.

Of course not all Latinos joined the Liberal cause. Some sided with the Imperialists, particularly with those who sympathized with Confederacy. The United States of America, from 1861-1865, was fighting what is now known as the Civil War. This was a political conflict between the North and the South. Turmoil was affecting the United States southern border as well, and the French Intervention in Mexico interacted in complex ways with the Civil War in the United States.

Literature Review

Historian, Ryal Miller, in his article, *Arms across the Border: United States Aid to Juárez during the French Intervention in Mexico* speaks of the financial and clandestine operations to fund Juárez and his forces. Juárez sent special agents to the United States to secure funds from the United States Government and private parties. Two of the key Juarista agents were General Plácido Vega and General Gaspar Sánchez Ochoa. Mexican bonds were used to purchase weapons, munitions, and other military supplies. Other liberal efforts to win support in the US were undertaken through the diplomatic ties forged between Matias Romero, Juárez's diplomatic representative in Washington DC, and the government of Abraham Lincoln, President of the United. The United States official policy was neutrality, but its sympathy lay with the liberals and it gave official recognition only to Juárez's government. Mexican liberals also won popular support in the US from citizens who championed the Monroe Doctrine, which stated that any European attempt to colonize the Americas would be a violation of the continent's sovereignty.

Miller's articles, "Californians against the Emperor" and "Plácido Vega: A Mexican Secret Agent in the United States, 1864-1866", focus specifically on the secret assignments Vega was given by Juárez. The primary purpose of the mission was to supply Mexican troops; however the mission of the Mexican agent violated American neutrality laws, which decreed that American weapons and ammunitions could not cross the border. These laws were deemed particularly important during the Civil War. Hundreds of thousands of dollars were spent on weaponry at an instance. Some of the secret agents had, in their possession large amounts of currency, ranging between \$100, 000-10,000,000 in funds to purchase weapons¹. Those Americans who helped supply the weapons, many of whom were military officers, were compensated for their efforts by being paid in the tens of thousands of dollars. At times the rewards were as much as \$50,000². These funds were allocated to help the Liberal cause. Heavy recruitment strategies by Vega, and his use of

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the Spanish newspapers to spread propaganda, were directed to an audience who was of Mexican descent in California.

David E. Hayes-Bautista, author of the book “El Cinco de Mayo: An American Tradition depicts the history of the holiday, Cinco de Mayo”. Hayes-Bautista’s Chapter four focuses on juntas patrióticas across the state of California. Also, Hayes-Bautista lauds the role women and their patriotism, both within the juntas and by forming their own pro-Juárez groups. Hayes-Bautista also acknowledges some elites, of Mexican descent, sided with the Confederate cause to gain both political and financial gain. The book enables the reader to see that the history of Cinco de Mayo was impacted by Mexican Americans who played a significant role and that the history of the French Intervention so the celebration of-Cinco de Mayo must acknowledge their participation and commitment.

Joseph A. Stout, Jr., author of the book *Schemers and Dreamers*, gives the historical accounts of filibustering attempts on Mexico starting with the ambitions of Aaron Burr, winner of the duel against Alexander Hamilton, to obtain Mexican land and create an independent nation, to the filibustering attempts of the early 20th century. Hayes-Bautista fails to acknowledge the links between champions of the Mexican resistance to the French and filibusterers. Miller does not acknowledge the grassroots movement that mobilized to champion the liberal cause. And Stout does not give sustained treatment to the larger political tensions in the Mexican and American arenas.

Another gap in the scholarship is an analysis of the involvement of some of the Juárez supporters that were secretly dealing with the Imperialist during the French rule. Another matter not addressed is the involvement of Union troops and commissioned officers who participated in filibustering during or after the Civil War. A secondary contribution of this research is to trace the links among Union forces, the Confederacy and the Imperialists that threatened Mexico’s territorial integrity and political sovereignty.

Methodology

The Cinco de Mayo research project will conduct its methodology by the analysis of primary documents from the time period of the conflict. The first focus of the research is to measure the amount of support that was given to the Juárez forces by Latinos and Latinas living in the United States. Analysis of primary sources, such as newspaper articles from the 1860’s, was used to analyze the involvement and contributions of all involved parties in the conflict. This project also assesses linkage between the Mexican conflict and other historical events during the historical time frame. The focus of the project is to identify those who were aiding the Juárez forces for the good of Mexico and those who helped Mexico, but did so for their own political gain, often by aligned themselves with both expansionists and Filibusters. For this purpose the research used primary sources digitized in the database “Hispanic American Newspapers”, Other sources include correspondence between Juárez and his secret agents in order to identify the assets, strategies, locales, and “players” during a multinational conflict and imperialist European expansion. This data will test the hypothesis of Latinos in the United States contributing to the aid of Juárez and those who sought to exploit Mexico’s vulnerability to filibustering ventures.

Results

The United States Neutrality Laws, which were established after a treaty signed in 1818, stated that individuals could stockpile arms and ammunition as long as they were not organizing an expedition into a country that was at peace with the United States. Peace and enforcement of the 1818 treaty would have helped Mexico gain stability to grow both politically and economically, but it was poorly enforced. Filibusterers organized openly



with little interference from the government. The law did little to prevent filibustering, however, in part because it had strong popular support and because it was difficult to differentiate between filibusterers, legitimate armed colonists, and political bravado in favor of the Monroe Doctrine and Westward expansion. In the year 1848 the Treaty of Guadalupe Hidalgo was signed, ceding to the United States nearly half of Mexico's territory. The land included present day California, Arizona, New Mexico, and Texas among others. The treaty also required the United States to protect the Mexican borderland from any threat. The northern Mexican states had scarce population so the Mexican government encouraged settlement to create a buffer from an external attack. Promotion to colonize the lands by the government was a plan to grow the population in the region. On July 19, 1848, then President of Mexico Jose Joaquin Herrera established a decree declaring the northern-most states as military colonies to protect the area from both Indians and filibusterers. Once there was security and progress the land would be turned over to civilian control, said Herrera.


Section One

The conflict between the French Imperialist and those loyal to the Liberal Government, headed by Benito Juárez, was made up of heroes, foes, traitors and common citizens. These individuals had a role in the conflict. Some were of the political elite, military, clandestine agents and citizens of both the United States and Mexico that had a role in ousting or trying to maintain imperialist rule in the country. Every day citizens, such as miners in the northern states of Mexico and everyday residents in the State of California organized to contribute to the cause of Mexican democracy. High-ranking officials such as President Juárez and his ambassador to the US, Matias Romero, struggled to resist French invasion and imperial rule. Throughout the period of 1862-1867, in both Mexico and the United States, contributions came from both men and women. Yet, some of the so-called heroes in the Mexican cause later were considered traitors of the war. Generals of the Liberal Mexican Army allied themselves with Confederates, who wished to expand slavery into Mexico, filibusters, and even secret societies.

The Imperialist takeover of the Mexican Republic was an act of war that stripped the Mexican people of their freedoms. Individuals, both men and women, who were situated in the southwestern United States, came together to establish patriotic junctions in aid of the Juárez regime³. They were groups that were establishing to support the Liberals against the French⁴. Within weeks of the defeat of the French, in the First Battle of Puebla in 1862, 5000 people in California were mobilizing to donate at the minimum one dollar on a monthly basis⁵. Quickly, by September of 1862, the cause of the patriotic groups, also known as Juntas Patrióticas, established themselves as something beyond fundraising organizations. In Los Angeles, California, in 1862, a group of men established one of the earliest juntas that was dedicated to not only arm, also to help mobilize troops and supply Liberal Mexican troops with war materials⁶. Those who moved to support Mexico saw their actions as something that went beyond defense of Mexico. In the eyes of anti-imperialists, the invasion of the French was an attack on the American continent as a whole⁷. Pro-Juárez advocates proclaimed that the fall of Mexico endangered the rest of the Americas and would in turn isolate and threaten democracy in the United States.

These patriotic clubs gained tremendous popularity, especially in California, involving an estimated total of some 13,831 junta members, from 1862-1867⁸. Women also created independent juntas that were administered by women. On April 20, 1865, "Sociedad Patriótica de Señoras de Virginia City" in the State of Nevada, came together to mourn the assassination of the American president Abraham Lincoln whom they hailed as





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a champion of Republicanism in the continent and a friend of Mexico's fight for liberty⁹

One of Juárez's top clandestine agents, General Plácido Vega, was in charge of seeking funds and military necessities from the United States¹⁰. Vega was ordered to traffic weapons and other materials across the US/Mexican border¹¹. Vega mostly used Mexican ports to land the materials that were obtained while operating in the United States, though he also tried an overland approach when US port authorities blocked his shipments. Difficulties in the disbursement of the attained goods by Vega were slowed and even stalled by the French¹². Due to the increased traffic of weapons and materials in into Mexico, the Imperial Mexican Government established that all ports in the country were to comply with their regulations¹³. Vega, ultimately had no control over where the weapons and other materials ended up. That is why some of his efforts may have allowed Imperial forces and foes to take control over obtained weaponry.

Matias Romero, the Mexican diplomatic voice in the United States, as a liaison to between the Juárez and Lincoln administrations. Mexican citizens saw his service as an asset during the French intervention¹⁴. Romero, a man that propagated both liberal and progressive stances, was an individual that went beyond his political beliefs to better the country. However, Romero tried to float a loan through Napoleon Zerman who had earlier promoted a filibustering scheme. Zerman, who was a French, had lead a filibustering attempt to oust, then Mexican president, Antonio de Santa Anna¹⁵. His fleet carried 120 who were American nationals. The attempt was to aid with the revolt from five states in Mexico who wanted to separate from the country.

Some of the American champions of the Liberal cause in Mexico included some of the military iconic figures of the day, yet self-interest may have motivated them. General Logan, from the state of Illinois, granted his support to the Juárez cause. Logan, called the French interventions an attack not just of Mexico's sovereignty but on the democratic advancement of the Americas¹⁶. Logan called for a strong¹⁷ opposition against the French and stated that every country and citizen has the right to a government that they have them rule¹⁸. The general went on to claim that this, the liberation of Mexico, is an American promise to its people¹⁹. If America failed so would the rest of the continent. Ulysses S. Grant, General during the Civil War and later President of the United States, claimed support towards the Liberal cause. Grant had sent a total of 100,000 troops to observe the conflict from the American border²⁰. Grant felt that the only way that the Mexican people were going to be able to gain their liberties back was by completely ousting Maximiliano and its forces from the country²¹. Grant called Mexico a land full of brave men and women who have fought through the intervention with pride and valor²². Grant believed that Mexico would have emancipation, which the Mexican people would have their freedom and European intervention would become a thing of the past, yet it is worth noting that Grant later won Mexican support to build a railroad which promised him personal profit²³. There other top military officials who were part of helping in the Mexican liberation, however some of their intentions were not always clear, nor in the best interest of the Mexican people. General Lew Wallace was one of these individuals. Wallace was sent down to Texas to negotiate a treaty with the Confederates, who wished to expand slavery, but there is no documentation of what was said of concluded in those meetings. It is known that the confederacy had plans of expanding slavery into Mexico. Confederate sympathizers, such as the secret society known as the Knights of the Golden Circle, advocated the expansion of slave ownership beyond American borders.

The French presence in Mexico was a conflict that did not directly involve the

United States. During this time the United States was trying to refurbish its democracy, because the nation was divided by the Civil War. However, the Lincoln administration still managed to send its support to Juárez government, which was the government the US recognized. Members of Lincoln's cabinet proposed a joint expedition, with both Confederates and unionist, to help oust the French because its occupation was in violation of Manifest Destiny²⁴. The hope was that by uniting against the French, the sectional tensions between the North and the South would ease and full-out Civil War could be avoided. Here again, US proposals to aid Juárez against the French had self-serving motives. Mexico feared that armed US army incursion, even in defense of Mexico, might result in further loss of territory as had so recently occurred in the Mexican War of 1848.

Filibustering was common practice during the nineteenth century. The justification offered by filibusterers for occupying vast territory, usurping the resources, and controlling the residents was that they were liberating the oppressed and fostering productivity and prosperity.

Some of Juárez's military leaders were some of the traitors against his liberal government. Among those who betrayed the recognized Mexican government were some of the nation's top military officers. Some of the men who were seen as traitors were Generals Cortina, Lopez, Hinojosa and Olvera all of whom had originally sided with Juárez, but as the war progressed they foresaw a French victory and decided to side with the invader²⁵. Cortina, also refrained his troops from engaging in conflict from a retreating French force in Monterey²⁶. Years after the war, Cortina attempted to raise an Army in the northern state of Tamaulipas. In 1872 a group of insurgents, in the state of Matamoros numbering around 800 men, were believed to have been commanded by Cortina. Also, Cortina was part of several revolutionary revolts, which took place after the exodus of the French, in which his troops did not attack rebel forces²⁷. Post Imperial rule, Mexico faced significant waves of insurgency. The stronghold of the insurgency was along the Texas and Mexican border. An American politician, who was a Republican, spoke of the possibility of annexation. However, fear of more violence was prompted by concern that Cortina possibly might march into Texas with his forces, which were made up of political moderates and Mexican indigenous recruits. General Carvajal, from the state of Tamaulipas, was a military officer who had power ambitions of his own. Initially, Carvajal had been enlisted in the Liberal Army to aid with the clandestine operations that Juárez had assigned to General Plácido Vega. Personal letter correspondence between Vega and Juárez, while Vega was operating in the United States, indicate a lack of security when dealing with Carvajal through Vega's eyes.

Not only did filibusterers seek to usurp Mexico's territory, but also to flout its prohibition of slavery. Ambitious Confederates had plans to expand slavery practices into the northern most area of the Mexican Republic. Lydia Marie Child, a Unionist and abolitionist, wrote to the former Governor of Virginia, Henry Alexander Wise, of her disgust of the American Confederacy expanding slavery into the Mexican territory. On September of 1865, during the final stages of the Civil War, General Robert E. Lee, leader of the Confederate forces, wrote to one of his officers, about the migration of southern people into Mexican land. The Confederacy publicly spoke of their support of filibustering. Initially, Confederate forces, had come up with a plan to filibuster the northern most Mexican states, which later turned into a proposed expedition into central Mexico in order to oust Maximiliano and his empire.

A major impetus for filibustering and extending slavery into Mexico came from



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a secret society called the Knights of the Golden Circle, which was founded explicitly to organize expeditions into Mexico. Originally, this organization was made up of between 80 and 100 men of high-ranking political or military positions²⁸. They developed into two separate legions, one in Cuba and the other in the United States, each was composed of over 10,000 men²⁹. This secret society misdirected disguised its ambitions by claiming to be advocates of the Monroe Doctrine, saying “The “K.G.C.” is not a filibuster enterprise, but a spontaneous expression of public sentiment to the carrying out of the Monroe Doctrine”³⁰. By 1859 the main objective of this new secret society was the acquisition of Cuba³¹. As stated before the purpose of the organization was to carry out the Monroe Doctrine, but ultimately the organization was built for practical adventures, “Its ultimate design is undoubtedly to perfect an organization of discontents for the purpose of undertaking practical adventures to Cuba and Central America, whenever a suitable opportunity occurs.”³².

There can be a possible linkage between the Knights of the Golden Circle and the French invasion of Mexico, because of its early attempt to enter Mexican territory. This organization, as early as 1859, had intentions of filibustering to liberate Mexico from the Juárez Administration³³. The Knights of the Golden Circle used propaganda to justify their ambitions to take over a territory and nation. They stated their goals as breaking up the exclusiveness of the church in the everyday lives of citizens, protecting the lives of people, and increasing commerce by implementing a Navy³⁴. This group pledged to respect the right of property, expand prosperity through the re-opening of Mexico’s mines, and expand the equity through of educating the people³⁵. In the eyes of the Knights of the Golden Circle, their rule of Mexico would have made it one of the loveliest countries, also including other territories like Cuba and Central America³⁶. They claimed they were not a filibustering group because they would not enter a country in order to steal and oppress from its people; that only those, they said, could they be called filibusterers³⁷. There is evidence that the Knights of the Golden Circle were working together with the Confederacy to continue the expansion of slavery in to Latin America³⁸. Alliances with former Mexican political elites was also partaken by the Knights of the Golden Circle. General A. Bickley, President of the organization, met with former Mexican president Santa Anna, who at the time was believed to be a French spy³⁹. The KGC also spoke enlisting the Fenians another secret society with filibustering inclinations.

The Fenian, or Phénian Brotherhood, was a political and secret society that existed around the time of the French invasion of Mexico. This society was made up of Irish expatriates living in the United States who wanted to support Irish dissidents to help and create the Irish Republic⁴⁰. Their ultimate ambition was to save Ireland from British rule and bring the Irish their freedom, that they felt their countrymen deserved⁴¹. The Fenians mobilized to invade British-controlled Canada as a means of attacking the British⁴².

The French intervention of Mexico became a war fought in newsprint no less than on the battlefield. Newspaper editors in the United States were able to pro-Juárez propaganda and information long after the pro-Republican papers in Mexico had been censored by Maximiliano. supporters, of the Empire used newspapers to extoll the merits of Empire and the French intervention, including one such paper as in Brownsville, Texas, that was particularly committed to Imperialistic views.

The state of California was a major staging ground for the formation of filibustering ventures and of freely- associated people coming together to aid the cause for Mexican liberty. Residents of the US West Coast and Southwest had strong ties to



Mexico's Pacific coastal and northern border states. The northernmost states of the Mexican Republic became some of the major areas of conflict, the most coveted for mining and other resources, and a site for to traffic goods from the US to Europe through Mexico's ports, especially during the Civil War when the Union blockaded Southern ports.


The States of California was the one of the most instrumental areas in the United States when it came to aiding the Liberal forces. The Juárez administration heavily encouraged securing weapons in California and shipping them to Mexico from its ports, especially from San Francisco. However, filibustering expeditions, also originated in the city of San Francisco. Ten years before the invasion of the French, on November 19, 1851, a filibustering trip was constructed. The mission was led by the filibusterer Walker, which departed from San Francisco to the Mexican state of Baja California. Walker's expeditions carried approximately between 200 and 800 men. Another vessel, in alliance with Walker, carried between 150-200 men. Walker and his men left the San Francisco Bay on a November day. Walker's men were armed and ready to go forward with their expedition of Baja California. To their surprise when they docked in the Mexican territory Mexican officials were waiting for them. Immediately Walker and his men, so they would not be apprehended by the authorities, pretended to be men of commerce. This was one of the early failed filibustering attempts into Mexican territory. Other filibustering expeditions organized from California in the 1850s included those of Rousset, Crabb, so California was well-accustomed to the phenomenon of newspaper solicitations for armed men to board ships bound for Mexico.

Section II

California proved to be a useful source of support for the Liberal campaign to regain independence from the French. Boats were sailing out of San Francisco with thousands of weapons, gunpowder, small arms and other materials that were heavily coveted by Juárez and his forces⁴³. The Mexican government was using Mexican bonds to pay for the services that some of the Californian and American officials were providing to the Mexican government. The Mexican officials also employed American officers to help traffic the weapons, from states like California to, Mexico. Sometimes deals soured. One such official, General Knox, urged his US contacts to take back the weapon and other material provided to the Mexican government, because of lack of payment. Independent bankers in California also became involved in loaning money to the Mexican officials to support the Republican cause.

The Rio Grande, is a geographical area that cotermines Texas and Arizona. On the Mexican side it includes the states Sonora, Chihuahua, Coahuila, Nuevo Leon and Tamaulipas. The Rio Grande area and California were the primary sites for launching filibustering expeditions and mustering material aid for Mexico during the French Intervention. Texas suffered bloodshed from both the Mexican conflict and the Civil War.

This particular military venture was led by the Union Major General Sumner⁴⁴. Sumner's forces totaled up to 7000 troops from California⁴⁵. Previous to this there had been earlier reports of Union agents in Sonora⁴⁶. These troops were situated in the West during the Civil War conflict⁴⁷. It was previously reported that the General Mexican Government had given permission to the Union Army to pass through Sonora⁴⁸. The Confederacy took note of the movement of weapons across the border between the Mexicans and the Unionists and mobilized to try to persuade Mexico to extend them the same privilege, offering to give Mexico military aid in exchange⁴⁹. General Sibley, a Confederate officer, sent a Colonel, by the name of Reilly, to negotiate with the Governor of Sonora. Col. Reilly



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offered his military aid by helping the state of Sonora oust Apache Indians in exchange for allowing his men to cross overland to the port of Guaymas, from the state of Arizona⁵⁰.

In the State of Nuevo Leon, a decree by then Governor Gomez, called for the execution of all those who betrayed the Mexican people. Americans, also known as Yankees, and remaining Europeans in the nation who were involved with the Imperial movement were subject to execution under Mexican law⁵¹. Americans who ventured to Mexico to fight risked their lives, not just on the battlefield, but in persecution as “foreigners.” The catalyst for this was the diplomatic stance taken upon the American government to not execute, Maximiliano, who the Mexicans saw as the main enemy during the span of the conflict⁵². They now saw that not even the Yankee himself could interfere with the Mexican sovereignty. Mexican nationals, in their minds, that if they went forward with the request of the American government the next step would have been to give up their land, mines and their women⁵³. Mexican national pride was centered around the ability to worship their God, till their own soil, work the mines⁵⁴. In the eyes of the Mexican people the country solely belonged to them and God⁵⁵. The foreign presence in Mexico was the only barrier between them and their liberties⁵⁶. There was a call to death to all those who were not Mexican nationals⁵⁷. General Gomez was quoted as saying, “In our struggles for liberty we have lost nearly all our lands, and our mines, and our liberty, and our women, and our honors we still have, but the foreigners have the available wealth of the Republic; but they will see in less than three years that Mexicans will have what they want to call Mexico”.

In Texas, in the year 1851, there were also heavy recruitment efforts to start a filibustering expedition. The man that was at the head of it was named Jose Maria J. Carvajal, who was organizing in Texas to invade. Carvajal recruited heavily for the invasion of the Mexican state of Tamaulipas. Carvajal’s primary motive was to establish, like other filibusterers the time, an independent nation that would be made up of the northern Mexican states, to be called the Republic of the Sierra Madre. During the years 1851-1855 those that were part of the movement made their way into the State of Matamoros. Carvajal publically announced his intentions through the media. He was quoted in newspapers that he planned on creating a new nation in the northern region of Mexico. The Mexican government quickly found out about Carvajal’s intentions and stationed troops on the border.

Carvajal enlisted about 300 men for his venture. The only prerequisite was that they provide their own weaponry and ammunition, among other necessary equipment. Those who joined the expedition had to swear allegiance to Carvajal. Also, they were to receive the same pay as a Texas Ranger. The United States government tried to stop the actions of Carvajal and his men. Millard Fillmore, the president of the United States at the time, claimed that anyone that violated the neutrality laws of the United States was going to be prosecuted for their actions. Generals of the American Army at the time, D.E. Twiggs and P.F. Smith, were ordered to go stop the filibustering goals of Carvajal and his men. The War Department was later notified that some of the same American troops deserted to join the Carvajal expedition. The barriers that were put upon Carvajal were ignored and he continued on with his goal of establishing a new nation in the bordering states between Mexico and the United States. Throughout all this the Mexican government believed that the United States government was not being sincere about stopping Carvajal.

On October 9, 1851 Carvajal fought his way into the state of Matamoros. Assisting Carvajal was one of the most illustrious and popular of the Texas Rangers, John S. “Rip” Ford. Awaiting Carvajal and his men were three Mexican Generals Don Antonio Jauregui, Jose L. Uruga and Francisco Avalos. These men and his troops defended against



Carvajal's invasion. By 1853 some of Carvajal's lieutenants had been apprehended by American officials in Corpus Christi Texas. In 1864 Carvajal and his men attempted to take over the Mexican territory. Continuous failure did not stop Carvajal from his territorial endeavor. Despite the threat he posed to Mexico's sovereignty, President Juárez later appointed Carvajal as Governor of the state of Tamaulipas.

Conclusion

Expansionist movements in the US created a threat to the sovereignty of Mexico. Manifest Destiny, which is a movement that advocated the westward expansion of the United States, was one of the primary threats to the Mexican people.

Constant war in Mexico and foreign ambitions, such as filibustering movements in the United States and the French Intervention in the 1860s slowed the progress that Mexico needed to achieve in order to become a nation of prosperity and freedom. May 5, 2012 marked the 150th anniversary of the First Battle of Puebla, where the Mexican people first encountered the Imperialist forces of France. In the span of 150 years, stability improved, but often at the expense of an open political system. In the present moment, the US continues to play a major role in destabilizing Mexico, particularly in trafficking arms. Recently a political scandal over an Operation known as "Fast and Furious," has made headline news. This operation is one of several recent law enforcement initiatives known as "gunwalking" that allows guns to be sold to suspected traffickers in order to trace them into Mexico and nab high-level cartel members. The failure of this program, including the identification of these arms at crime scenes and cartel operations, has upset both Mexican and US publics. What began over a hundred years ago persists to the present. Well-intentioned involvement, including traffic of arms to Mexico, can end up reinforcing the position of those groups who threaten Mexico's sovereignty and peaceful prosperity.



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Notes

(Endnotes)

- ¹ Ryal Miller, "Arms across the Border: United States Aid to Juárez during the French Intervention in Mexico," 21.
- ² Ryal Miller, "Arms across the Border: United States Aid to Juárez during the French Intervention in Mexico," 31.
- ³ Hispanic American Newspapers. *Voz del Mundo*. 1865.
- ⁴ Hispanic American Newspapers. *Voz del Mundo*. 1865.
- ⁵ David E. Hayes-Bautista. *El Cinco de Mayo An American Tradition*. (University of Berkley, 2012). 109
- ⁶ Hayes-Bautista, *El Cinco de Mayo An American Tradition*. 1862. 109
- ⁷ "La Causa de Mejico es la Causa de la America" *Voz del Nuevo Mundo*. (1865).
- ⁸ Hayes-Bautista, *El Cinco de Mayo An American Tradition*. 1862
- ⁹ "Junta Patriotica Mejicana de Hornitor" *Voz del Nuevo Mundo* (1865).
- ¹⁰ Ryal Miller, "Arms across the Border: United States Aid to Juárez during the French Intervention in Mexico," 21
- ¹¹ Ryal Miller, "Arms across the Border: United States Aid to Juárez during the French Intervention in Mexico", 21
- ¹² "Celebraciones del 16 de Setiembre en Virginia City" *Voz del Nuevo Mundo*
- ¹³ "Celebraciones del 16 de Setiembre en Virginia City" *Voz del Nuevo Mundo*
- ¹⁴ "Ministerio" *Voz de Chile y de las Republicas Americanas*. (1868).
- ¹⁵ "News of the Week" *The Weekly Herald* (1856).
- ¹⁶ "Estractamos los [Illegible] Articulos Del "New-York Herald"
- ¹⁷ "Estractamos los [Illegible] Articulos Del "New-York Herald"
- ¹⁸ "Estractamos los [Illegible] Articulos Del "New-York Herald"
- ¹⁹ "Estractamos los [Illegible] Articulos Del "New-York Herald"



- ²⁰ "Opion del General Grant Sobre Mejico" *Voz del Nuevo Mundo*
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- ²² "El Gral. Grant en la Cuestion Mejicana" *El Zaragoza* (1865)
- ²³ "El Gral. Grant en la Cuestion Mejicana" *El Zaragoza* (1865)
- ²⁴ Ryal Miller, "Arms across the Border: United States Aid to Juárez during the French Intervention in Mexico," 9
- ²⁵ "Camargo" *Republican*. (1866).
- ²⁶ "Camargo" *Republican*. (1866).
- ²⁷ "Camargo" *Republican*. (1866).
- ²⁸ "Filibusteros" *Clamor Publico* (1856).
- ²⁹ "From Central and South America" *San Francisco Bulletin*, published as *Daily Evening Bulletin* (1864)
- ³⁰ "The Knights of the Golden Circle" *The New York Herald-Tribune*.
- ³¹ "A New Filibustering Expedition" *The Sun* (1859).
- ³² "A New Filibustering Expedition" *The Sun* (1859).
- ³³ "A New Filibustering Expedition" *The Sun* (1859).
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- ³⁹ "The Knights of the Golden Circle" *The New York Herald-Tribune*. (1859).
- ⁴⁰ "Col. Corcoran and the Fenian Brotherhood" *The Philadelphia Inquirer* (1862).
- ⁴¹ "To-day Anniversaries and Gatherings 's Despatches. Eastern Dates to October 4th, Death of Admiral Gregory. Religious" *San Francisco Bulletin* (1866).





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- ⁴² “Col. Corcoran and the Fenian Brotherhood” *The Philadelphia Inquirer* (1862).
- ⁴³ Hayes-Bautista, *El Cinco de Mayo An American Tradition*. 1862
- ⁴⁴ “Latest from Arizona” *Agusta Chronicle* (1862).
- ⁴⁵ “Latest from Arizona” *Agusta Chronicle* (1862).
- ⁴⁶ “Latest from Arizona” *Agusta Chronicle* (1862).
- ⁴⁷ “Latest from Arizona” *Agusta Chronicle* (1862).
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- ⁵¹ “Mexico. The Shooting of Gen. Vidaurri-The Counselor of Maximilian Imprisoned-An Address by Gen. Escobedo” *New York Tribune* (1867).
- ⁵² “Mexico. The Shooting of Gen. Vidaurri-The Counselor of Maximilian Imprisoned-An Address by Gen. Escobedo” *New York Tribune* (1867).
- ⁵³ “Mexico. The Shooting of Gen. Vidaurri-The Counselor of Maximilian Imprisoned-An Address by Gen. Escobedo” *New York Tribune* (1867).
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Understanding a Revolution: Complexity Economics



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Abstract

Complexity Economics is a recent field, constantly discussed and debated. Many economists do not agree with the application of complexity to the study and modeling of economic systems because of the broadness of the ideas of complexity while others develop and observe complexity models at different scales. This paper explores the historical background, ideas and development of complexity and complex systems and its applications to the economy. The current research is working on a dynamic model that visually displays the interconnections between different industries in San Antonio, Texas. The software Gephi creates a "map" of the economy of San Antonio, linking industries in relation to how much they trade with one another, making it possible to visually study the different relations and clusters of industries that have the biggest effect in the economy. An industry that has many links to other industries can affect the patterns of behavior within the economy in comparison to those industries that have fewer links. This model supports the idea that economics functions as a complex system and should be modeled using the theory of complexity.



Introduction and Background

The study of complexity in systems has intrigued researchers for the last thirty years. Today, there is no exact definition of what complexity means; nonetheless, many fields of study such as biology and economics are implementing the general theories of complexity, reinventing traditional models and seeking the improvement of science and society. Despite the fact that no agreed upon definition exists, most agree that complexity includes the idea of “systems with multiple elements adapting or reacting to the patterns these elements create” (Arthur, 1999, p. 107).

According to Complexity-NET, a European research group, complexity “tries to discover the nature of the emerging behavior of Complex Systems, often invisible to the traditional approach, by focusing on the structure of the interconnections and the general architecture of systems, rather than on the individual components.” Consequently, the definition explains the purpose of the science of complexity. Yaneer Bar Yam (2003), the director of the New England Complex Systems Institute, defined the complexity of a system as “the amount of information necessary to describe a system” (p. 6); and further used the definition as a way to compare simple systems with complex ones.

Furthermore, The Complex Systems Society defines a “complex system” as “any system comprised of a great number of heterogeneous entities, where local interactions among entities create multiple levels of collective structure and organization”. The generalized definition provides the basic idea behind a complex system; nonetheless, in order to understand complex systems defining some of the terms often used when discussing complex systems is important. Some of the terms include: complex, system, networks, scale, emergence, adaptive, interdependence and radical openness (Yam, 2003; Chu, Strand, Fjelland 2003; Baranger, 2000).

The first term in the list, “complex”, is the starting point when discussing complex systems. What makes a system complex rather than simple? What is something complex? According to Bar Yam (2003), something that is complex is made out of interwoven or interconnected parts or something that is hard to explain (p. 1). Therefore, a complex entity is something hard to define, made out of parts, in which each part is in some way connected to another part.

The second word that requires definition is “system”. A system, in relation to the current research, is “a delineated part of the universe which is distinguished from the rest by an imaginary boundary” (Bar Yam, 2011), moreover, is important to note that a system in the realm of complexity interacts with the environment, creating different patterns of behavior that are helpful when studying complex systems. In addition, Donella Meadows contributes to the definition of a system as, “An interconnected set of elements that is coherently organized in a way that achieves something... a system must consist of three things: elements, interconnections, and a function or purpose” (Meadows, 2008, p. 11), and clarifies that systems have the ability to, “change, adapt, respond to events, seek goal” (Meadows, 2008, p. 12).

Bar Yam (2011) defines the term “network” as the connections that allow the parts of a system to influence each other. In the research, Yam specifies the different types of networks such as influence networks in which “connected parts affect each other through the network”, and networks that transfer materials or information such as transportation networks and social networks. Understanding the behavior of networks is important when applying that knowledge to the different systems, such as economic systems and when researching about the relationships between agents in complex adaptive system.



The term “scale” means, “the size of a system or property that one is describing, or to the precision of observation or description” (Bar Yam, 2011), and refers to the “progressive” property of a complex system. For example, a single atom progresses into a molecule, then a cell and eventually into a living organism. The previous property of complex system helps understand the role “emergence” plays within a system. For example, Bar Yam explains that the behavior at smaller scales give rise to properties and behavior at larger scales, “The study of complex systems focuses on understanding the relationship between simplicity and complexity. This requires both an understanding of the emergence of complex behavior from simple elements and laws, as well as the emergence of simplicity from simple or complex elements that allow a simple larger-scale description to exist (Bar Yam, 2003, p. 293). The next term commonly used in the study of complex systems is “adaptive”. The current research is interested in specifically explaining complex adaptive systems, in which “adaptive” refers to a quality that systems have in which they adapt their patterns of behavior to the changing environment and most importantly, have the capacity to influence and change that environment as well.

Interdependence is a property of complex adaptive systems and it refers to the idea that a simple change of an agent in a complex system can transform and revolutionize the way that system works. Since a complex adaptive system works through networks made out of different nodes connected through links, interdependence explains why a small change to the dynamics of a system can affect the behavior and patterns of the whole entity. In the book, *Thinking in Systems*, Meadows (2008) affirms that interdependence has a bigger effect in systems when the interconnections and purposes of a system change rather than when the elements change. In the previous example, the author explains how a university has a constant, but changing flow of students (elements) but the nature of the university (system) does not change. Furthermore, Meadows explained that if the elements of a system are defining and more interdependent when they affect the interconnections and purpose of a system.

The last property of a complex adaptive system is radical openness. The term refers to the idea that a system is connected to another system and they have the ability to affect each other. Chu, Strand, Fjelland (2003) explain the concept using the example of Lake Victoria. In their example, the lake was home to the cichlid fish, a small fish the local habitants consumed. Because the fish was not a viable exportable product, a company brought to Lake Victoria a different fish species, the Nile perch. The Nile has a high market value, which provided revenue to the company, but caused the extinction of the cichlid fish. The previous event occurred because the lake was a radical open system:

“Here we already notice the first signs of radical openness: The original reason to introduce the Nile perch was an economic one. In this sense, the economic system is partly embedded in the ecological system of Lake Victoria and impacts on it; cause and effect chains propagate from the economic system into the ecological system. The economic system transforms the decline of the population numbers of the small cichlidae led to their disappearance from the local food markets while increasing numbers of the Nile perches did not find their way to the local markets (too expensive for the local people and also unsuitable for conservation by sun-drying)” (Chu, Strand, Fjelland, 2003, p. 5).

It important to recognize that the ideas of complexity, the study of complex systems and the properties of these systems, beg the question of what is the relationship with Chaos Theory, were ordered disorder exists and randomness is predominant. First, Chaos Theory refers to



“the qualitative study of unstable aperiodic behavior in deterministic nonlinear dynamical systems” (Kellert, 1993) and shares some characteristics with complex systems. Some of those shared characteristics include non-repetitive behavior, constant change, deterministic and nonlinear systems. Nonlinearity refers to “two quantities are not proportional to each other: doubling one causes the other to double as well” (Bar Yam, 2011). There is no doubt that complexity and chaos are related, nonetheless, not every chaotic system is complex, which indicates that chaos is a behavior that can occur in a complex system:

“So the field of chaos is a very small subfield of the field of complexity. Perhaps the most striking difference between the two is the following. A complex system always has several scales. While chaos may reign on scale n (n being a variable), the coarser scale above it (scale $n - 1$) may be self-organizing, which in a sense is the opposite of chaos. Therefore, let us add a fifth item to the list of the properties of complex systems: Complexity involves an interplay between chaos and non-chaos” (Baranger, 2000).

Additionally, Schneider and Somers (2006) explain the following in relation to Chaos theory: “Although chaotic systems and complex systems are different, for complex ones are less mechanical and more stable and predictable, Chaos Theory does inform Complexity Theory, as both concern non-linearity” (p. 355)

All of the properties and characteristics mentioned above summarize what is meant by complex adaptive systems. The concepts above give a better understanding of what makes a system complex and how complex systems are constantly evolving from one pattern of behavior to the next. The history of the science of complexity better explains how the ideas behind complexity developed and scaled up to what is understood today leading us to the start of Complexity Economics.

History of Complex Adaptive Systems

The following section focuses on briefly tracking the history behind the science of complexity and some of its branches. The purpose of identifying the most influential contributors to the science is to give some background information and understanding on past discoveries that have drastically revolutionized the ideas of complexity. Many scientists, physicists, philosophers and mathematicians have sought and continue to seek the evolution of complex systems as a way to explain the universe in more accurate way. Their past research has been the building blocks of complexity theory, general systems theory, chaos theory, the beginning of complex adaptive systems and finally, complexity economics. For thousands of years, scientists have tried to explain complexity and understand how a complex system works, but the mathematical and computational tools that have helped develop complexity were created until the 20th century. The upcoming section of the paper is concerned with the modern history of complexity.

Complexity Theory has roots from what is known as “Cybernetics”, General Systems Theory (GST) and System Dynamics. Even though the concept of complexity first appeared in 1925, the concept wasn’t studied by itself as a science until 1977. Therefore, complexity theory acquired some properties from cybernetics, GST and system dynamics.

Louis Kauffman, President of the American Society for Cybernetics, defined “Cybernetics as the study of systems and processes that interact with themselves and produce themselves from themselves” (MacGill, 2007). Cybernetics is a field that appeared after World War II and in 1946, “cybernetics itself emerged from a series of ten meetings organized again by the Macy Foundation, in which the cyberneticists were joined with a group of social scientists led by anthropologists Gregory Bateson and Margaret Mead, and

including Gestalt social psychologist Kurt Lewin” (Abraham, 2002, p. 2).

The general system theory started in Vienna during the 1920s. Ludwig von Bertalanffy is considered the originator of the GST and the one that created a link between the ideas in Vienna to those in England. Bertalanffy moved to the United States in 50s, bringing with him the main ideas of GST, “were holism and open systems, as found in the biological sphere, but Von Bertalanffy generalized grandly to social systems and world cultural history” (Abraham, 2002, p. 3.). According to MacGill (2007), “General systems theory emphasizes holism over reductionisms and organism over mechanism. Von Bertalanffy saw his work as particularly relevant to social systems and has been used in the fields of anthropology, economics, political science and psychology. Margaret Mead and Gregory Bateson helped develop General Systems Theory in the social sciences” (MacGill 2007).


According to Abraham (2002) system dynamics theory is “a large branch of mathematics created by Isaac Newton, and given its modern form by Poincare around 1880” (p. 4), that latter developed into what is known as chaos theory. Edward Lorenz realized how a simple miscalculation can cause erratic behavioral patterns in weather analysis and came up with the Butterfly Effect, in which he saw “a fine geometrical structure, order masquerading as randomness” (Gleick, 1987, p. 22) and tried to explain how simple events cascade into large irregularities in established patterns. As mentioned earlier, chaos theory consistency has many similarities with complexity theory.

These three branches evolved into what is known today as complexity, the study of complex systems. The study of complexity started in the 1980s at the Santa Fe Institute (Schneider, Somers, 2006, p. 353). Researchers and scientists joined the Santa Fe institute “a private, not-for-profit, independent research and education center” located in New Mexico, to “grapple with some of the most compelling and complex problems of our time. Researchers come to the Santa Fe Institute from universities, government agencies, research institutes, and private industry to collaborate across disciplines, merging ideas and principles of many fields -- from physics, mathematics, and biology to the social sciences and the humanities -- in pursuit of creative insights that improve our world” (Santa Fe Institute, 2012). Studies and research on complexity theory continue today and constantly being applied to study of more fields, including Economics.

Complexity Economics

The application of the theories of complexity to the study and modeling of economics has presented a new vision for the economic field starting in the late 1980s. Complexity economics consist of understanding the economy as a complex adaptive system, instead of the neoclassical theory and models. Herbert Gintis (2006) explains complexity economics as a “mirror inversion of Neoclassical theory” (p. 2). In *The Economy as a Complex Adaptive System*, Gintis defends the ideas of *The Origin of Wealth*, a book by Eric D. Beinhocker. In complexity economics, the idea of equilibrium systems is refuted, allowing a system that tolerates shocks and imperfect, chaotic behavior to take place. The characteristics of complex adaptive systems such as dynamic, agents, networks, emergence, evolution and nonlinearity are used in complexity economics and account for main differences between neoclassical theory and complexity economics.

The main purpose of complexity economics is to liberate economic system from the perfect models and theories of neoclassicism. In neoclassicism, economics is slaved to closed, static and liner models, unrealistic ideas of perfect information, price-structured



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models, no emergence of large patterns from smaller ones (macroeconomic patterns do not arise from micro patterns) and no evolution of the systems even though the agents and networks are in constant progression (Gintis, 2006, p. 3-4).

Brian Arthur, one of the fathers of complexity economics, started his work on complexity in the Santa Fe Institute, discovering some other differences between conventional economics and economic complexity. Arthur argues that complexity economics considers increasing returns instead of decreasing returns to scale¹ and that “Conventional economics thus studies consistent patterns—patterns in behavioral equilibrium, patterns that would induce no further reaction” (Arthur, 1999, p. 1).

In the book, *Complexity: The Emergent Science at the Edge of Order and Chaos* Mitchell Waldrop (1992) further outlines the thoughts and differences between classical economics and the “new” economics Arthur believed in: Classical economics bases language on decreasing returns, originates from equilibrium physics, uses people-identical models, does not include externalities, elements are prices and quantities, and no real dynamics exist (equilibrium); complexity economics uses increasing returns, bases on biology (self-organization, pattern, structure), externalities are a driving force, the elements are patterns and possibilities and the economy is in constant change, the economy is dynamic (Waldrop, 1992, p. 37).

The understanding of complexity economics is important because the science brings a new option to the study of Economics and Business. For many years, neoclassical economics has dominated research, ideas and policies, but since the models of conventional economics do not change and act in a reductionist way, the prediction of future economic tendencies and patterns have been inefficient. The basis of complexity economics lay on complex adaptive systems, which allow the system to change, adapt, adjust and consider possible spontaneous behavior from the agents of the system. Heinz Pagels, a renowned physicist said, “I am convinced that the nations and people who master the new science of complexity will become economic, cultural and political superpowers of the next century”, adding to the importance of the study of complexity and complexity in Economics. In the case of Business, complexity has tried to model business cycles and the chaotic nature of the stock market. Neoclassical economics has failed to successfully prevent the market to fail, complexity explores plausible possibilities.

Current Research

Cesar Hidalgo and Ricardo Hausmann (2007) applied the concepts of complexity to *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. In the book, the authors defined “economic complexity” as “the composition of the countries productive output and reflects the structures that emerge to hold and combined knowledge” (Hausmann, Hidalgo, 2007, p. 18). With the previous definition, the purpose of the atlas is to predict the amount of productive knowledge a country has, therefore identifying which national economies are more complex and why. The hypothesis of the study was to prove that increasing the complexity of the products leads to productive knowledge which later leads to development. The Atlas is an application of the building blocks of complexity economics and still includes some of the characteristics of complex adaptive system, such as interconnected and adaptive models. Both authors agree that the Atlas serves as a better indicator of the prosperity and the differences in income of a country.

¹ Decreasing returns of scale refers to “When our inputs are increased by m , our output increases by less than m ” (Moffatt, 2012)



The current research is building on past research done by Hidalgo and Hausmann (2007) in *The Atlas of Economic Complexity: Mapping Paths to Prosperity*, but at a different scale. Using complexity models the atlas evaluates countries and the current research is trying to build a city model using the atlas as a foundation. In the research, the Saber Institute, a joint collaboration between the San Antonio Hispanic Chamber of Commerce and St. Mary's Department of Economics started a complexity group made up of students and faculty from the Economics and Computer Science departments. The purpose of the collaboration is to create an efficient model that can apply the theories of complexity and understand the economy of San Antonio as complex adaptive system. By successfully "mapping" the San Antonio economy, the relationships and patterns of behavior between different industries can not only be understood, but visually appreciated through computational modeling.

The current research group believes that interpreting data and the economy as a complex adaptive system is a better way of understanding, explaining and predicting economics, and in this case, the economy of San Antonio.

Method

The current research seeks to determine if a complex system model is the best way to explain economic tendencies and try to predict patterns of behavior at the city-level, since we have seen it used for country-level comparisons.

Participants

The St. Mary's and SABER Institute research group hope to answer this question by developing a city-based model tailored to the San Antonio economy. The collaboration of the Department of Economics and the SABER Institute was essential to the creation of the San Antonio economy model.

Measures

The data used in the current research is from the database IMPLAN, which is a "PC based regional economic analysis system. Unlike other economic analysis products, IMPLAN constructs a complete set of regional social accounts" (University of Wisconsin Center for Cooperatives). For our project, the IMPLAN data of the city of San Antonio is transformed into data compatible with the networking software Gephi, "an open-source software for network visualization and analysis. It helps data analysts to intuitively reveal patterns and trends, highlight outliers and tells stories with their data" (Gephi, 2012). The St. Mary's team used this tool to create a network map of San Antonio's economy and this allowed us to see patterns between different industries in the IMPLAN data. In our case, each San Antonio industry data represented a node and the dollar flow between each industry was a linkage.

IMPLAN data is an input-output database that allows researchers to gather data using several different criteria such as city, state, county, zip code and region, "IMPLAN's Social Accounting Matrices (SAMs) capture the actual dollar amounts of all business transactions taking place in a regional economy as reported each year by businesses and governmental agencies. SAM accounts are a better measure of economic flow than traditional input-output accounts because they include "non-market" transactions. Examples of these transactions would be taxes and unemployment benefits" (MIG, 2011). The IMPLAN database was originally developed by several U.S. agencies as they looked for ways to gather economic information for planning purpose. The Agronomics Department at the University of Minnesota, in collaboration with the U.S. Forest Department and Federal Emergency Management Agency (FEMA) developed methods for collecting data known



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as FORPLAN an IMPLAN. The IMPLAN data used for this project is presented in the form of Social Accounting matrices, which include the movement of resources between industries by dollar value (Roman, 2012). The IMPLAN database is the standard data used for economic impact analysis.

Gephi is used in network theory to graph interconnected information and permits data analysis, including a visual interpretation of the database, manipulation of the variables.

Procedure

As mentioned earlier, the first step of the project was acquiring the data from IMPLAN. The data used in the current research included the dollar flow from different industries, a commodity code and the description of the industry, for example:

TABLE 1.
Visual example of the IMPLAN data set.

Commodity Code	Description	Industry Commodity Production
3,000	Total	125,746,914,619.252000
3,001	Oilseeds	211,123.690304
3,002	Grains	3,820,485.923434
3,003	Vegetables and melons	7,229,518.890381
3,004	Fruit	580,946.353944
3,005	Tree nuts	303,933.981129
3,006	Greenhouse, nursery, and floriculture products	80,713,478.088379
3,007	Tobacco	0.000000
3,008	Cotton	634,857.253166
3,009	Sugarcane and sugar beets	0.000000
3,010	All other crop farming products	12,659,231.997426
3,011	Cattle from ranches and farms	28,915,349.707889
3,012	Dairy cattle and milk products	2,508,926.740150
3,013	Poultry and egg products	25,662,265.777588
3,014	Animal products, except cattle, poultry and eggs	3,171,959.435746
3,015	Forest, timber, and forest nursery products	4,787,960.030589

In order to graph the data using the network graphing system Gephi, each commodity code was then transformed into a node identified with a number. For example, Node #66 in the Gephi format is the coffee and tea industry. Then, using the graphing software the research team was able to see the linkages between the different nodes. For example, Node #66 has links with Nodes #, 52, 53, 54, 55 among others. The tea and coffee industry is linked to non-chocolate confectioneries, frozen foods, canned fruit and fluid milk and butter. Even though the particular industry has many linkages, the dollar

flow between some of them is equal to zero. Links with a dollar flow greater than 1 have a strong link. In the coffee and tea example, Node #66 has a strong linkage to node #54, with a dollar flow of 1.273.

Results

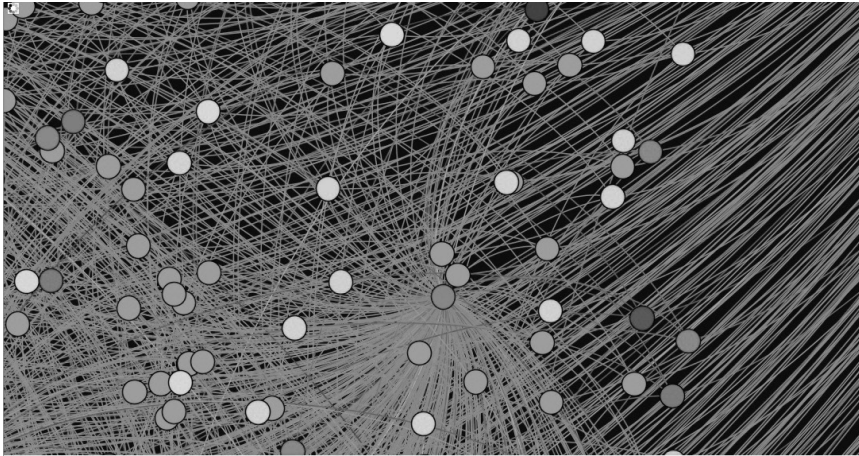


Figure 1- The image is a Gephi Illustration of a part of the San Antonio Economy.

The image above is an example of a complex adaptive system graphed using the program Gephi. In the network graph, the industries are the nodes, distinguished by different colors, and the dollar flow between two nodes is pictured with a linkage in the middle of the two.

The current network model of the San Antonio economy contains 356 nodes, representing a variety of industries ranging from tortillas to wholesale trade distribution services as contained in the IMPLAN data. The linkages between all nodes total over 80000, which supports the claim that the San Antonio, a city-level economy, is a complex system with a variety of different, interconnected agents. If a city's economy is as interconnected and depended on one another, based on the visual map of San Antonio, the traditional neo-classical models will continue to inadequately predict economic turnouts.

As we continue to process the data, we can now see that Node # 376, corresponding to scientific research and development services, is the most connected industry in San Antonio, meaning it touches 339 nodes and 301 nodes link back to it. This makes up a total of 640 node connections, accounting for the largest number of nodes in the San Antonio economy. We can also say that Node # 426 representing the cooking, housecleaning, gardening, and other services to private households industry is the least connected, with 2 in-degree linkages and 9 out-degree linkages, making a total of 11 links.

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TABLE 2.
Data from the Gephi Data Laboratory showing the most connected industries²

Nodes	Id	La...	Subcategory	▼ Degree
● 376	376		Scientific research and development services	640
● 319	319		Wholesale trade distribution services	639
● 411	411		Hotels and motel services, including casino hotels	630
● 413	413		Restaurant, bar, and drinking place services	630
● 338	338		Scenic and sightseeing transportation services and support activities for transportation	621
● 351	351		Telecommunications	621
● 149	149		Other plastics products	614
● 425	425		Civic, social, and professional services	614
● 360	360		Real estate buying and selling, leasing, managing, and related services	613
● 388	388		Services to buildings and dwellings	613
● 432	432		Products and services of State & Local Govt enterprises (except electric utilities)	613
● 381	381		Management of companies and enterprises	610
● 410	410		Other amusements and recreation	608
● 39	39		Maintained and repaired nonresidential structures	606
● 369	369		Architectural, engineering, and related services	605
● 389	389		Other support services	605
● 365	365		Commercial and industrial machinery and equipment rental and leasing services	600
● 386	386		Business support services	600
● 374	374		Management, scientific, and technical consulting services	599
● 390	390		Waste management and remediation services	598

TABLE 3.
The 20 least connected industries in San Antonio³

Nodes	Id	La...	Subcategory	▲ Degree
● 426	426		Cooking, housecleaning, gardening, and other services to private households	11
● 437	437		* Employment and payroll only (state & local govt, non-education)	11
● 438	438		* Employment and payroll only (state & local govt, education)	11
● 439	439		* Employment and payroll only (federal govt, non-military)	11
● 440	440		* Employment and payroll only (federal govt, military)	11
● 359	359		Funds, trusts, and other financial services	179
● 364	364		Video tape and disc rental services	183
● 300	300		Wood television, radio, and sewing machine cabinets	193
● 309	309		Dental laboratories	196
● 11	11		Cattle from ranches and farms	204
● 93	93		Footwear	207
● 406	406		Museum, heritage, zoo, and recreational services	209
● 18	18		Wild game products, pelts, and furs	212
● 316	316		Musical instruments	216
● 15	15		Forest, timber, and forest nursery products	219
● 13	13		Poultry and egg products	227
● 87	87		Cut and sewn apparel from contractors	229
● 64	64		Tortillas	232
● 66	66		Coffee and tea	234
● 90	90		Other cut and sew apparel	234

² “Degree” refers to the total number of linkages a node has. As mentioned in the Results section, Node #376 is the most connected with 640 links.

³ Cooling, housecleaning, gardening and other services to private households are connected with 11 other nodes.

This process of network analysis allows us to consider questions like: Do we have a robust creative economy? We can now answer this by looking at how connected the creative sectors are with the more important nodes in the economy. The model presented by the current research is also helpful in analyzing which sectors of the economy is San Antonio more dependent on, which industries are not growing or having constant flow of dollars. Complexity models take into account the economy as a whole and understanding the networking process can help analysts and policymakers have a better economic outcome.

Findings and Examples

The current model of the San Antonio economy can be used to see a variety of industries and the connections those industries have with one another; in this case, the model will describe and analyze the art industry, the education industry, the agriculture, the natural gas and oil industry, the textile industry and tourism in San Antonio.

The art industry is made up of several nodes which range from performing arts to jewelry. The following nodes include:

TABLE 3.
Art Industry of San Antonio, Texas.

Node	Description of the Industry	In-Degree	Out-Degree	Degree
#153	Pottery, ceramics, and plumbing fixtures	210	346	556
#159	Glass products made of purchased glass	250	312	562
#187	Ornamental and architectural metal products	247	345	592
#310	Jewelry and silverware	224	85	309
#312	Dolls, toys and games	224	288	512
#378	Photographic services	214	51	265
#402	Performing Arts	214	250	464
#404	Promotional services for performing arts and sports and public figures	235	320	555
#405	Independent artists, writers, and performers	209	320	529
	Total Average	225.22	257.44	482.67

Table 3 demonstrates that on average, the art industry is fairly interconnected. The entire art industry in general has an average of 482.67 outgoing and incoming linkages to other industries. Additionally, the model also allows the analysis of the individual industries that make up the entire art industry. For example, Ornamental and architectural metal products industry is the most interconnected part of the art industry and the outgoing flow of dollars is more than the incoming.

The next industry is private education and the nodes that correspond to the different sectors of the industry include:

TABLE 4.
The Education Industry in San Antonio, Texas

Node	Description of the Industry	In-Degree	Out-Degree	Degree
#391	Elementary and secondary education from private schools	258	9	267
#392	Education from private junior colleges, colleges, universities, and professional schools	296	63	359
#393	Other private educational services	255	121	376
	Total Average	269.67	64.33	334

In contrast to the art industry, the private education is less interconnected because it is not available to everyone. On average, the industry has 240 incoming linkages and about 64 outgoing linkages. It is interesting to compare the art industry to the private education industry using the model because it correctly depicts the nature of each business. The art industry has less incoming linkages, which account for less incoming flow of the dollars, but on the other hand, private education has more linkages, which implies that private education's purpose is to be profitable.

TABLE 5.
Agriculture in San Antonio, Texas.

Node	Description of the Industry	In-Degree	Out-Degree	Degree
#2	Grains	209	327	536
#3	Vegetable and Melons	207	41	248
#4	Fruit	198	329	527
#5	Tree Nuts	179	328	507
#8	Cotton	198	326	524
#10	All other farming crops	232	95	327
#11	Cattle from ranches and farms	179	25	204
#12	Dairy cattle and milk products	205	326	531
#13	Poultry and egg products	191	36	227
#14	Animal products, except cattle, poultry and eggs	212	329	541
#15	Forest, timber, and forest nursery products	165	54	219
#19	Agriculture and forestry support services	214	24	238
	Total Average	199.08	186.67	385.75

The industries that make up the agricultural sector of San Antonio are more connected than private education, but less connected than the art industry. On average each industry has about 386 linkages, 137 outgoing and 199 incoming. Additionally, out of the industries analyzed in the current research, agriculture is the second industry with the most amounts of sectors.

TABLE 6.
Natural Gas and Oil Industry in San Antonio, Texas.

Node	Description of the Industry	In-Degree	Out-Degree	Degree
#20	Oil and natural gas	213	343	556
#28	Oil and gas wells	226	9	235
#29	Support services for oil and gas operations	229	321	550
#32	Natural gas, and distribution services	247	348	595
#115	Refined petroleum products	244	345	589
#118	Petroleum lubricating oils and greases	213	344	557
#206	Mining and oil and gas field machinery	224	324	548
#121	Industrial gas	216	325	541
#326	Retail Services - Gasoline stations	295	281	576
	Total Average	234.11	293.33	527.44

The natural gas and oil industry is the most interconnected industry of the industries currently analyzed, with an average of 527.44 incoming and outgoing linkages. This is a logical assumption supported by the model, because oil and gas production is needed as a power source to run other industries. In 21st century, countries and cities as well, depend on oil, petroleum and gas to run the economy, a fact clearly supported by the current model of the San Antonio economy. Additionally the most interconnected subcategory is node #32, natural gas, and distribution services and the node with the least number of links is #28, oil and gas wells.

TABLE 7.
Textile Industry in San Antonio, Texas.

Node	Description of the Industry	In-Degree	Out-Degree	Degree
#76	Broadwoven fabrics and felts	213	122	335
#77	Woven and embroidered fabrics	188	292	480
#80	Finished textiles and fabrics	204	307	511
#84	Textile bags and canvas	179	217	396
#85	All other textile products	243	345	588
#86	Knit apparel	190	75	265
#87	Cut and sewn apparel from contractors	193	36	229
#88	Men's and boys' cut and sewn apparel	165	139	304
#89	Women's and girls' cut and sewn apparel	204	125	329
#90	Other cut and sew apparel	172	62	234
#91	Apparel accessories and other apparel	197	140	337
#92	Tanned and finished leather and hides	171	71	242
	Total Average	193.25	160.92	354.17

The textile industry in San Antonio is the industry with the most amounts of subcategories. Nonetheless, it is not as interconnected as the natural gas and oil industry or

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the art industry. Furthermore, textile industry has an average of 354.17 combined incoming and outgoing linkages and the most connected subcategory node #91. Comparing the textile and art industry, the art sector of the economy has more money flowing to the different subcategories, than those categories in the textile industry. Additionally, the art industry is more profitable because it has more money flowing in that the than the textile industry.

TABLE 8.
Tourism in San Antonio, Texas.

Node	Description of the Industry	In-Degree	Out-Degree	Degree
#338	Scenic and sightseeing transportation services and support activities for transportation	273	348	621
#406	Museum, heritage, zoo, and recreational services	200	9	209
#408	Bowling activities	244	13	257
#409	Amusement parks, arcades, and gambling recreation	264	16	280
#410	Other amusements and recreation	284	324	608
#411	Hotels and motel services, including casino hotels	282	348	630
#412	Other accommodation services	250	348	598
#413	Restaurant, bar, and drinking place services	285	345	630
	Total Average	260.25	218.88	479.13

Tourism is thought to be a large part of the San Antonio Economy because of the Alamo, the River-walk and other touristic attractions such as amusement parks and museums. Nonetheless, the model proves that the tourism in San Antonio is not as interconnected as it could be. Even though tourism has a larger flow of incoming dollars than outgoing dollars, improvements can be made to make the tourism in San Antonio more emergent in the system. Tourism is made of 479.13 linkages, on average.

The analysis mentioned above are some of the applications of the model used to explain the economy of a city, in this case San Antonio, Texas. The model allows researchers to discover interesting connections between industries and to what extent are the industries developed in relation to the networks they form with other industries in the complex economic system.

Limitations

The current research is still a work in progress. The Economics Department of St. Mary's University in collaboration with the SABER Institute are still working on the final details of the model and will keep working on improving the quality of the model. Additionally, some of the limitations that could be encountered with the model include: not being able to change the IMPLAN data to Gephi-compatible data, understanding the Gephi program and manipulating the model correctly. A final limitation the current research suffered from was the amount of time available to do the research and analyze the



356 nodes and their different links. The model is large and it cannot be analyzed in such a short amount of time.

Conclusions

Complexity Economics is a recent field and a new pathway in the study and modeling of economics. Centers such as the Santa Fe Institute are dedicated to the study of complexity and complex systems and their application to economic modeling. Nonetheless, complexity economics is proven to be a plausible way to explain Economics and other social sciences as well. So far, the model has effectively explained the economy of San Antonio and has fulfilled the expectations the research group had when the project started.

Current neoclassical models are failing to accurately predict what is going on in the economy and what is going to happen; therefore, complexity economics is seen by many as a solution to the problem.

The current research has the purpose to explain complexity economics and prove that the economy can be understood as a complex adaptive system. The network model of the San Antonio helped explain the economy from a different perspective, considering different variables. The model proved to be helpful in analyzing the sectors of the economy. Nonetheless, more analyzing should be done to the model in order to fully elaborate on the efficiency of itself.

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Regulation of Cx43 Hemichannels through AKT Kinase in Bone Osteocytes



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Abstract

Connexin 43 (Cx43) hemichannels in osteocytic cells are believed to play an important role for the release of bone modulators in response to mechanical loading, an important process in bone formation and remodeling. However, regulation of the opening of these hemichannels upon mechanical stimulation is fairly unknown. Through previous research, this lab showed that Cx43 interacts with integrin $\alpha 5\beta 1$, which is a critical step in hemichannel opening. Mechanical stimulation in the form of fluid flow shear stress (FFSS) strengthens the interaction between Cx43 and integrin $\alpha 5\beta 1$. Here, we show that FFSS activates AKT, which is required to maintain the interaction between the two proteins. Inhibition of active AKT disrupts the interaction between Cx43 and integrin $\alpha 5\beta 1$ and significantly reduced Cx43 hemichannel opening. Both integrin $\alpha 5\beta 1$ and Cx43 are substrates of AKT and continuous fluid flow increases the phosphorylation of both the proteins by AKT. Therefore, AKT, activated by FFSS, directly phosphorylates Cx43 and integrin $\alpha 5\beta 1$, which is a vital mediator of anabolic function of mechanical loading in the bone.



Introduction

Bones, which are made of mineralized calcium phosphate, go through a process of remodeling, in which one type of bone cell, osteoclasts, degenerate the bone and another type of bone cell, osteoblasts, form the bone (Datta et al., JCP 2008). Osteocytes, yet another type of bone cell, are located in the lacunae of the compact bone, and are connected by gap junctions to one another, which is regulated by FFSS (Alford et al., Bone 2003). The gap junctions and hemichannels in osteocytes are part of the complex intracellular communication system of bone remodeling, and these channels have been found to abundantly express a gap junction and hemichannel forming protein called connexin 43 (Cx43), which is extensively present in murine long osteocytic long bone cells (MLO-Y4) (Kato et al., BMR 1997). However, there is little known about the interactions that occur between the diverse proteins present within the bone cells to coordinate bone function.

Previously, in the lab I suppressed the E11 protein in osteocytes-like MLO-Y4 cells and confirmed that the protein is necessary in gap junction and hemichannel formation, and without the protein the channels would not open and close properly (Bonewald et al., JBMR 2000). The lack of functioning gap junctions, which connect the “arms of the osteocytes,” called dendritic processes, and hemichannels, which connect the cell to the extracellular matrix (ECM), impedes intracellular communication (Donahue, Bone 2000). Gap junctions and hemichannels play an important role in cell-cell communication through the passage of important chemicals required for bone growth (Taylor et al., AJPCP 2007). The osteocytes require hemichannels for the release of anabolic bone modulators, like prostaglandin (PGE_2), a chemical that promotes bone formation (Cherian et al., MBC 2005). Without proper communication between the three aforementioned bone cells, the bone would degenerate too much and could ultimately cause osteoporosis, osteoarthritis, or osteomalacia (Burger et al., JN 1995).

In this lab, and other labs, there has been research on mechanical stimulation through the use of Fluid Flow Shear Stress (FFSS), which is likened to the effects of exercise on the body's bone cells (Duncan et al., CTI 1995). The mechanical stimulation helps to open and close the cellular channels, stimulating intracellular communication. Cx43, like E11, is a channel forming protein (Alford et al., Bone 2003). The Cx43 protein is highly expressed in osteocytes and forms cell surface expressed Cx43 hemichannels which are critical to the release of and other anabolic bone modulators like ATP, the coenzyme used as an energy carrier in organismal cells (Genetos et al., JCP 2007). The Cx43 hemichannels open for a short amount of time and then close (Stiller-Jackson et al., JBC 2008). Understanding the mechanisms that regulate the opening and closing of these channels along with the interactions of Cx43 with other proteins is, therefore, vital for a better understanding of bone remodeling and intracellular communication. Integrins, mechanosensors, are receptors that transform mechanical stress on the cell into a chemical signal (Giancotti et al., Science 1999). In the lab, an interaction between Cx43 and integrin $\alpha 5 \beta 1$ was noticed and found to be critical to the opening of Cx43 hemichannels (Batra et al., PNAS 2012). However, other factors that might affect this interaction to facilitate the opening of the Cx43 hemichannels were unknown. Therefore, we decided to study the role of the protein kinase AKT-1 in the interaction between Cx43 and integrin $\alpha 5 \beta 1$ (Cowin et al., JBE 2001). AKT is one of the kinases responsible for the phosphorylation of Cx43, and is also known as Protein Kinase B (PKB), of which there are three isoforms: AKT-1, AKT-2, and AKT-3 (Park et al., CCA 2007).

Materials and Methods

1. Prepare α -Modified Essential Medium (MEM). The medium is prepared using 2950 ml deionized , three packets of alpha MEM media powder (orange color), 6.6 mg sodium bicarbonate (color changes red) and then mix the media well with a spin vane on a stir plate. Then, adjust the pH to 7.4 with 12N HCl. The antibiotic penicillin and streptomycin, which is stored at -240°C , is added to the media and the media is mixed. The media is filtered through 0.2 micron filter and stored at 4°C until the cells are ready to be plated.

2. Prepare Fresh Collagen and Coat the Plates. The collagen, Rat Tail Collagen I, is 3.6 mg/ml. The collagen is diluted in 0.2N Acetic acid to 0.15 mg/ml in 500 ml. Therefore, the 500ml beaker will contain 21 ml of collagen, 400 ml of deionized , and 600 μl of acetic acid. The fresh collagen is mixed with a spin vane on a stir plate and can be used up to six times if stored at 4°C . The 20 sterile 100mm plates are coated in the hood with 4-6 ml of collagen per plate. The plates are left coated for one hour under the hood, closed, and then the collagen is removed and the plates are left open to dry for an hour and a half. The plates are sealed, so that they remain sterile, and are stored at 4°C (five 150mm plates are also coated and stored).

3. Waking up, Dividing, and Plating the Cells. The MLO-Y4 osteocytic cells, derived from murine long bones, are stored in liquid nitrogen until use. The cells are plated on rat tail collagen type I-coated surfaces and grown in α -MEM with 2.5% Fetal Bovine Serum and 2.5% Bovine Calf Serum. Once the cells are plated, they must be divided/split. The media is aspirated and the plates are washed with 10 ml PBS each. The PBS is aspirated and 1 ml of Trypsin, stored at 4°C , is added to each plate, severing the peptide bonds linking the gap junctions between the cells, releasing the cells from the plate. The plates are incubated at 37°C for 5 minutes with the Trypsin. Then, 9 ml of media is added to the plates and the contents of the plates are pipetted into a test tube and centrifuged at 2000 rpm for 5 minutes. Take fresh sterile plates out of the 4°C and aspirate the spun test tube, saving the pellet. The new plates are labeled with the passage number, which is the number of times the cells have been divided. The cells are divided into 3 plates, adding approximately 2.2 ml of the pellet to each plate. The plates are mixed with 8 ml of fresh medium and the plates are stored at 37°C .

4. Fluid Flow Shear Stress. The MLO-Y4 osteocytic cells are plated on sheets coated with collagen are labeled C, 30min, 2hr, 4hr, and 24 and subjected to FFSS for the indicated amount of time, allowing two sheets to be run simultaneously. Media is flown over the cells on the apparatus from a height. Sheets used as control are not run through FFSS. To collect the lysate from the FFSS treated cells, media is cleared from the sheet and cells are scraped using a scraper in 3ml of PBS resulting in three tubes per sheet. The tubes are labeled as follows:

$C_1, C'_1, C''_1, C_2, C'_2, C''_2, 30_1, 30'_1, 30''_1, 30_2, 30'_2, 30''_2, 2_1, 2'_1, 2''_1, 2_2, 2'_2, 2''_2, 4_1, 4'_1, 4''_1, 4_2, 4'_2, 4''_2, 24_1, 24'_1, 24''_1, 24_2, 24'_2, 24''_2$, and $24''_2$.

5. Collect the Lysates. The cells are washed with PBS 3 times, and then the cells are collected in PBS and Protease inhibitor, which prevents degradation. The cells are spun at 14000 rpm for 2 minutes and the pellet is kept. The tubes are sonicated for 5 seconds, twice, and placed on ice for 30 minutes. The contents are then mixed and spun at 14000 rpm for 7-10 minutes.

6. Immunoprecipitation. The lysates are checked for Cx43 expression for equal loading

on protein G beads. Then, protein G beads (Protein G sepharose fast flow 4B; Amersham GE) are added to the lysate and antibody mixture (including the Cx43 Antibody and the α -5 Antibody), which is incubated for 2 hours at 4°C. RIPA buffer and 10 ml PBS are placed on ice before the 2 hours is up, so that they are cool for the elution. Elution is performed with 2X non-reducing sample buffer, which contains little SDS, so that the cellular interactions are not broken. Keep the cells on ice and aspirate the media and wash each plate with PBS 5 times. Add inhibitors to the 30ml of PBS, including 300 μ l NEM, 300 μ l PMSF, 150 μ l leupeptin, 150 μ l , and 150 μ l phosphatase inhibitor. Then, add 2.2 ml PBS with inhibitors to each plate. The RIPA buffer has inhibitors added to it, but the buffer must be used quickly (within 20 minutes) after the addition of the following inhibitors: 300 μ l NEM, 300 μ l PMSF, 150 μ l leupeptin, 150 μ l , and 150 μ l phosphatase inhibitor. Take the supernatant out of the tubes with separate syringes and add 1 ml RIPA buffer and centrifuge at 5500 rpm for 2 minutes. The beads have to be dry, so get a 10 l syringe and take out the last of the excess liquid, washing the syringe between uses. Add 25 μ l of 2X sample buffer for 20 minutes and give them a brief spin to dislodge any stuck beads. The samples are placed in a boiling hot water bath for 3 minutes.

7. Preparing the gel. 10% SDS gel is prepared using 30% acrylamide by preparing the separating gel using deionized , Tris-HCl (pH 8.8), 10% SDS, and 30% acrylamide. To set the gel, a polymerization reagent is added (Ammonium persulfate and TEMED). The gel is left to set for 1 hour and then the stacking gel is prepared using deionized , Tris HCl (pH 6.8), 10% SDS, and 30% Acrylamide. Ammonium persulfate and TEMED are added to allow the gel to polymerize and then two 10 well 1.5 mm thick gel combs are put into the gel for the well formation. The gel is left to set for 20 minutes and then the gel is packed in wet paper and stored at 4°C until use (not more than 6 days).

8. Running the gel. The gel is placed into the gel electrophoresis apparatus, and running buffer is added to fill the inner chamber of the apparatus and less than half way up the outer chamber. The running buffer is prepared using 28.8 g glycine, 6.04 g Tris base, 2 g SDS, and 1.8 L deionized . The well comb is removed from the gel and the samples are loaded on the gel as follows: PageRuler Prestain Marker, C, 30, 2, 4, and 24. The gel is run for 10-15 minutes at 90 volts and then for 1 hour and 15-30 minutes at 120 volts.

9. Transferring the gel. Two filter pads, two filter papers, and one membrane are soaked in transfer buffer, in 4°C until the gel run is complete. The transfer buffer is prepared fresh using 28.8 g glycine, 6.04 g Tris base, 200 ml methanol, and 1.6 L deionized and stored at 4°C. The gel wells are cut off and the gel is sandwiched between the transfer apparatus, filter pad, filter paper, gel, membrane, filter paper, filter pad. The bubbles are patted out or rolled out of the “sandwich” and the gel is placed closer to the black side, which is faced toward the black side of the apparatus. The ice pack is placed on the outside of the “sandwich” inside the apparatus and the apparatus is filled with transfer buffer. The apparatus is closed and connected, just as the electrophoresis apparatus is connected, and the apparatus is packed in ice around the outside using a glass tray. The transfer is run for 1 hour and 15 minutes at 95-97 volts.

10. Protein Staining and Blocking Nonspecific Sites. The membrane is removed from the apparatus and placed in a weigh boat. The protein is stained using Ponceau stain for 3 minutes and then rinsing the stain with water until the stain is no longer apparent. The membrane is left in the weigh boat, adding 10% milk/ , stored at 4°C, covering the membrane. Place the weigh boat on a shaker for one hour, at room temperature, covered in cellophane.

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11. Wash Buffer Formulations. Wash the membrane with 1st washing buffer (TBST) 3 times for five minutes on the shaker at room temperature. The 1X washing buffer is prepared using 1 x 2.5 mM Tris, 15 mM NaCl (Sodium Chloride), and 0.005% Tween 20. The antibody is then diluted in 1st washing buffer on the membrane overnight.

12. Probing the Membrane. The membrane is probed overnight at 4°C with an antibody, that specifically recognizes the substrates of AKT, called phosphoserine AKT substrate antibody. The next day, the antibody is removed and washed once with the 1st washing buffer for 5 minutes at room temperature and then twice with 2nd washing buffer for 5 minutes. Soon after, the secondary antibody with the horseradish peroxidase (HRP) tag specific to the primary antibody is added to the membrane for 1 hour at room temperature. The membrane is then washed with the 2nd washing buffer three times for 5 minutes at room temperature.

13. Detecting the protein bands: The membrane is now washed with water and the water is then dried for 1 minute at room temperature on a paper towel. The detection substrate called the chemiluminescence reagent (ECL) is added to the membrane which binds to the HRP tag on the secondary antibody and glows in dark. The membrane is incubated with the ECL for 1 minute at room temperature and then dried for another minute. The membrane is then placed under a sheet inside a cassette and developed in the dark room. An X-ray film is placed on the membrane which captures the signal/glow from the ECL reagent and developed on an X-ray machine to give a dark band wherever the specific protein of interest is present.

14. Stripping the membrane. To probe with another antibody, the membrane is stripped using a stripping buffer, which is prepared using 0.2 M Glycine with a pH of 2.8. First the membrane is washed twice with the 2nd washing buffer for 5 minutes at room temperature and then twice for 20 minutes at room temperature with the stripping buffer. Then the membrane is washed with the 1st wash buffer three times for 5 minutes at room temperature followed by a 1 hour incubation with the milk (blocking solution). The membrane is then washed again three times with 1st washing buffer for 5 minutes. The membrane is probed with a total antibody to either Cx43 or the integrin $\alpha 5$, depending upon the experiment.

15. AKTi Incubation. Cells are plated in plates labeled: , , and . Four centrifuge tubes are labeled as follows: , , and . The control “C” cells receive no drug, but the “A” tubes of cells are incubated with 10 μ l of AKTi (inhibitor of AKT kinase), which is stored at -80°C and is light sensitive, for an hour and a half at 37°C. The “C,” or Control cells are incubated as well, without the AKTi.

16. Collect the Lysates. The lysates are collected from the 150mm plates by washing the cells with PBS 3 times, and then collecting cells in PBS and Protease inhibitor, which prevents degradation. The cells are spun at 1400 rpm for 2 minutes and the pellet is kept. The tubes are sonicated for 5 seconds, twice, and placed on ice for 30 minutes. The contents are then mixed and spun at 14000 rpm for 7-10 minutes.

17. Co-Immunoprecipitation. The lysates are incubated overnight with the $\alpha 5\beta 1$ antibody at 4°C. Then, protein G beads (Protein G sepharose fast flow 4B; Amersham GE) are added to the lysate and antibody mixture (also known as AB+B), which is incubated for 2 hours at 4°C (the same is done with the control tubes as well without the AKTi). RIPA buffer and 10 ml PBS are placed on ice before the 2 hours is up, so that they are cool for the elution. Elution is performed with 2X non-reducing sample buffer, which contains little SDS, so that the cellular interactions are not broken. Keep the cells on ice and aspirate the media and wash each plate with PBS 5 times. Add inhibitors to the PBS, including 200 μ l NEM,

200 μ l PMSF, 100 μ l leupeptin, 100 μ l , and 100 μ l phosphatase inhibitor. The RIPA buffer has inhibitors added to it, but the buffer must be used quickly (within 20 minutes) after the addition of the following inhibitors: 300 μ l NEM, 300 μ l PMSF, 150 μ l leupeptin, 150 μ l , and 150 μ l phosphatase inhibitor, otherwise the inhibitors lose their activity.

18. Elution. Take the supernatant out of the tubes with separate syringes and add 1 ml RIPA buffer and centrifuge at 5500 rpm for 2 minutes. The beads have to be dry, so get a 10 l syringe and take out the last of the excess liquid, washing the syringe between uses. Add 25 μ l of 2X non-reducing sample buffer, for 20 minutes and give them a brief spin to dislodge any stuck beads. Boil the lysates and samples in a hot water bath for 5 minutes at 95°C and then centrifuge them at 5500 rpm for 2 minutes. The beads are ruptured with a small syringe (26 ½ gauge) by triturating the beads 20 times placing the contents into labeled tubes including: C lysate, AKTi lysate, AB+B, C, and AKTi.

19. Preparing the gel. 10% SDS gel is prepared using 30% acrylamide by preparing the separating gel using deionized , Tris-HCl (pH 8.8), 10% SDS, and 30% acrylamide. To set the gel, a polymerization reagent is added (Ammonium persulfate and TEMED). The gel is left to set for 1 hour and then the stacking gel is prepared using deionized , Tris HCl (pH 6.8), 10% SDS, and 30% Acrylamide. Ammonium persulfate and TEMED are added to allow the gel to polymerize and then two 10 well 1.5 mm thick gel combs are put into the gel for the well formation. The gel is left to set for 20 minutes and then the gel is packed in wet paper and stored at 4°C until use (not more than 6 days).

20. Running the gel. The gel is placed into the gel electrophoresis apparatus, and running buffer is added to fill the inner chamber of the apparatus and less than half way up the outer chamber. The running buffer is prepared using 28.8 g glycine, 6.04 g Tris base, 2 g SDS, and 1.8 L deionized . The well comb is removed from the gel and the samples are into the gel as follows: PageRuler Prestain Marker, Plain lysate, C lysate, AKTi lysate, A+B, C, and AKTi. The gel is run for 10-15 minutes at 90 volts and then for 1 hour and 15-30 minutes at 120 volts.

21. Transferring the gel. Two filter pads, two filter papers, and one membrane are soaked in transfer buffer near the end of the hour and 15-30 minutes. The transfer buffer is prepared using 28.8 g glycine, 6.04 g Tris base, 200 ml methanol, and 1.6 L deionized . The gel wells are cut off and the gel is sandwiched between the transfer apparatus, filter pad, filter paper, gel, membrane, filter paper, filter pad. The bubbles are patted out or rolled out of the “sandwich” and the gel is placed closer to the black side, which is faced toward the black side of the apparatus. The ice pack is placed on the outside of the “sandwich” inside the apparatus and the apparatus is filled with transfer buffer. The apparatus is closed and connected, just as the electrophoresis apparatus is connected, and the apparatus is packed in ice around the outside using a glass tray. The transfer is run for 1 hour and 15 minutes at 95-07 volts.

22. Protein Staining and Blocking Nonspecific Sites. The membrane is removed from the apparatus and placed in a weigh boat. The protein is stained using Ponceau stain for 3 minutes and then rinsing the stain with water until the stain is no longer apparent. The membrane is left in the weigh boat, adding 10% milk/ , stored at 4°C, covering the membrane. Place the weigh boat on a shaker for one hour, at room temperature, covered in cellophane.

23. Wash Buffer Formulations. Wash the membrane with 1st washing buffer (TBST) 3 times for five minutes on the shaker at room temperature. The 1X washing buffer is prepared using 1 X PBS. The antibody is then diluted in first washing buffer on the

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membrane overnight.

24. Reading the Bands. The gel is checked for AKT phosphorylation. If there is an interaction, then the cells with the AKTi (AKT inhibitor) will show less band intensity.

25. Dye Uptake: Cells are treated with AKTi and cultured on collagen type-I, FN and poly-lysine matrices for 48 hours, then subjected to fluid flow at 16 dynes/ for 30 minutes. Cells are incubated with 0.2% LY (Mr ~ 547 Da) and 0.2% rhodamine dextran (RD) (Mr ~ 10 kDa) dye mixture for 5 minutes. A ratio of fluorescent cells to total cells per image is determined using Image J software (NIH). Cells cultured on collagen for 48 hours are incubated with RGD peptide (1 mM) and FN (10 µg) coated Dynabeads for 30 minutes and 1 hour, and were subjected to fluid flow followed by dye uptake. Cells cultured on collagen for 8 hours using FN-depleted media and FN containing media were subjected to fluid flow for 10 min followed by dye uptake. Dye uptake was also conducted after incubation with mouse IgG (50 µg/ml or TS2/16 (50 µg/ml) diluted in SMEM for 30 min alone or coincubating with carboxolone (100 µM) or HC blocking Cx43 (E2) antibody (1:400). MLO-Y4 cells transfected with Cx43CT-GFP constructs were assayed for dye uptake using a mixture of Alexa350 (1 mM) and RD (2%) after fluid flow. All data is analyzed using GraphPad Prism 5.04 software (GraphPad).

Results

AKT is activated by FFSS, and through previous research in the lab, AKT-1 was identified as the expressed isoform in osteocytic MLO-Y4 cells. The time points for FFSS were used to identify the most ideal amount of FFSS for AKT expression, revealing maximum activation at the 30 minute time point followed by a gradual decrease in the activity, as shown in Figure 1. To determine if AKT is involved in the hemichannel opening of Cx43, an AKT-1 and AKT-2 inhibitor was applied to the MLO-Y4 cells. Successful inhibition of AKT activity was monitored, using the AKTi inhibitor, in the osteocytic MLO-Y4 cells showed a lack of AKT activity, as conveyed in Figure 2. Active AKT levels decreased in the AKTi treated cells but not the controls. However, the total AKT remained the same in all the cells as shown in the Figure 2. Levels of GAPDH, to check cell toxicity

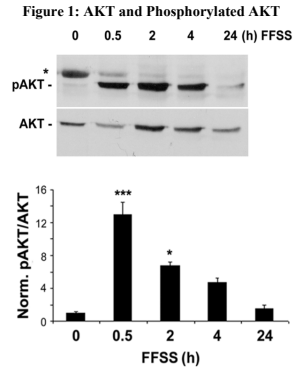


Figure 1. The amount of phosphorylated AKT is shown in relation to the amount of AKT loaded into each gel after FFSS (Figure provided by Dr. Nidhi Batra from Dr. Jiang's laboratory).

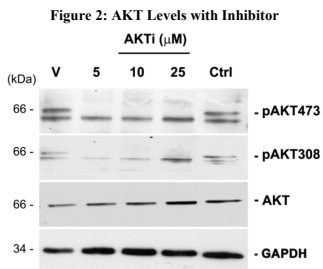


Figure 2. The level of AKT, after the Inhibitor AKTi is added at different concentrations is probed with p-AKT to determine active AKT, and with GAPDH to check cell amount and cell toxicity. (Figure provided by Dr. Nidhi Batra from Dr. Jiang's laboratory).

showed no difference in the treated and untreated cells indicating AKTi was not toxic to the cells. Dye Uptake, a measure of the hemichannel opening was performed after the effectiveness of AKTi was checked. A marked decrease in the amount of dye taken in by the cells with inhibited AKT activity was noticed, relaying a decrease in the opening and closing of Cx43 hemichannels, as revealed in Figure 3. Activated AKT is required for the opening of hemichannels and the interaction between Cx43 and integrin α5β1. If the AKT is not activated, then there is little to no interaction between Cx43 and integrin

$\alpha 5\beta 1$. The co-immunoprecipitation shows a lack of interaction between Cx43 and integrin $\alpha 5\beta 1$ due to inhibition of AKT activity in cells treated with AKTi but not the control, as shown in Figure 4. To determine if FFSS activated AKT had any effect on the phosphorylation of Cx43 and integrin $\alpha 5\beta 1$, either of the two proteins were immunoprecipitated with the respective antibody (Cx43 or $\alpha 5\beta 1$ antibody) and the eluates were immunoblotted with a motif antibody to AKT phosphorylated substrates. Both Cx43 and integrin $\alpha 5\beta 1$ were detected as substrates of AKT as detected through the AKT substrate antibody. FFSS increased the phosphorylation of Cx43 and integrin $\alpha 5$ at 2 hours. To comprehend how FFSS-activated AKT influences the phosphorylation of Cx43 and integrin $\alpha 5\beta 1$, the phosphorylation of Cx43 and integrin $\alpha 5\beta 1$ mediated by AKT was studied. Lysates collected from different time points

Figure 4: The Interaction of Cx43 and Integrin $\alpha 5$ With and Without the AKTi

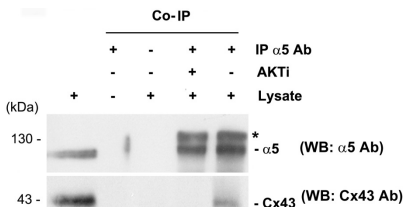


Figure 4. Lysates treated with and without AKTi are immunoprecipitated with integrin $\alpha 5$ antibody and probed with Cx43 antibody (Figure provided by Dr. Nidhi Batra from Dr. Jiang's laboratory).

immunoprecipitated using the integrin $\alpha 5\beta 1$ antibody and the immunoprecipitates were immunoblotted using anti-P/S AKT substrate and, integrin $\alpha 5\beta 1$, or integrin $\beta 1$ antibody. Cells were subjected to FFSS for different time periods (0 minutes, 30 minutes, 2 hours, and 24 hours) Cx43 and integrin $\alpha 5\beta 1$ were immunoprecipitated from cell lysates with the anti-Cx43 or the integrin $\alpha 5\beta 1$ antibody, respectively, and immunoprecipitates were immunoblotted with P/S AKT substrate and with either the Cx43 antibody or with the integrin $\alpha 5\beta 1$ antibody. An increase in phosphorylation of both Cx43 and integrin $\alpha 5\beta 1$ by AKT was observed after 2 hours of FFSS, as revealed in Figures 5 and 6. Graphs were plotted using the ratio of mean band densities of AKT phosphorylated Cx43 or integrin $\alpha 5$ to the total Cx43 or integrin $\alpha 5$ respectively.

Figure 3: The Dye Uptake

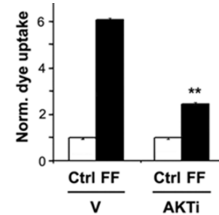


Figure 3. The extent of hemichannel opening as measured by Dye Uptake in AKTi treated cells and those with only the Vector used to dissolve the inhibitor was dissolved (DMSO) (Figure provided by Dr. Nidhi Batra from Dr. Jiang's laboratory).

of FFSS treatment were immunoprecipitated with either Cx43 or $\alpha 5\beta 1$ antibody and immunoblotted with the anti-AKT substrate and either the Cx43 or the $\alpha 5\beta 1$ antibody. AKT phosphorylates both Cx43 and integrin $\alpha 5$ in MLO-Y4 cells. Cx43 was immunoprecipitated from cell lysates using m-monoclonal (mouse) anti-Cx43 antibody. Immunoprecipitates were immunoblotted with either anti-P/S AKT substrate or Cx43 antibody, and Cx43 was phosphorylated by AKT. Integrin $\alpha 5\beta 1$ from cell lysates was

Figure 5: The Detection of Cx43 and Phosphorylated Cx43

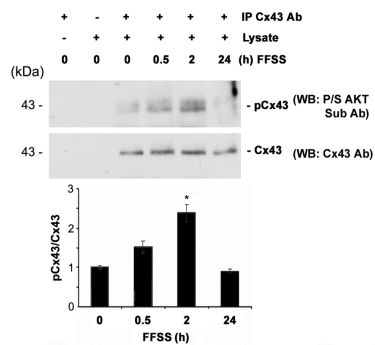


Figure 5. The amount of phosphorylated Cx43 is shown in relation to the amount of Cx43 loaded into each gel after FFSS (Figure provided by Dr. Nidhi Batra from Dr. Jiang's laboratory).

Regulation of Cx43 Hemichannels through AKT Kinase in Bone Osteocytes

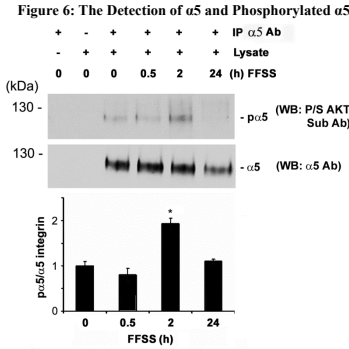


Figure 6. The amount of phosphorylated Integrin $\alpha 5$ is shown in relation to the amount of Integrin $\alpha 5$ loaded into each gel after FFSS (Figure provided by Dr. Nidhi Batra from Dr. Jiang's laboratory).

Discussion

Information regarding hemichannel regulation is limited, especially for mechanically stimulated regulation. The elucidation of a regulatory mechanism for Cx43 hemichannels was found through AKT activation by mechanical stimulation through FFSS, the effects of which can be recreated by exercise in the body. The activation of AKT through FFSS, the impact of mechanical stimulation to induce Cx43 hemichannel opening, and the interaction between Cx43 and integrin $\alpha 5\beta 1$ were discovered through this study. A mechanism for the opening of Cx43 hemichannels due to activation of AKT in response to mechanical stimulation was identified through this study. Integrin $\alpha 5\beta 1$ and Cx43 are directly phosphorylated by AKT, and FFSS increases the phosphorylation of the two proteins, enhancing the interaction between Cx43 and integrin $\alpha 5\beta 1$. The interactions between AKT, Cx43, and $\alpha 5\beta 1$ are more clearly understood now, allowing for a better comprehension of the activity of the bone cells and intracellular communication that occurs in bone remodeling. This study, which could help alleviate cases of osteoporosis, osteoarthritis, and osteomalacia. The findings of this research and previous research in this lab have culminated into a model showing the mechanism of regulation involving the phosphorylated Cx43, $\alpha 5\beta 1$, and AKT with FFSS. The model shows phosphorylation of both Cx43 and integrin $\alpha 5$ by AKT which is enhanced upon FFSS due to activation of AKT and facilitates the Cx43 hemichannels opening the activation of Cx43 and $\alpha 5\beta 1$ by an already phosphorylated AKT. The Cx43 hemichannel opens to allow exchange of release and take up anabolic factors, showing a network of intracellular communication.

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A Preliminary Study Investigating The Link Between Financial Performance and Environmental Corporate Social Responsibility: Information Technology Industry



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Abstract

This study will investigate the relationship between environmental aspects of corporate social responsibility (CSR) and financial measures in the technology hardware industry. The study will use regression analysis to examine the relationship by merging data from the CRSP and Socrates KLD databases and an extensive literature review on electronic waste and its impact on the environment. Three models are developed. The dependent variables used were return on assets, return on sales, and Tobin's Q which measures market performance. The two dependent variables to represent corporate social responsibility were environmental strengths and environmental concerns from the KLD database. The results and implications from the analysis will be presented.

Introduction

Electronic waste has become a recent growing concern within today's society. The issue of electronic waste management has existed since the industrial revolution that took place in 1760 – 1850. (Montagna) It is not just the manufacturing process that is the problem. In the United States, it is legal to dump one's obsolete electronic waste such as a printer, monitor or fax machine out on to the curb within a trash receptacle. (Grossman, 211) Once arriving at a solid waste site, the obsolete electronic waste may be noticed by the sanitary workers that monitor the debris for salvageable appliances. If the electronic waste is not salvaged, then the obsolete appliances will continue to damage the earth with the harmful chemicals that may pollute the earth for generations to come. (Cascadia Consulting Group)

Even when salvaged, the circuit boards that derived from the electronic waste will be smelted by hand to extract metals. (Figure 1) According to Greenpeace International smelting releases highly poisonous gases and pollutes the environment. (Greenpeace) "Becoming aware of the effects of e-Waste is the first step in arresting this problem" (Kade).

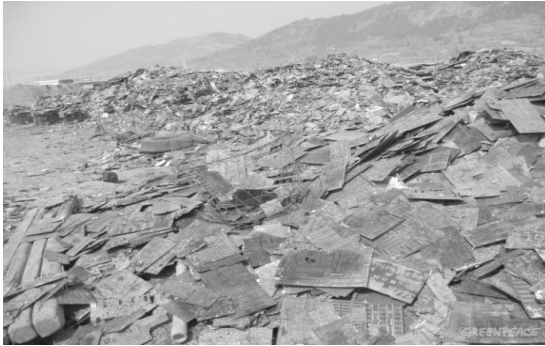


Figure 1

Piles of circuit boards from hazardous computer waste stretch into the distance near an e-waste scrap yard. The circuits will be smelted by hand to extract metals. Greenpeace.

Electronic waste is defined as discarded, often obsolete technology; also known as e-waste. According to the U.S. environmental Protection Agency (EPA), in 2007 the United States alone generated over 2.5 million tons of e-waste (General Information on E-Waste). Consumer electronics and obsolete office equipment can be a "Toxic cocktail that includes cadmium, mercury, lead, and other hazardous materials" (Gallaugher 77).

If not disposed of properly the fate of electronic waste is residing in a domestic landfill or being sent abroad. Sending electronic waste abroad can be ten times cheaper than facing the consequences domestically (Bodeen). Therefore it is not surprising that up to 80 percent of the material dropped off for recycling is eventually exported (Royte). There are two main types of pollutants produced by the landfilling process. These two types of pollutants are landfill gas and leachate. Landfill gas can contain up to 55% methane and (CH₄) and carbon dioxide (CO₂) (Homes 79). Leachate is any liquid that, in passing through matter, extracts solutes, suspended solids or any other component of the material through which it has passed. Leachate is produced as water seeps through the waste within a landfill site producing a harmful chemically enhanced liquid.

The impact of electronic waste not only has an effect on the environment today, but also will impact tomorrow in the water within our seas, the environment of endangered animals and even breast milk within humans. (Grossman 1) With growing

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concern for future generations and pressure from both citizens and government, there has been a push for corporate social responsibility to help with preventing damage to the environment. There is also increased emphasis for transparency and a greater expectation that corporations measure, report and continuously reduce the impact of their industrial operation's impact of the environment. (Tsoutsoura, 3) This includes both product design, manufacturing, and retirement of their products.

“The relationship between a firm's corporate social responsibility (CSR) – or, more recently, its corporate social responsiveness – and its financial performance has been the subject of lively debate since the 1960's” (Cochran, Wood 42). According to Friedman within a free society there is only one responsibility of a business. The responsibility of a business is to use its capital and partake in business practices that accomplish increased profits, as long as the practices are open and free competition without deception or fraud. (Friedman) Friedman's views are, while ethical; do not particularly give back to society. The government has enacted regulation and taxes to encourage environmental conscious behavior of corporation but often those processes create a minimum expectation.

Corporate social responsibility should exceed minimum standards. According to Business for Social Responsibility (BSR), corporate social responsibility is defined as “achieving commercial success in ways that honor ethical values and respect people, communities, and the natural environment” (McWilliams and Siegel). A point worth noticing is according to McWilliams and Siegel, corporate Social Responsibility, (CSR) is more than just following the law. Frooman further expands the definition of corporate social responsibility as follows: “An action by a firm, which the firm chooses to take, that substantially affects an identifiable social stakeholder's welfare” (Frooman).

Every company is different in how they implement their corporate social responsibility within the work place and work practices. The differences between the companies that support corporate social responsibility and the companies those that do not often depend on aspects such as the specific companies size, the particular industry involved, the firm's business culture, stakeholder demands, and how historically progressive the company is engaging in CSR (Tsoutsoura). Some companies that focus on corporate social responsibility only focus on one particular area of interest, while other companies are versatile within corporate social responsibility. It is important that the CSR principles that companies want to implement are apart of the companies' specific corporate objectives, important for management and employees. In order for the Salazar 6

companies' social responsibility to be successful, the corporate values must be within the companies' strategic planning (Tsoutsoura).

There are many advocates for the adoption of corporate social responsibility foundations within all corporations. It is the government's primary responsibility to address the issues within society, but the contribution of private firms can be substantial. There has also been an argument of the shifting balance of power between firms and governments in responsibility to protect the environment. According to OECD, of the 100 largest global economies, as measured by GDP, 51 of are US corporations, and only 49 are nation states. “So because economic power has shifted to the corporations; they, therefore, should have an increasing role in and responsibility for addressing social problems” (Tsoustoura 5).

Past empirical research has found many outcomes within the relation of corporate social responsibility and financial performance. According to Arlow and Gannon, 1982, “Economic performance is not directly linked, in either a positive or negative fashion to



social responsiveness.” Other research has found that, “Asset turnover and asset age are added as explanatory variables. This expanded analysis reveals that the key correlate with CSR is asset age and that the omission of this variable in previous studies may have led to spurious positive correlations between CSR and financial performance” (Cochran and Wood). Another stream of research has tried to measure corporate social responsibility and its relation to financial performance using CSR related independent variables and accounting ratios and marketing measures as dependent variables. The purpose of the research is to examine if there is statistical evidence that CSR activities related to proper management of electronic waste can enhance financial performance of publically traded companies in the electronic manufacturing sector.

Literature Review:

The Literature Review section first describes the research surrounding Corporate Social Responsibility and factors related to electronic waste management. The research is then focused on research studies that surround Corporate Social Responsibility and measures of financial performance.

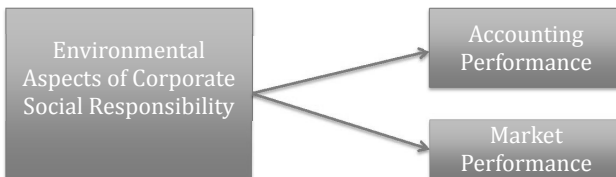
Corporate Social Responsibility and Financial Success

Though there are multiple ways to measure financial success, this research concentrates on measuring a company’s financial success is the company’s accounting ratios using Return on Assets (ROA) and Return on Sales (ROS) and market performance using Tobin’s Q.

Return on assets will be calculated as net income divided by average total assets, and is an important measure of how well a company is using its assets to generate profitability (Kieso et al. 2012). Return on sales will be calculated as net income divided by sales. This measure represents the number of cents of profit generated by each dollar of sales (Stice and Stice 2008). The combined return on sales with asset turnover during the period shows how profitability the company used assets during the period (Kieso et al. 2012). These ratios are common measures of financial performance within the CSR literature (McGuire, Sundgren, and Schneeweis, 1988; Howard, 2010; Orlitzky, M., Schmidt, F. & Rynes, 2003).

Today’s corporate social responsibility is not just doing the minimum without causing harming others or the environment, but exceeding the expectations of the minimum obligations (Luoma-aho, Olkkonen). There are many ways to define corporate social responsibility, many have defined CSR with the help of “The Triple Bottom Line” (TBL) that acknowledges three different responsibilities business have today. The three responsibilities that businesses have today are economic, environmental and social (Elkington).

Model Development:



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Hypotheses:

Two hypotheses are proposed and will be tested. The first hypothesis addresses the relationship between accounting measures and electronic waste management. The second hypothesis addresses the relationship between market measures and electronic waste management.

H01: A Significant negative or null relationship exists between Environmental strengths and Accounting Measures of Success.

H11: A significant positive relationship exists between Environmental strengths and Accounting Measures of Success.

H02: A significant negative relationship exists between Environmental strengths and Market Measurements of success.

H12: A significant positive relationship exists between Environmental strengths and Market Measures of success.

The Data Methodology, Dependent and Independent Variables

Data:

This investigation will involve panel data from the technological hardware industry concluded over the years of 2004 to 2009. The data is from the Center for Research in Security Prices (CRSP) with the Socrates database from Kinder, Lydenburg, and Domini (KLD). This data will then analyzed and combined to research the correlation between the electronic waste management and corporate social responsibility, as measured by the KLD ratings, in contrast with financial and market performance.

The KLD Socrates database or statistical tool for analyzing trends in social and environmental performance is a data set with annual records of the environmental, social, and governance performance of companies rated by KLD Research and Analytics Incorporated. The KLD database is an extensive tool that in 2003 has expanded their coverage to the largest 3,000 United States companies by market capitalization. (KLD Database) This database has and is currently being used within comprehensively in business ethics and socially responsible research (Hillman, Keim). The KLD Database covers approximately 80 indicators in seven major qualitative issue areas including: community, corporate governance, diversity, employee relations, environment, human rights and product. In addition to the above indicators, KLD also provides exclusive screening information for involvement in the following controversial business issues: alcohol, gambling, firearms, military nuclear power and tobacco (KLD Database). Each of these categories includes assorted indicators of a strength or concern, a weakness, relevant to the respective factors.

Variables:

The research will be developed by two categorical variables by simply combining the KLD indicator ratings variables for company strengths listed under Environment (ENV_STRENGTHS), and the KLD indicator ratings variables that return concerns listed under Environment (ENV_CONCERNS). The eight indicator variables from the KLD

database disintegrated into environmental strengths, the strengths are as follows: Beneficial Products and Services, Pollution Prevention, Recycling, Clean Energy, Communications (regarding good environmental practices), Property, Plant and Equipment (maintained above average environmental practice for the industry), Management Systems (commitment to superior management systems thorough IS 14001; the environmental management standard);, and Other Strengths (superior commitment to management systems voluntary programs, or other environmentally proactive programs). There are seven KLD indicator variables that disintegrate into environmental concerns as follows: Hazardous Waste, regulatory Problems, Ozone Depleting Chemicals, Substantial Emissions, Agricultural Chemicals, Climate Change, and other concerns (the company has been involved in a environmental controversy not covered in other KLD ratings).

The dependent variables that will be used within this study represent both accounting measures of financial achievement and marketing measures of financial achievement. The ROS and ROA will be used to closely represent financial performance. While Tobin's Q will represent market performance.

Methodology:

Due to the nature of this study involving variables that serve as important discriminators of performance. The research calls for a cross section, fixed effects OLS regression. The research will be arguing that accounting performance is dependent upon environmental and CSR activities that occur together with the accounting measure. Thus, both the dependent variable and the independent environmental and CSR variables are measured at time t as depicted in Equation (1). In contrast because the market is forward looking, we use a lagged dependent variable, Tobin's Q, and then use current period independent variables as proxies for expectations in the future period.

EQUATION 1:

$$ROA = \text{constant} + \text{Environmental Strengths} + \text{Environmental Concerns} + \text{Research \& Development to Sales} + \text{Market Value Equity to Book_Value Equity} + \text{Total Debt to Assets} + \text{Capital Expenditures to Sales} + \text{Return On Assets}(-1)$$

EQUATION 2:

$$ROS = \text{Constant} + ROS (-1) + ROS (-2) + \text{Environmental Strengths} + \text{Environmental Concerns} + \text{Research \& Development to Sales} + \text{Market Value to Book} + \text{Total Debt to Assets} + \text{Operating Cash Flow to Sales}$$

EQUATION 3:

$$Tobins\ Q = \text{constant} + \text{Environmental Strengths} + \text{Environmental Concerns} + \text{Tobin's Q} (-1) + \text{Total Debt to Equity} + \text{Operating Cash Flow to Assets}$$

Limitations and Future Research:

Limitations:

Though the KLD Database is an extensive tool while researching electronic waste management, corporate social responsibility and the financial outcomes, there are many Information technology manufacturing companies not included within the databases used in this study. Our sample was limited to publically traded companies



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whose data was in both of the databases. It is possible that the element of transparency required for publically traded companies could impact commitment to corporate social responsibility. Some investment organizations and individuals use data from the KLD database to make investment decisions. Another limitation within the research is the selection of ratio variables used to measure performance and independent variables used within the hypotheses equations. Some studies in this area have used different variables in their research. However, the measures chosen for this analysis are well supported as valid measurements in CSR and financial performance research studies.

Future Research:

A topic for further research would ask who is exactly responsible for proper electronic waste management. It is likely a shared responsibility between manufacturers, consumers, and government is necessary to properly address the issue. This research could examine the magnitude of the problem on the environment, the associated costs, and how should the costs be allocated between the various stakeholders. Another topic for further research would be to investigate software companies. This research could examine the environmental aspects of corporate social responsibility and the affects of market and accounting performance within software companies.

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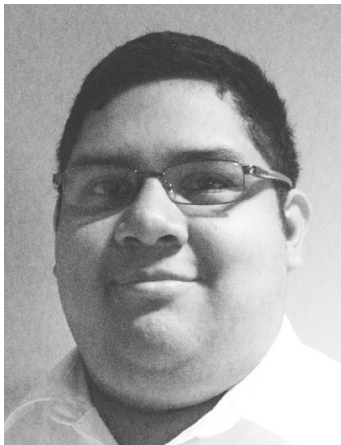
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Spatial Modeling of Resource Competition and Allelopathy



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Abstract

*The research project presents a model of species competition and allelopathy that used a computational approach. Our work expanded on previous research which considered a nutrient competition with the added ability of one competitor to produce a toxin which kills an opposing competitor. Some species of algae, such as *P. parvum*, are known to create toxins when the amount of nutrients in its surrounding environment is low. Such poison production has had a negative impact on the Texas fishing industry. The method used for creating this model involved a system of partial differential equations that took into account the various nutrients and toxins that affected algae population growth. A basic model of nutrient diffusion across a single dimension was created and then expanded to include two nutrient competitors, one which was a poison-producer and the other which was a poison-susceptible. To simulate this environment we applied numerical methods, developed in the C++ programming language to solve the governing systems of partial differential equations quickly and efficiently. To visualize the data, we used the software package MathGL, which provided the appropriate C++ functions needed for plotting our data*



1. Introduction

The paper presents a realistic model of phytoplankton population in a lake using a computational approach. Phytoplankton populations are affected by such factors as river flow, the availability of nutrients, and the production of toxins by harmful algae. A strong flow will wash microbial populations downstream, but sufficiently slow flow will enable algae to persist in a hydraulic storage zone which forms in fringing coves around the edges of a lake (Grover, et al, 2011). The existence of multiple species in these zones will cause competition for any limited nutrient resources. One particular species of algae, *Prymnesium parvum* (common name: golden alga), has caused great concern in the scientific community due to its ability to produce a toxin, prymnesin. *P. parvum* requires nitrogen and phosphorus to grow. When these two nutrients are limited, *P. parvum* produces prymnesin, which kills other algae, in order to secure nitrogen and phosphorus, a phenomenon which is known as allelopathy (Graneli and Solomon, 2010). This toxin can be fatal not only to competing algae but also to surrounding fish. Studies have shown that toxic golden algal blooms have killed over 12 million fish in Texas since 1985, resulting in the loss of millions of dollars' worth of dead fish, lost revenue to local economies, and lost time and resources involved in responses to the fish kills (Texas Park and Wildlife, 2002). Understanding how the golden algae bloom can help prevent future toxic fish kills. Researchers have created two models of this littoral environment using both ordinary and partial differential equations that take into account the various nutrients and toxins that affect algae population growth. The gradostat model (Martines, et al, 2011) focuses on a single cove that is coupled to a larger, main lake. In this cove, the phytoplankton and the algae are allowed to flow between the cove and the main lake where they compete for a limited nutrient in each zone. A second nutrient gradient model (Grover, et al, 2009) is an idealized riverine reservoir which consists of a single main channel, through which the river flow transports and disperses nutrients along with the phytoplankton and harmful algae, coupled to an ensemble of fringing coves on the shoreline. Our project will focus on a model of nutrient competition and allelopathy across a single dimension inside a chemostat. We will attempt to determine how the potential growth rate and nutrient requirement of two competitors (one of which is a toxin-producer and the other which is toxin-susceptible) plays a role in their competition and whether the results agree with the principal of competitive exclusion.

2. Method

The model that will be presented is derived from the fundamental conservation law. This law states that "the rate of change of a certain quantity in a given domain must equal the rate which the quantity flows across the boundary [of the domain] plus the rate at which the quantity is created, or destroyed, in that domain" (Logan, 2004). To demonstrate this law, consider the example of heat moving through a rod. The rod (shown in Figure 1) of length 0 to L has heat entering at $x = 0$ and exiting at $x = L$. The equation $u = u(x,t)$ denotes the density of heat located in a given cross section, A , at position x in the tube at time t . The equation $\phi = \phi(x,t)$ is known as the flux term and denotes the amount of heat crossing the section A at position, x at time t . Finally, the equation $f = f(x,t)$ is known as the source term and denotes the amount of heat created or destroyed in cross-section A .

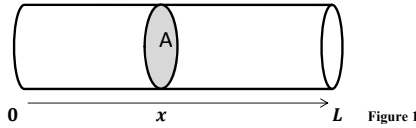


Figure 1

The fundamental conservation law equation relates these three terms in the following manner:

$$u_t(x, t) + \phi_x(x, t) = f(x, t)$$

or simply

$$u_t + \phi_x = f$$

In this equation, u_t is the partial derivative of equation u with respect to t (time), and ϕ_x is the partial derivative of equation ϕ with respect to x (space). When no source is added, the equation is as follows:

$$u_t + \phi_x = 0$$

Fick's law states that in diffusion, the flux moves in direction of high concentration to low concentration, at a magnitude that is negatively proportional to the concentration gradient (the partial derivative, u_x) (Logan, 2004). Fick's law is stated as the equation:

$$\phi = -Du_x$$

When substituting the flux term into the conservation equation, the equation becomes

$$u_t + (-Du_{xx}) = f$$

Moving the terms around, we can see that the partial derivative of u with respect to time is equal to the second partial derivative of u with respect to space multiplied by the constant D .

$$u_t = Du_{xx} + f$$

The equation above is known as the diffusion partial differential equation (PDE). Since the environment this project will model involves river flow, advection must also be taken into account. Advection is the movement of a substance caused by the bulk motion of a fluid, at velocity c (Logan, 2004). If the substance is undergoing both advection and Fickian diffusion, then the flux term is denoted by the following equation:

$$\phi = cu - Du_x$$

Substituting the above flux term into the fundamental conservation law equation and adding a source term transforms the equation into:



$$u_t + cu_x - Du_{xx} = f$$

Moving several of the terms around, we can rearrange the equation as such:

$$u_t = Du_{xx} - cu_x + f$$

In this equation, Du_{xx} represents the diffusion of a substance, cu_x the advection and f the source. This form of the diffusion PDE will provide the base for the models that will be built in this paper.

2.1 Modeling

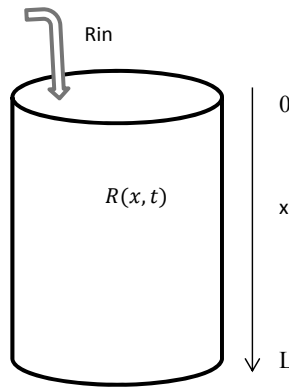


Figure 2

2.1.1 Model 1 – Nutrient Only

Our first model only takes into consideration a nutrient which undergoes diffusion in a tank. In this model, the nutrient only diffuses in one dimension: from the top of the tank to near the bottom. The function $R(x, t)$ denotes the concentration of nutrient at a given cross section of the tank, x at time, t (shown in Figure 2). For this model the nutrient will not be undergoing advection and new nutrient will not be created inside the tank. However, nutrient will continue to be inserted at the top of the tank at a constant rate. Using what we know of the fundamental conservation law we can state that,

$$R_t + \phi_x = 0$$

where the flux term is defined by Fick's Law as:

$$\phi = -DR_x$$

Inserting the flux term back into the fundamental conservation law equation and rearranging the terms we get:

$$R_t - DR_{xx} = 0$$

$$R_t = DR_{xx}$$

The above equation is a partial differential equation and relates two partial derivatives which we most solve.

One method of approximating the first derivative of a function is the forward difference method. The forward difference method relates the value of a function at point x_0 and at a nearby point $x_0 + h$ to approximate the derivative of the function at x_0 (Burden and Faires, 1997):

$$f'(x_0) \approx \frac{f(x_0 + h) - f(x_0)}{h}$$

In this equation, the smaller h is, the more accurate the approximation will be. We can apply this method to approximate the partial derivative R_t . Note that in this case we use k instead of h :

$$R_t(x_0, t_0) \approx \frac{R(x_0, t_0 + k) - R(x_0, t_0)}{k}$$

Furthermore we can retrieve an approximation for a second derivative using the central difference method:

$$R_{xx}(x_0, t_0) \approx \frac{R(x_0 + h, t_0) - 2R(x_0, t_0) + R(x_0 - h, t_0)}{h^2}$$

We can then substitute the two approximations into our partial differential equation:

$$\frac{R(x_0, t_0 + k) - R(x_0, t_0)}{k} = D \left(\frac{R(x_0 + h, t_0) - 2R(x_0, t_0) + R(x_0 - h, t_0)}{h^2} \right)$$

We are looking for a way to calculate $R(x_0, t_0 + k)$, the concentration of nutrient at a cross-section of the tank, x at one further time step $t_0 + k$. We can rearrange the above equation to isolate $R(x_0, t_0 + k)$ on the left.

$$R(x_0, t_0 + k) = R(x_0, t_0) + \frac{kD}{h^2} (R(x_0 + h, t_0) - 2R(x_0, t_0) + R(x_0 - h, t_0))$$

$$R(x_0, t_0 + k) = R(x_0, t_0) - \frac{2kD}{h^2} R(x_0, t_0) + \frac{2kD}{h^2} (R(x_0 + h, t_0) + R(x_0 - h, t_0))$$

$$R(x_0, t_0 + k) = \left(1 - \frac{2kD}{h^2} \right) R(x_0, t_0) + \frac{kD}{h^2} (R(x_0 + h, t_0) + R(x_0 - h, t_0))$$

A model such as this one requires boundary conditions. Boundary conditions tell us the concentration of nutrient at the top and bottom of the tank. For this model, the amount of nutrient that is inserted at the top of the tank is always the same value which we denote with the variable R_0 . Nutrient does not cling to the bottom of the tank so the concentration of nutrient there is always 0. The boundary conditions can be expressed in the following

manner:

$$R(0, t) = R_{in}$$

$$R(L, t) = 0$$

2.1.2 Model 2 – Nutrient and Single Population

The second model is an expansion of the first model and adds a species population to the tank, in addition to the nutrient. The population undergoes diffusion and reproduces at a certain rate as well as dies at a certain rate. The growth and death rate of the population is dependent on the amount of nutrient that is available. Thus, the nutrient is also depleted as it is consumed by the population. The mathematical model for this environment is modified from the PDE in Model 1.

$$R_t = DR_{xx}$$

However, since the nutrient is now being eaten by the population, we have to add a term that describes the nutrient’s depletion, as such

$$R_t = DR_{xx} - qN\mu(R)$$

In this new term, q represents the amount of nutrient per day that species N must consume. The function $\mu(R)$ represents the nutrient uptake and growth rate of species N. This function is the Monod function, written as

$$\mu(R) = \frac{\mu^{max}R}{R + \hat{k}}$$

The term μ^{max} refers to the maximum growth rate of the species and k is known as the half-saturation constant, the value at which $\mu(R)$ is equal to half μ^{max} (Huisman, et al, 2004). The equation for the population of species N is as follows:

$$N_t = DN_{xx} + N\mu(R) - NE$$

where $\mu(R)$ represents the species’ growth rate and represents E it’s death rate. Our overall system of equations looks like this:

$$R_t = DR_{xx} - qN\mu(R)$$

$$N_t = DN_{xx} + N\mu(R) - NE$$

Using the techniques we used in Model 1, we can rearrange the equations to find $R(x_\sigma t_\sigma + k)$ and $N(x_\sigma t_\sigma + k)$. For simplicity, $R(x_\sigma t_\sigma + k)$ will be denoted as R^j and $N(x_\sigma t_\sigma + k)$ as N^j in the following operations.

R_i^j :

$$\frac{R_i^j - R_i^{j-1}}{k} = D \left(\frac{R_{i+1}^{j-1} - 2R_i^{j-1} + R_{i-1}^{j-1}}{h^2} \right) - N_i^{j-1} q \frac{\mu^{max} R_i^{j-1}}{R_i^{j-1} + \hat{k}}$$

$$R_i^j = \left(1 - \frac{2kD}{h^2} \right) R_i^{j-1} + \frac{kD}{h^2} (R_{i+1}^{j-1} + R_{i-1}^{j-1}) - \frac{qk\mu^{max} N_i^{j-1} R_i^{j-1}}{(R_i^{j-1} + \hat{k})}$$

N_i^j :

$$N_i^j = \left(1 - \frac{2kD}{h^2} \right) N_i^{j-1} + \frac{kD}{h^2} (N_{i+1}^{j-1} + N_{i-1}^{j-1}) + \left[\frac{\mu^{max} R_i^{j-1}}{(R_i^{j-1} + \hat{k})} - E \right] N_i^{j-1} k$$

Like the previous model, this model also requires boundary conditions. For the nutrient, the boundary conditions remain the same. For the boundary conditions of species N, we assume that N doesn't cling to the top or bottom of the tank. Therefore, the boundary conditions for N and R are as follows:

$$\begin{aligned} R(0, t) &= Rin \\ R(L, t) &= 0 \\ N(0, t) &= 0 \\ N(L, t) &= 0 \end{aligned}$$

2.1.3 Model 3 – Nutrient Competition

For Model 3, a competing species population is added to the tank in addition to the nutrient and first species population. The concentration of the second population is determined by the function $M(x, t)$. Like the first species, the second species undergoes Fickian diffusion in the tank and eats nutrient in order to live and reproduce. The second species also perishes at a certain rate which is determined by the amount of nutrient available. Model 3 is simply an expansion of Model 2 but with a third equation added for that second species.

$$\begin{aligned} R_t &= DR_{xx} - Nq_1\mu_1(R) - Mq_2\mu_2(R) \\ N_t &= DN_{xx} + N\mu_1(R) - NE_1 \\ M_t &= DM_{xx} + M\mu_2(R) - ME_2 \end{aligned}$$

As you'll notice each species has a different growth and death rate and the rate of change of nutrient is now affected by how much both species consume. Once again we can use the same methods as in Model 1 and 2 to simplify our equations and determine the concentration of nutrients and the species population that will exist at a certain cross section at one further time-step.

R_i^j :

$$R_i^j = \left(1 - \frac{2kD}{h^2}\right)R_i^{j-1} + \frac{kD}{h^2}(R_{i+1}^{j-1} + R_{i-1}^{j-1}) - \frac{q_1 k \mu_1^{max} N_i^{j-1} R_i^{j-1}}{(R_i^{j-1} + \hat{k}_1)} - \frac{q_2 k \mu_2^{max} N_i^{j-1} R_i^{j-1}}{(R_i^{j-1} + \hat{k}_2)}$$

N_i^j :

$$N_i^j = \left(1 - \frac{2kD}{h^2}\right)N_i^{j-1} + \frac{kD}{h^2}(N_{i+1}^{j-1} + N_{i-1}^{j-1}) + \left[\frac{\mu_1^{max} R_i^{j-1}}{(R_i^{j-1} + \hat{k}_1)} - E_1\right]N_i^{j-1}k$$

M_i^j :

$$M_i^j = \left(1 - \frac{2kD}{h^2}\right)M_i^{j-1} + \frac{kD}{h^2}(M_{i+1}^{j-1} + M_{i-1}^{j-1}) + \left[\frac{\mu_2^{max} R_i^{j-1}}{(R_i^{j-1} + \hat{k}_2)} - E_2\right]M_i^{j-1}k$$

The boundary conditions for this model are similar to the conditions in previous models:

$$\begin{aligned} R(0, t) &= R_{in} \\ R(L, t) &= 0 \\ N(0, t) &= 0 \\ N(L, t) &= 0 \\ M(0, t) &= 0 \\ M(L, t) &= 0 \end{aligned}$$

2.1.4 Model 4 – Nutrient Competition and Allelopathy

For Model 4, a toxin is added to the tank. This toxin is produced by species M and kills species N. This phenomenon is known as allelopathy. The concentration of toxin is denoted by the equation $P(x, t)$. Like the two species and the nutrient, the toxin undergoes Fickian diffusion throughout the tank. The toxin also decays over time. With the toxin added, the system of equations becomes

$$R_t = DR_{xx} - Nq_1\mu_1(R) - Mq_2\mu_2(R)$$

$$N_t = DN_{xx} + N\mu_1(R) - NE_1$$

$$M_t = DM_{xx} + M\mu_2(R) - E_2(P)M$$

$$P_t = DP_{xx} + \alpha[\mu_1^{max} - \mu_1(R)]N - SP$$

In this equation, $\alpha[\mu_1^{max} - \mu_1(R)]N$ represents the amount of toxin that is dispersed proportional to the population of species N. In particular, the term is known as the toxin production constant which tells us how fast toxin is produced; the term $[\mu_1^{max} - \mu_1(R)]$ shows that the amount of toxin produced depends on how much nutrient species N needs. When species N has reached close to its maximum growth rate, its food needs are small, so the amount of toxin produced is also really small. When N's growth rate has yet to reach its

maximum growth rate, its food needs are great and it produces a greater amount of toxin. Finally, term is the toxin decay rate (Tulyaganova and Martines, 2012). Since species M is now toxin-susceptible, its death rate must now be changed to incorporate the effect of the toxin. Its death rate is now denoted by the function which is stated as

$$E_2(P) = \gamma P + E_2$$

The variable denotes how effective the toxin is against species M while denotes the original death rate of species M.

As in our previous models, we can use forward difference and central difference to simplify our equations and determine the concentration of nutrient and species populations that will exist at a certain cross section at one further time-step.

R_i^j :

$$R_i^j = \left(1 - \frac{2kD}{h^2}\right) R_i^{j-1} + \frac{kD}{h^2} (R_{i+1}^{j-1} + R_{i-1}^{j-1}) - \frac{q_1 k \mu_1 \max N_i^{j-1} R_i^{j-1}}{(R_i^{j-1} + \hat{k}_1)} - \frac{q_2 k \mu_2 \max N_i^{j-1} R_i^{j-1}}{(R_i^{j-1} + \hat{k}_2)}$$

N_i^j :

$$N_i^j = \left(1 - \frac{2kD}{h^2}\right) N_i^{j-1} + \frac{kD}{h^2} (N_{i+1}^{j-1} + N_{i-1}^{j-1}) + \left[\frac{\mu_1 \max R_i^{j-1}}{(R_i^{j-1} + \hat{k}_1)} - E_1 \right] N_i^{j-1} k$$

M_i^j :

$$M_i^j = \left(1 - \frac{2kD}{h^2}\right) M_i^{j-1} + \frac{kD}{h^2} (M_{i+1}^{j-1} + M_{i-1}^{j-1}) + \left[\frac{\mu_2 \max R_i^{j-1}}{(R_i^{j-1} + \hat{k}_2)} - (\gamma P_i^{j-1} + E_2) \right] M_i^{j-1} k$$

P_i^j :

$$P_i^j = \left(1 - \frac{2kD}{h^2}\right) P_i^{j-1} + \frac{kD}{h^2} (P_{i+1}^{j-1} + P_{i-1}^{j-1}) + \alpha \left[\mu_1 \max - \frac{\mu_1 \max R_i^{j-1}}{(R_i^{j-1} + \hat{k}_1)} \right] N_i^{j-1} k - SPk$$

The boundary conditions for this model are similar to the conditions in the previous model

$$\begin{aligned}R(0, t) &= R_{in} \\R(L, t) &= 0 \\N(0, t) &= 0 \\N(L, t) &= 0 \\M(0, t) &= 0 \\M(L, t) &= 0 \\P(0, t) &= 0 \\P(L, t) &= 0\end{aligned}$$

2.2 Programming the Models and the Simulation

The programming of the model is created using the C++ programming language, edited on Microsoft Visual Studio 2010. However, the code is compiled and executed on MinGW, a minimalist GNU for Windows. The software package, MathGL, is used to graph the data.

2.2.1 Important Variables

Most of the variables used in this program are of type float as it provides greater accuracy than the int variable type (Deitel and Deitel, 2010).

The two variables float `space_min` and float `space_max` are numeric variables that are assigned the minimum value of our spatial variable, x and the maximum value of x , respectively. In our case the minimum value of x is 0 (the top of the tank) and the maximum value is L (the complete length of the tank.)

The two variables float `time_min` and float `time_max` are numeric variables that are assigned the minimum value of our time variable, t and the maximum value of t , respectively. In our case the minimum value of t is 0 and the max value is however many hours we want the simulation to cover.

The variable int `m` represents the number of intervals the length of the tank is going to be divided into. The greater the amount of intervals, the more accurate our simulation will be. The variable int `n` represents the number of time steps our total time is going to be divided into. The greater the amount of time steps, the more accurate our simulation will be.

C++ allows us to store data in one-dimensional arrays but in order to easily change the size of the arrays we use dynamic allocation (Geitel and Geitel, 2010). The concentration of nutrient at each cross-section of the tank is stored in the dynamically allocated array float `*dataR` which is of size `m+1`. The concentration of species M and the concentration of species N are stored the dynamically allocated arrays float `*dataM` and float `*dataN`, respectively. The concentration of toxin is stored in the dynamically allocated array float `*dataP`. Copies of each array (`new_dataR`, `new_dataM`, `new_dataN`, and `new_dataP`) are created as temporary placeholders for values as calculations are run.

2.2.2 Initialization of Boundary Conditions and Initial Distribution

The boundary conditions are set by initializing the first and last index of each of the 6 arrays to the desired value. In this case `dataR[0] = Rin`, where R_{in} is a value representing the amount of nutrient that is entering at the top of the tank. The rest of the boundary conditions are set to 0.

The initial conditions are set using a “for loop”. This “for loop” inserts values into the inner indices of each array; that is every index except the first and last, which are set as the

boundary conditions:

```
for(int i = 1; i < m; i++)
{
    dataR[i] = some value;
    dataN[i] = some value;
    dataM[i] = some value;
}
```

The same is done for the “placeholder” arrays data_newR, data_newN, data_newR.

2.2.3 Calculating the concentration of nutrient and species population

The concentration of the nutrient, species population, and toxin are calculated using a separate function. This function, R, receives as inputs the 6 arrays as well all of the values necessary for calculations as shown in Model 3. This function is called $n + 1$ times, for each time step starting at $t = 0$ to $t = n$ (Deitel and Deitel, 2010).

In the function, a “for loop” calculates the values for R_i^t, N_i^t, M_i^t and inserts them into the “place holder arrays” data_newR, data_newN, and data_newM, respectively. After each iteration of the for loop, the values in the “placeholder” arrays are moved to the data arrays dataR, dataN and dataM, respectively.

2.2.4 Visualizing the data

A software package, MathGL is used to visualize the data. Since MathGL seems to be incompatible with Visual Studio, a Linux shell for Windows, MinGw is used to run the simulation and display visuals. In order to visualize the data, three objects of type mglData must be constructed: t, t2, t3 (Balikin, 2008). Each object has a public array (“a”) that is initialized to size m. The data in dataR, dataM, dataN are transferred to t.a, t2.a and t3.a, respectively, using the class function Set(). The data is plotted using the function called gr->Plot() where t, t2, and t3 are passed (Balikin, 2008).

3. Results

3.1 Parameters

Using the simulation of the model described in 2.1.4, we investigated several cases of nutrient competition with allelopathy. In each of the simulations we assigned values for most parameters, as listed below:

For our time and space variables the following values were assigned:

```
float space_min = 0, space_max = 5;
float time_min = 0, time_max = 50;
int m = 5, n = 12000;
```

The rest of the variables were assigned the following values:

```
float D = 1;
float q1 = 0.000000004;
float q2 = 0.000000004;
float khat1 = 0.001;
float khat2 = 0.002;
```

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```
float E1 = 0.2;
float E2 = 0.2;
float alpha = 0.001;
float gamma = 0.1;
float s = 0.1;
float Rin = 1;
```

The variable float D represents the variable in our model, which is known as the diffusion coefficient – the rate at which the species population, the toxin and the nutrient diffuse in the tank.

The variables float q1 and float q2 represent the variables q1 and q2 in the model, where q1 is the amount of nutrient species N needs to consume per day and q2 is the amount of nutrient organism M needs to consumer per day.

The variables float khat1 and float khat2 represent the variables \hat{k}_1 and \hat{k}_2 in the Monod function. k_1 is the half-saturation constant of species N, the concentration of nutrient available when the growth rate of N is half its maximum growth rate. Similarly, k_2 is the half-saturation constant of species M, the concentration of nutrient available when the growth rate of is half its maximum growth rate.

The variables float E1 and float E2 represent the variables E_1 and E_2^{min} in the model the mortality rates of species N and M, respectively.

The variable float alpha represents α in the model. This is the toxin production constant which defines how fast toxin is generated by species N.

The variable float gamma represents γ in the equation $E_2(P)$. This variable gives an indication of how effective the toxin produced by N is effective against M.

The variable float s represents the variable S in the model, which is the toxin-decay rate.

The variable float Rin represents the amount of nutrient that is initially put into the tank.

Boundary and Initial Conditions

The boundary conditions tell us the concentration of organisms, nutrient and toxin that exists at both ends of the tank (the top and bottom). In our simulation, no organisms or toxin cling to the ends of the tank, so they don't exist there. The amount of nutrient at the top of the tank is equal to the amount of nutrient that is fed into the tank. Nutrient does not exist at the bottom of the tank. The values are assigned in each respective array as such:

```
dataR[0] = Rin;
dataR[m] = 0;
```

```
dataN[0] = 0;
dataN[m] = 0;
```

```
dataM[0] = 0;
dataM[m] = 0;
```

```
dataP[0] = 0;
dataP[m] = 0;
```

```
new_dataR[0] = Rin;
new_dataR[m] = 0;
```



```
new_dataN[0] = 0;
new_dataN[m] = 0;
```

```
new_dataM[0] = 0;
new_dataM[m] = 0;
```

```
new_dataP[0] = 0;
new_dataP[m] = 0;
```

Initial conditions are the initial distribution of species M and M, toxin and nutrient at every slice of the tank (except the two ends) at time 0. The amount of nutrient in the tank is initially equal to the amount that is fed into it. The concentrations of species M and N are initially both equal to 4. No toxin initially exists in the tank. The values are assigned as follows:

```
for (int i = 1; i < m; i++)
{
    dataR[i] = Rin;
    dataN[i] = 4;
    dataM[i] = 4;
    dataP[i] = 0;
}
```

The simulations in the three cases below changes the values of α_1^{max} and α_2^{max} in differing configurations to investigate the role of the potential growth rate on the competition.

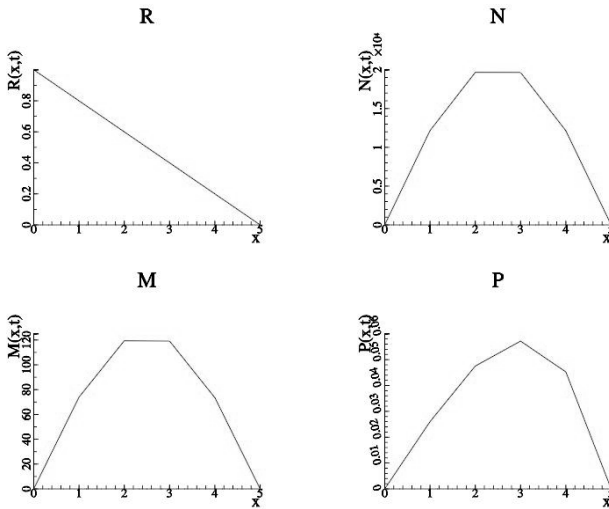
Case 1

In Case 1, the parameters are chosen such that N has a larger potential growth rate than M. The values of α_1^{max} and α_2^{max} were set as $\alpha_1^{max} = 0.75$, $\alpha_2^{max} = 0.65$. The resulting data



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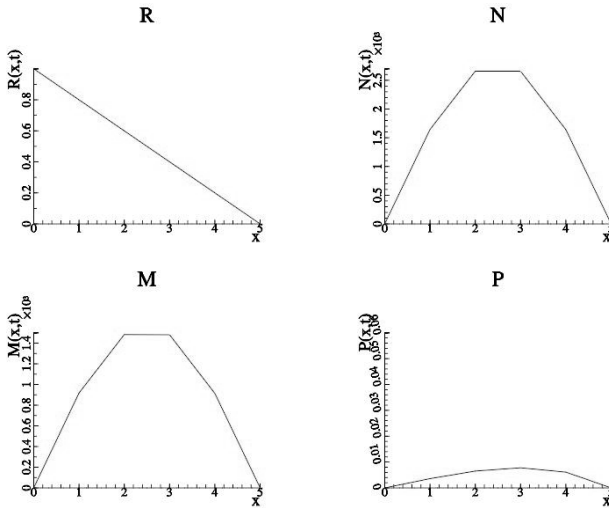
is shown below.



The results of the simulation show that when the potential growth rate of N is far greater than the potential growth rate of M , N will greatly outnumber M . In fact, the concentration of M is almost equal to 0 compared to the concentration of N . After 50 hours, the maximum concentration of N is about 20,000 and exists at around the middle of the tank. In comparison, the maximum concentration of M is about 120 and also exists around the middle of the tank. The results also show that amount of nutrient stabilizes, staying the same at top of the tank but decreasing further along the tank. Finally, the results show that the amount of toxin peaks near the bottom of the tank, where food has become scarcer. However, the overall amount of toxin in the tank isn't a large quantity.

Case 2:

In Case 2, the parameters are chosen such that N and M have a similar potential growth rate. The values of α_1^{max} and α_2^{max} were set as $\alpha_1^{max} = 0.71$, $\alpha_2^{max} = 0.70$. The resulting data is shown below.



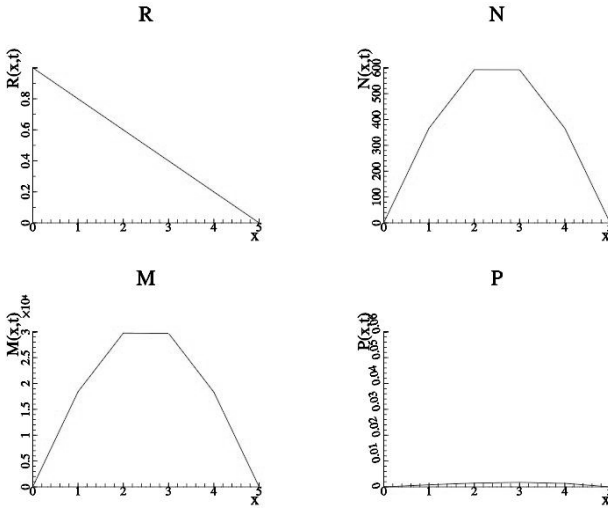
The results of the simulation show that when the potential growth rate of N is almost equal to the potential growth rate of M, the concentration of N will be nearly equal to M, though N still slightly outnumbers M. After 50 hours, the maximum concentration of N is about 2,500, considerably less than it was in Case 1, and exists at around the middle of the tank. In comparison, the maximum concentration of M is about 1,500, greater than it was in Case 1, and also exists around the middle of the tank. The effect on the nutrient remained the same as in Case 1. Finally, the amount of toxin in the tank dramatically decreased, due to the smaller concentration of organism N. As in Case 1, the amount of toxin peaks near the bottom of the tank where nutrient is scarcer.

Case 3:

In Case 3, the parameters are chosen such that N has a smaller potential growth rate than M. The values of α_1^{max} and α_2^{max} were set as $\alpha_1^{max} = 0.68$, $\alpha_2^{max} = 0.76$. The resulting data is shown on the following page.



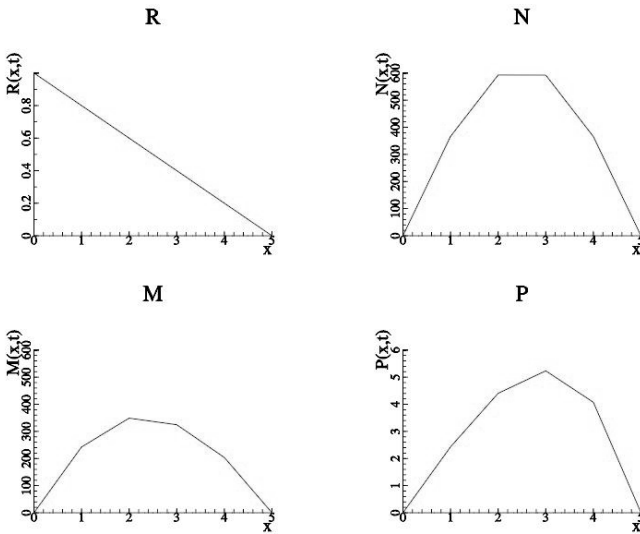
Spatial Modeling of Resource Competition and Allelopathy



The results of the simulation show that when the potential growth rate of N is far less than the potential growth rate of M, the concentration of N will be far less than the concentration of M. In fact, the concentration of N is almost equal to 0 compared to the concentration of M. After 50 hours, the maximum concentration of N is about 600, considerably less than it was in Case 1, and exists at around the middle of the tank. In comparison, the maximum concentration of M is about 30,000, far greater than it was in Case 1 and Case 2 and closer to the concentration of N in Case 1. The effect on the nutrient remained the same as in Case 1 and 2. Finally, the amount of toxin in the tank is at its smallest due to the very low concentration of N. As in Case 1, the amount of toxin peaks near the bottom of the tank where nutrient is scarcer.

Case 4:


In Case 4, the parameters are chosen such that N has a smaller potential growth rate than M. The values of α_1^{max} and α_2^{max} were set as $\alpha_1^{max} = 0.68$, $\alpha_2^{max} = 0.76$. In addition, the toxin production rate α is greatly increased to 3. The resulting data is shown below.



The results show that when species N is producing toxin at an extremely high rate, species N will outnumber species M, as the toxin will stop the population of species M from growing so wildly as it did in Case 3. Thus, the toxin production provides species M with an advantage over species N that allows it to outnumber N despite N's greater growth rate. This result shows that allelopathy does play a critical role in nutrient competition.

4. Discussion

Previous models similar to this ended with results that agreed with the principle of competitive exclusion, which states two species competing for a single limiting nutrient leads to one competitor outcompeting the other, resulting in the death of one species (Huisman, et al, 2004). Specifically, the species that required the least amount of nutrient would win. Our results agree with the principle, as they show that the potential growth rate affects which species will outcompete the other, but only when toxin production is minimal or non-existent. The species with the greatest potential growth rate requires less food to survive, and will outnumber its competitor as shown in the three cases we simulated. In Case 1, species N severely outnumbered species M due to its greater potential growth rate. In Case 3, the roles were reversed as species M greatly outnumbered species N due to its greater potential growth rate. In Case 2, where the potential growth rate of both species was close to equal, the concentration of both species was about equal as well. Yet, species N (which had a slightly higher potential growth rate) still outnumbered species M by a small margin. However, in Case 4, where the poison production rate was greatly increased, the toxin-producing species M was able to outnumber the toxin-susceptible species N. Relating the results to the case of the golden algae, perhaps the reason why large blooms of golden algae happen is because the golden algae is producing enough toxin to overcome other species that may have a higher growth rate. As our results showed, during nutrient



Spatial Modeling of Resource Competition and Allelopathy

competition, a high toxin production rate can be a greater asset to a species population than a higher potential growth rate. Overall, our computational approach to modeling nutrient competition and allelopathy concurs with past research while providing a fast and efficient method of providing results that might shed some light on the expansion of golden algae.

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Gesture Based Nurse Call/Alert System



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Abstract

The demand for doctors and nurses as well as the amount of in-patients in hospitals are increasing per year. This means that nurses have to take care of more patients at one time, and assisting each patient can become difficult when multiple patients require help at the same time. Patients call nurses for various reasons such as experiencing pain, bathroom assistance, or general patient comfort. Knowing what a call is for can allow nurses to react and help the patients quicker. To distinguish different alerts, a system based on the Microsoft Kinect sensor is proposed herein to differentiate between gestures. Specifically, we used a Microsoft Kinect sensor to detect a patient's body position in a room using its depth and infrared sensors. Using the Kinect, the system can track the position of the arms over time, and be able to detect a gesture such as raising either arm or raising both arms. Based on the different gestures, the system will alert the nurse central station with patient room number and type of alert. Knowing the type of alert a patient is calling for can be used to not only prioritize the alerts as they are received, but also reduce the time it takes a nurse to process an alert.

I. Introduction

The Association of Nursing Schools has stated that there will be a shortage of nurses in the near future[1] and the Health Research and Educational Trust published an article in which they found that on average the ratio of patients to nurses are between 639 (California Workforce Initiative) and 533 (Office of Statewide Health Planning and Development)[2]. When taking responsibility of five to six patients at any given time, the possibility of having multiple alerts arise at one time is high. Therefore, this research proposed that by classifying different alerts, nurses can process the patient initiated alerts efficiently and effectively by responding to alerts that are more critical first. The Center for Disease Control (CDC) reports that in 2008 there were a total of 123.8 million visits to the emergency department. From those visits, 13% resulted in hospital admission (that is, approximately 16 million persons were admitted), which lasted on average 5.5 days [3]. The goal of the proposed research project was to design a new form of interaction between patients and nurses at hospitals and clinics. A Kinect sensor has the ability to recognize body positioning, which can be used to detect gestures that are made by patients. Prior projects involving gesture recognition such as the Hidden Markov Models [4] show the potential in using the Kinect camera to detect gestures. The Kinect sensor has already proven to be a success in the operating room where it is used as a touch less interface to view medical images by gesturing swipes to move between images [5]. A wireless system has also been in development that allows the nurses to receive text messages about a call. This allows nurses to receive the mobile alert and skip the nurse central call station [6].

In order to accomplish this goal, a Kinect sensor must be able to detect a patient's gesture to differentiate the alert. The design of this project involves using the Kinect sensor to track the patient at all times, and detect when a patient is requesting a nurse call. The programming language that will be used in this project is C#, due to its compatibility with the Microsoft Kinect SDK. The Kinect will monitor the patient's upper body, and when the sensor registers a known movement such as a hand raise, it will be able to detect the hand raise and send the appropriate alert to the nurse central station.

The component chosen for this project was the Kinect sensor and was chosen due to its ability to track body positioning. The sensor has 3D depth sensors that are implemented using infrared. The infrared is used to map distinct features in the camera view by analyzing a speckle pattern from the infrared light [7]. With the ability to detect the presence of a human and also the positioning of its major limbs, we can differentiate between different movements such as raised right or left arm.

To validate the system, three test subjects were recruited to perform the different gestures and test the success rate of detection, whereas a confusion matrix was used to test the accuracy of the system.

In summary the goal of the research is to help aid nurses during patient initiated nurse calls. The use of motion based controls can allow nurses to gather more information about a patient nurse call, which will allow the nurse to be able to process the calls with higher efficiency. In the next section, we first describe the design requirements for the proposed system.

II. Methods

II.1 Design Requirements

To aid nurses and improve the current nurse call system in place, the new system must be able to accomplish the following functions.

1. Monitor a patient that can move his arms while in bed
2. Detect three patient gestures to distinguish between: Pain, Bathroom, Comfort
3. Alert Nurses with information regarding the call.

II.2 Parts Used

The Microsoft Kinect Sensor (Kinect for Windows, SDK version 1.5, Microsoft ,<http://www.microsoft.com/en-us/kinectforwindows/>, 3D depth cameras) was deployed in this project. The Kinect sensor has 3D depth sensors, RGB camera, and also uses infrared to map a room and get position of detected objects; this can be seen in figure 1. Along with the sensor, Microsoft has also released a dedicated SDK or software developer kit. The SDK has features that can be accessed through a user-designed program, such as skeletal tracking, and depth information of objects recognized. The sensor has the ability to monitor a patient by detecting the upper body through the use of its skeletal tracking.



Figure 1: The Kinect sensor

II.3 System Design

The placement of the Kinect sensor camera will be directly above a patient's bed looking downward toward the patient. To detect a patient's gesture, the depth sensor information was used. The patient's upper body joints were tracked, which included the patient's head, shoulders, elbows, and wrists. Pythagorean theorem was used to calculate the length of the arm by using the 3D positioning of the shoulder, elbow, and wrist of each arm. The length of the arm is then used as a reference that is translated to depth positioning. The system uses the length of the arm to adjust the depth reference point of the shoulder. The length of the arm is reduced by 15% and is used to create a new reference point with respect to the shoulder. The adjusted arm length was added to the depth position of the shoulder, placing the reference point on a plane in front of the patient and between itself and the Kinect. When the wrist depth position, which is denoted by Z position, is closer to the Kinect camera than the reference plane, then the arm is extended upwards toward the

Gesture Based Nurse Call/Alert System

Kinect camera, as seen in Figure 2. This is denoted as either a right arm or left arm raise and the appropriate alert is displayed. The system can also detect when both arms have been raised at the same time.

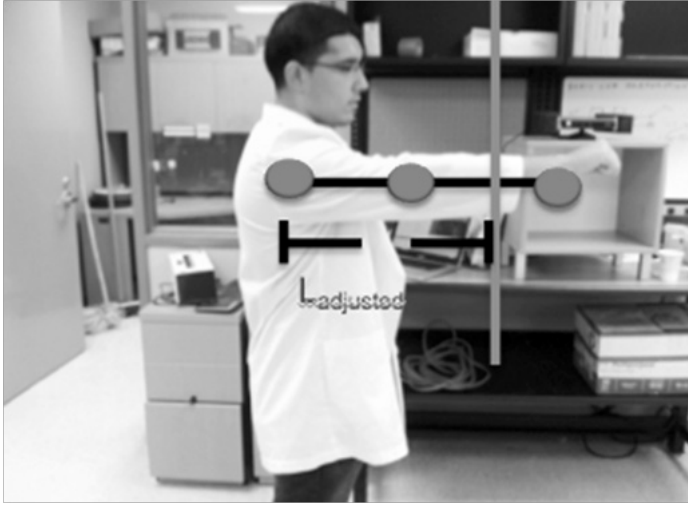


Figure 2: The blue line is the reference plane that has been extracted by using the shoulder depth and adding to it the adjusted arm length value. When the arm is extended the wrist crosses the plane, which is recognized as an arm raise.

II.4 Gesture Classification

The system will employ three basic gestures to differentiate the top three reasons nurses are called by patients. The simplicity of the gestures allows patients to remember and follow the new system without a high learning curve. Table 1 indicates the gesture matched with its corresponding alert.

Gesture	Alert
Left arm raised	Pain
Right arm raised	Bathroom
Left and right arm raised	Patient comfort

Table 1: Gesture and corresponding alerts

II.5 System Program Flow Chart

In order to retrieve information from the Kinect sensor, the camera must first be initialized (See figure 3). Initializing the camera allows for the program to communicate with the camera and extract the information necessary such as position of various joints that will be used for positioning. Once the camera is initialized, the program uses the information to detect a body. Until the body is detected, it continues to search. Once the body is detected, it then calculates the length of both arms and creates the adjusted lengths that will be used as a reference point between the Kinect and the patient. Once the adjusted

barrier is set, the program checks for the three different types of gestures one at a time. If a gesture is detected, it displays the gesture on the console and returns to check if a body is detected to repeat the process. When detection is not made, it will loop in same format without displaying on the console and check to make sure a body is being detected.

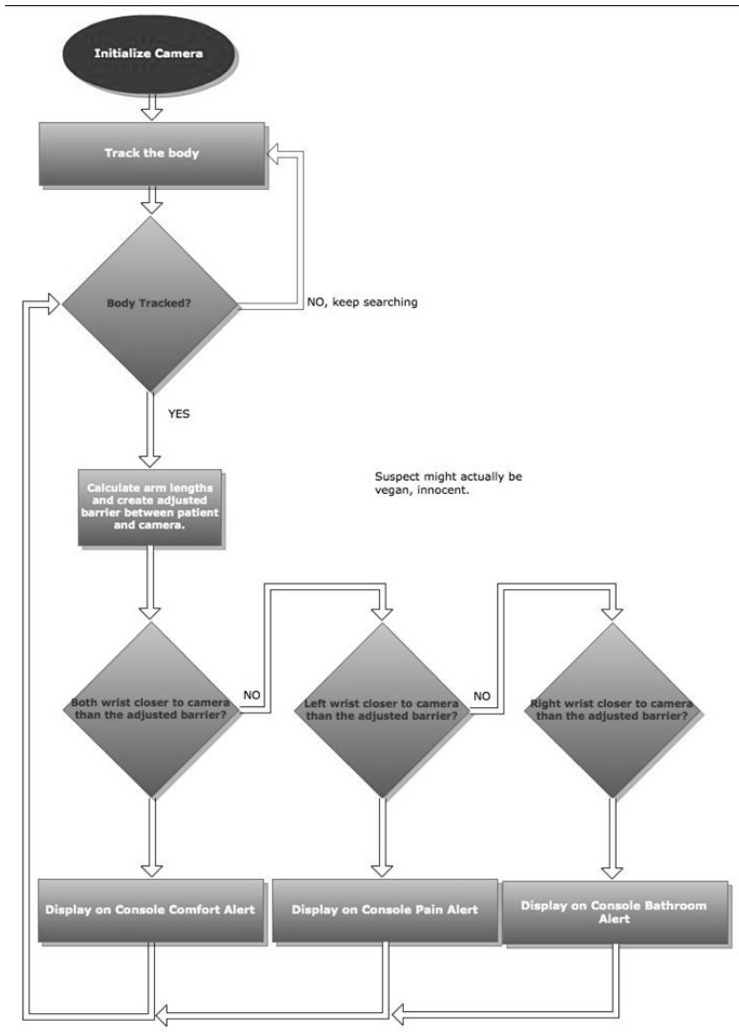


Figure 3: Flowchart of proposed gesture detection system.

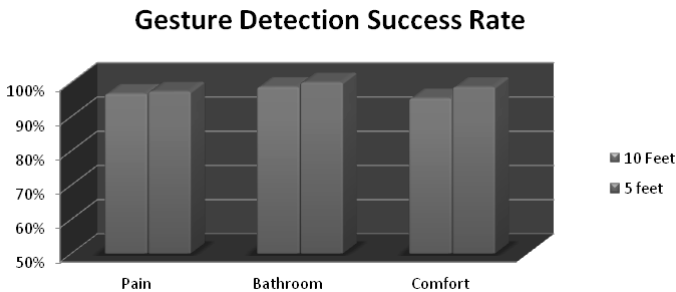
Gesture Based Nurse Call/Alert System

II. 6Nurse Call Station

The Kinect will be connected to the nurse call station computer, where when a gesture is detected; a message will be displayed on the monitor. The message will contain room number and type of alert that is being recognized.

III. Results

Three subjects of different height and arm length, to show adaptability, tested the system. The first test recorded the success rate of the gesture detection. Each subject repeated the three gestures fifty times at both five feet and ten feet. When a gesture was not detected, it was recorded and Graph 1 shows the success rate of detection of a gesture.



Graph 1: Success rate of gesture detection at both five and ten feet.

Using a confusion matrix, the accuracy of the gesture detection method was quantified. The confusion matrix test is run to test the accuracy of a system. A matrix is created that demonstrates the accuracy of the system by relating possible outcomes with actual outcomes. When testing gesture one, if gesture two is detected, it is recorded under row one column two. The matrix was run with three subjects; each subject repeated the individual gestures a set number of times, and the gesture that was detected was recorded. Left arm raise was repeated fifteen times, right arm raise was repeated twenty times, and both arms raise was repeated eighteen times. The test was repeated at both five feet and ten feet. Tables 2-Table 4 show the results from each subject.

5ft Subject 1			
	Pain	Bathroom	Comfort
Pain	15	0	0
Bathroom	0	20	0
Comfort	0	0	18
10ft Subject 1			
	Pain	Bathroom	Comfort
Pain	15	0	1
Bathroom	0	20	0
Comfort	0	0	17

Table 2: Confusion matrix results for subject 1

5ft Subject 2			
	Pain	Bathroom	Comfort
Pain	15	0	0
Bathroom	0	20	0
Comfort	0	0	18
10ft Subject 2			
	Pain	Bathroom	Comfort
Pain	13	0	2
Bathroom	0	20	0
Comfort	0	0	16

Table 3: Confusion matrix results for subject 2

5ft Subject 3			
	Pain	Bathroom	Comfort
Pain	15	0	0
Bathroom	0	20	0
Comfort	0	0	18
10ft Subject 3			
	Pain	Bathroom	Comfort
Pain	12	0	0
Bathroom	0	20	0
Comfort	0	0	17

Table 4: Confusion matrix for subject 3

IV. Conclusion

The gesture detection method proved to be reliable and accurate. The detection testing showed that the program detected over 95% of the gestures, while the confusion matrix indicates that the method can accurately differentiate between the three classes of gestures. There was a small misclassification error, which can be attributed to the programming to detect the gesture. When detecting the comfort alert, the patient must extend both arms towards the Kinect, and we found that if the patient extended one arm towards the Kinect quicker, the detection would detect the different alert. To remedy this, a modification of the programming to detect the comfort alert can be made, in which a checks and balances system ensures the correct gesture is being detected. The system can detect the different gestures and be used to aid nurses when processing the patient initiated alerts. The more information the nurse can have available the better they can organize and process the patient alert calls.

V. Future Research

Further research in the classification and detection of the gestures can be performed to improve the method. Although the current method can detect a gesture over 95% of the time and is very accurate, additional improvements can be made. Designing the nurse interface system to accompany the gesture detection system can assist nurses as they process the alerts. The system must also be tested in a clinical environment under real conditions to test its accuracy.

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From Sovereignty To Dependence: A Cherokee Tale



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Abstract

Border interactions between the United States and Mexico are a political and policy practice that has recently made international headlines. However, conflict, commerce, military and diplomatic alliances between both nations are something that has been part of the borderland since the inception of New Spain, present day Mexico. On May 5, 1862 the Mexican people and government were tested against their will and democratic values when the French, led by Emperor Napoleon III, launched a military attack on the City of Puebla. The Mexican forces, seen as the underdogs, undermined the odds and defeated the French Imperial military. The conflict gave birth to what we know now as the celebration of El Cinco de Mayo. The battle gave birth to a conflict that lasted most of the 1860's. The United States aided the liberal government, which was the recognized governing body, led by Benito Juarez. Juarez sent special agents to the United States to collect combat materials, men and financial support from the residents of the United States. The Mexican people suffered treason from their military, filibustering attempts from American and Mexican nationals, along with secret societies whose main target was to exploit the Mexican people during French rule.





Introduction: This Land was Your Land, This Land is My Land

“We, the great mass of the people think only of the love we have to our land for...we do love the land where we were brought up. We will never let our hold to this land go...to let it go it will be like throwing away...[our] mother that gave...[us] birth.”
Aitooweyah¹

The Cherokee Nation controlled approximately twenty-five million acres of land in what would become the South-Eastern United States when they first encountered the white explorers from the European continent. It was some of the richest and most fertile farming soil on the continent, and it included parts of modern day Virginia, Kentucky, Tennessee, Mississippi, Alabama, Georgia, and both of the Carolinas. With forced relocation west of the Mississippi River, the Cherokee’s land was reduced to just over four and a half million acres.

By their eviction in 1838, most of the Cherokee Nation felt the same as Aitooweyah. The land they were being forced to leave was their ancestral land, given to them by the Great Mother. Early archaeologists agreed with the Cherokee’s assertion: the Cherokee people had occupied their native land for thousands of years prior to contact with Europeans. However, modern archaeologists have determined that the evidence used to construct this theory of early arrival is more accurately attributed to the peoples of the Mississippian culture. They argue that the Cherokee actually moved into the southern Appalachia area in the 15th to 16th century².

After their forced relocation, the Cherokee people occupied 4,420,068 acres in northeast Indian Territory. This land was arid grassland, not well-suited for farming, which limited the Cherokees’ ability to support themselves. This new land led to numerous financial problems for the Cherokee over the next several decades. This pivotal period in the history of the Cherokee people can be considered a direct reflection of the change in status experienced by all native peoples in the early 19th century from being independent and sovereign to becoming wards of the United States government. This change of status led to the Cherokees being dependent upon the federal government’s good will and fair treatment. This good will turned out to be fickle, with the best interests of the Native Americans often being placed at much lower level of priority than the interests of the white settlers who coveted the Native Americans ancestral land.

1 Letter to Principal Chief, John Ross n.d.

2 Wetmore, Ruth Y. *First on the Land: The North Carolina Indians*. Winston-Salem: Blair, 1975.) Wetmore asserts that ancestors of the Cherokee Nation occupied the southeast Appalachian region beginning sometime between 8000 BCE and 1500 BCE. (Williams, Mark. *Nacoochee Revisited: The 2004 Project*. Archaeological Survey Report, Archaeological Department, University of Georgia, Box Springs: Lamar Institute, 2004, 29.) Williams, by contrast, while examining the Nacoochee Mound in Georgia, considered the location where the explorer De Soto first encountered the Cherokee in the 16th century, found no evidence that the Cherokee were in Georgia as late as the early 16th century.



Chapter 1: The Time of Uneasy Co-Existence

“...and I am safe in affirming that the proofs of genius given by the Indians of N. America, place them on a level with Whites in the same uncultivated state.....I believe the Indian then to be in body and mind equal to the white man.”

Thomas Jefferson³

The various tribes of Native Americans across the North American continent have always been greatly varied as to their cultural practices and organizational policies. To attempt to classify the many tribes into one expression, such as the noble savage, that explains the entire multitude of tribes would be futile. Upon first contact with European settlers, the Cherokee had already incorporated primitive agricultural practices and built towns⁴. They would certainly have seemed uncivilized compared to European standards which centered on Christianity and commercialism, but they were far from being a tribe of restless roamers surviving simply through hunting and gathering with little or no organizational patterns. In fact, the Cherokee had a thorough and well established tribal governing system, which would stay in place until the early nineteenth century when they would adopt a constitution and governmental structure, based upon the United States government, in order to demonstrate their advances in civilization.

The colonies won their independence from the British during the American Revolutionary War. During this war, the Cherokee fought on the side of the British, not so much because they favored the British, but because they feared the citizens of the colonies' unchecked advances into their ancestral lands. Upon the colonies' victory, the Cherokee were brought to the negotiation table for peace talks. The result of these negotiations was the Treaty of Hopewell signed on November 28, 1785⁵. This treaty outlined the boundary of Cherokee land, arranged for a prisoner exchange, gave the United States government the exclusive right to regulate trade with the Cherokee, and established peace between United States and the Cherokee Nation provided the Cherokees did not enter into treaties with any other sovereignty and that federal government placed the Cherokees under its protection. It was the first of many treaties between the Cherokee Nation and the United States government, and it established the precedent of the federal government negotiating with the Cherokees as one sovereign nation negotiating with another. This precedent lasted without serious challenge until the late 1820s.

In 1790, several families, in clear violation of the Treaty of Hopewell, settled inside of the established boundary of the Cherokees land. George Washington presented a letter to the Senate concerning how best to address this situation. President Washington clearly believed it was necessary to enforce the treaty or invite the Cherokees back to the

3 Letter to Chastellux Paris, June 7th , 1785

4 (Thornton, Russell. "Boundary Dissolution and Revitalization Movements: The Case of the Nineteenth-Century Cherokees." *Ethnohistory* (Duke UP) 40, no. 3 (1993): 362.)

5 (Kappler, Charles J, ed. "TREATY WITH THE CHEROKEE, 1785. Nov. 28, 1785. | 7 Stat., 18." OSU Library Electronic Publishing Center. Oklahoma State University Library. 1904. <http://digital.library.okstate.edu/kappler/> (accessed June 12, 2012.) This treaty marked the beginning of fifty years of treaties between the Cherokees and the federal government, which usually ended with the Cherokees ceding more of their land.

treaty negotiating table to ask them to sell the land that was settled by the white settlers⁶. Hence, the president believed the Cherokee were an independent nation. If this were not the case, settlers relocating from one area within the United States to another would not have been an issue worth addressing the Congress.

The other major treaty the Cherokee Nation used to establish their sovereignty over the land that belonged to them was the Treaty of Holston signed on July 2nd, 1791 and proclaimed on February 7th, 1792⁷. This treaty carried similar terms as the Treaty of Hopewell; however, it added stipulation that if any citizens of the United States or any other non-Indians settled on Cherokee lands said persons would sacrifice the protection of the United States and the Cherokees could punish said individuals or not at the Cherokees' discretion. Moreover, it guaranteed all of the land belonging to the Cherokees that was not ceded would be protected. In the interceding years between the Treaty of Holston and the Treaty of New Echota in 1835, the Cherokees and the United States completed many treaties that involved Cherokee land cessions, despite the United States continuously guaranteeing the sanctity of the Cherokees' land⁸.

A thorough examination of the wording of all these treaties paints a muddy and often double-sided portrait of the level of autonomy the Cherokee Nation actually possessed. Cherokees were permitted to determine punishments for criminals within their boundaries. However, even this authority was conditioned. If a United States citizen committed capital crimes such as murder or robbery the federal government retained the authority to execute those punishments. But, the real paradox in the treaties between the Cherokees and the United States was that all of the treaties between 1785 and 1835 required Cherokee land cessions, while well more than half of the treaties in the same period either guaranteed the Cherokees' remaining land was secure from intrusion or confirmed previous treaties that had made the land guarantees.

There was, however, one compact made during this early republic period that would lay the groundwork for many problems the Cherokee would later face, and establish the pivotal question of Cherokee autonomy and sovereignty. The compact of 1802 between the United States and the State of Georgia was a compact in which Georgia

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- 6 (Washington, George. "Letter from President George Washington to the United States Senate Concerning the Cherokee." Vol. Letterbook 25. Edited by Dorothy Twohig. Washington D.C.: Library of Congress, August 11, 1790.) Washington felt obliged to either use his authority to remove the settlers, or to compel the Senate to renegotiate the boundary between the United States and the Cherokee.
- 7 (Kappler, Charles J, ed. "TREATY WITH THE CHEROKEE, 1791. July 2, 1791. 7 Stat., 39. Proclamation, Feb. 7, 1792." Oklahoma State University Library Electronic Publishing Center. Oklahoma State University Library. 1904. <http://digital.library.okstate.edu/kappler/> (accessed June 12, 2012.) This treaty would become crucial in later disagreements between the Cherokees and the various governmental agencies that wished to possess the Cherokees' land.
- 8 (Kappler, Charles J, ed. "TREATY WITH THE CHEROKEE, 1835. Dec. 29, 1835. 7 Stat., 478. Proclamation, May 23, 1836." Oklahoma State University Electronic Publishing Center. Oklahoma State University Library. 1904. <http://digital.library.okstate.edu/kappler/> (accessed June 12, 2012.) This treaty, negotiated by John F. Schermerhorn and a group of Cherokees, including Major Ridge, John Ridge, Elias Boudinot, and Stand Watie among others, who were not authorized by the Cherokee Nation to negotiate treaties forever relinquished all Cherokee claims to the land east of the Mississippi River in exchange for an equal amount of land in the Indian Territory and roughly five and a half million dollars.

From Sovereignty to Dependence: A Cherokee Tale

ceded its western territory, which later became Alabama and Mississippi, for one million two hundred and fifty thousand dollars⁹. It also contained the stipulation that the federal government would extinguish all Indian land claims within the defined boundaries of the State of Georgia as soon as it could be reasonably and peacefully accomplished¹⁰. This agreement contradicted the treaties which the federal government had reached with the Cherokee Nation forever guaranteeing their lands. As such, this compact became the rallying cry for Georgians who desired the land claimed by the Cherokees within their designated borders. In the interpretation of representatives of Georgia, the power of the United States to legislate on behalf of the Cherokees established in the Treaty of Hopewell was transferred to the State of Georgia in the Compact of 1802¹¹. In truth, this was a misconstruction of the intent of Article 9 of the Treaty of Hopewell. John Forsyth, along with the majority of politicians who used this line of reasoning, neglected the terminology with which Article 9 was constructed: "For the benefit and comfort of the Indians, and for the prevention of injuries or oppressions on the part of the citizens or Indians."¹² Moreover, the end of the article held the governmental use of this managing power accountable to the approval of the Cherokees.¹³

The process of loss of independence for the Cherokees was not a quick and violent transition, but was rather a slow eroding of the powers of their internal government combined with apathy from the federal government towards their plight. It was, in fact, not apathy on the part of the government, but rather a deliberate and malicious program of forced acculturation which aimed at creating social reform among the Native American population and breeding dissension within the tribes between the conformers and the traditionalists.¹⁴ The Cherokee Nation was one of the tribes selected for the United States government's civilization programs. The Cherokees were quite responsive to it, with great numbers of members subscribing to Christianity and settling into more agricultural lifestyles. In fact, the civilization programs were so effective that by the 1820s the Cherokees had achieved

9 ("The Articles of Agreement and Cession," 24 April 1802, in *American State Papers*, Public Lands 2 vols. (Washington, 1834), vol. 1, 125-26.)

10 Ibid.

11 ("Speech of Mr. John Forsyth of Georgia in the Senate of the United States on the Bill for an Exchange of Lands with the Indians Residing in any of the States or Territories, and for Their Removal West of the Mississippi." *National Journal*, April 1830: 2-3.) It was part of the debates about the Indian Removal Act. In particular, Mr. Forsyth was rebutting the statements made by Mr. Frelinghuysen of New Jersey; (Treaty of Hopewell, 1785 1904) Article 9 gave the United States Congress the exclusive right to regulate trade with the Cherokee and to manage all their affairs; ("The Article of Agreement and Cession." 1834) In Article 2 the United States government ceded to the State of Georgia whatever claim, right, or title, they may have to the jurisdiction or soil of any lands lying within the United States, and out of the proper boundaries of any other State, and situated south of the southern boundaries of the States of Tennessee, North Carolina, and South Carolina, and east of the boundary line hereinabove described, as the eastern boundary of the territory ceded by Georgia to the United States.

12 (Treaty of Hopewell, 1785 1904)

13 Ibid.

14 Calloway, Colin G. *First Peoples: A Documentary Survey of American Indian History*. 4th. Boston, MA: Bedford, 2012). P 275.

a higher level of literacy and prosperity than the Georgians around them.¹⁵ This rise in the level of civilization pleased the federal government and led many northern states to believe the Cherokees were worthy of having a state of their own. It, however, infuriated those in the southern states around the Cherokee, who coveted their land and the wealth it produced, and who believed that the Cherokee were inferior to the whites. This created great resentment among those closest to the Cherokee, as the Cherokee gains led to a great rise in Cherokee nationalism in the early nineteenth century.¹⁶

However, this rise in civilization and prosperity was not without its consequences, even amongst the Cherokee. There were many who resented this so called civilizing, who wished only to retain their traditional practices on their own land without interference from the United States government. As the Cherokee went through their period of state-building in the early nineteenth century, there were revitalization movements which sought to return the Cherokees to a more traditional path. The most notable of these was White Path's Rebellion, 1824 to 1827. White Path called for a rejection of Christianity and a return to more traditional customs.¹⁷ The governments of the states within which the Cherokee lands were contained took advantage of these divisions within the Cherokee Nation, convincing the traditionalists among the Cherokee that the only way they would be able to maintain their traditional customs and culture was to relocate to lands west of the Mississippi River, where they would be autonomous and unmolested. These tactics were effective and resulted in two separate migrations of Cherokees into the Arkansas Territory west of the Mississippi River prior to the infamous Trail of Tears.

The first of these migrations occurred in 1810. Approximately one thousand disaffected Cherokees voluntarily migrated to the Arkansas River valley.¹⁸ For the politicians of the states and federal government who favored total removal of all eastern tribes this voluntary relocation reinforced the notion that the only satisfactory conclusion to the issue of the Southeastern tribes was relocation west of the Mississippi River. From this point forward there was no period prior to the Trail of Tears when there was not a group of United States politicians agitating for complete removal. The second major migration occurred from 1817-1819. It was organized and executed under the terms of the Treaty of 1817 between the Cherokees and the United States government.¹⁹ Terms included cessions of Cherokee land east of the Mississippi River in exchange for lands in the Arkansas territory. It also outlined a division of the annuities between the Cherokee Nation East and the Cherokee Nation West, along with supplying provisions for those among the Cherokee who chose to voluntarily relocate. For those who chose to remain on the eastern side of the Mississippi River, the United States government promised to provide fee-simple title of six hundred and forty acres to the heads of families who wish to become

15 McLoughlin, William G. "Thomas Jefferson and the Beginning of Cherokee Nationalism, 1806 to 1809." *The William and Mary Quarterly* (Omohundro Institute of Early American History and Culture) 32, no. 4 (Oct. 1975): p. 548.

16 *Ibid.*, p. 548-549

17 (Thornton 1993)

18 (Garrison, Tim Alan. *The Legal Ideology of Removal: The Southern Judiciary and the Sovereignty of Native American Nations*. Athens, GA: Georgia UP, 2009.)

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American citizens.²⁰

The federal and the state governments containing portions of the Cherokees' land actively advocated for both of these emigrations. Whereas, the policy of the federal government at the end of the eighteenth century was to encourage the tribes east of the Mississippi River to embrace civilization and acculturation, in the early nineteenth century the policy shifted to coercive appeals to the tribes to relocate outside of the established boundaries of the states in order to retain their autonomy and the ability to acculturate at their own pace. By the third decade of the nineteenth century, the patience of the chief executive of the United States along with the patience of the local states, especially Georgia, had run out. In the 1830s Cherokee sovereignty east of the Mississippi River was completely destroyed and the vast majority of the Cherokees left in the east were forced to relocate west into the newly formed Indian Territory.

Chapter 2: The Politically Conquered

“The legislation of Georgia proposes to annihilate [the Cherokee]. As its very end and aim . . . If those laws be fully executed, there will be no Cherokee boundary, no Cherokee nation, no Cherokee lands, no Cherokee treaties . . . They will all be swept out of existence together, leaving nothing but the monuments in our history of the enormous injustice that has been practised towards a friendly nation.”

William Wirt²¹

By 1827, the Cherokees had adopted a constitution based upon the United States, established an executive office, judiciary branch, and a bicameral legislation.²² When John Ross was elected Principal Chief in 1828, the Cherokee had already adopted a national policy asserting that no more of the Cherokee's ancestral land would be ceded to the United States. The politicians of the federal government along with local state governments, when faced with the Cherokees' resolute determination to maintain their claims to their land sought alternative methods to force the Cherokees to remove to lands west of the Mississippi River. The legislature of Georgia took the first direct action when they passed a series of laws from 1827-1830; which extended the jurisdiction of the State of Georgia over all of the Cherokee lands within Georgia's defined borders. These laws not only held Cherokees to the same standard of law applicable to all Georgians. They also created extra standards which applied specifically to the Cherokees such as declaring all Cherokee land title and laws null and void, making any further attempts by the Cherokee to pass legal statutes illegal and prevented Cherokees from taking any legal action against whites within the Georgian judicial system.²³ The Georgians took these actions because

20 Ibid.

21 Speech before the Supreme Court by the lawyer for the Cherokee Nation in Cherokee Nation v. Georgia, 1831.

22 (McLoughlin 1975) p. 548

23 (Conser, Jr., Waller H. “John Ross and the Cherokee Resistance Campaign, 1833-1838.” The Journal of Southern History (Southern Historical Association) 44, no. 2 (May 1978).)p. 194

they knew President Andrew Jackson would not be interfere with them, and were impatient with the federal government's lack of progress towards fulfilling the terms of the Compact of 1802.²⁴ Moreover, the Georgians claimed sovereignty over the Cherokee land by right of discovery, right of conquest, and right of compact. John Ross responded to these claims in the annual address to the Cherokee Nation on October 13, 1828. He refuted these claims by stating that the Cherokee had possessed the lands long before any Europeans had arrived, the Europeans had never conquered the Cherokees on the land the Georgians were claiming, and the Compact of 1802 demanded that the lands be acquired peacefully.²⁵

The Cherokee Nation attempted to peacefully resist this intrusion through appeals to the federal government. It was their belief that, since the United States government had solemnly and repeatedly affirmed their status as a nation and guaranteed them exclusive possession of and jurisdiction over their territory as prescribed in the numerous treaties between the federal government and the Cherokee Nation, the United States government would intervene and protect their political system and their territory.²⁶ However, the Cherokee quickly discovered that the chief executive, President Andrew Jackson, was sympathetic to the Georgians' cause and favored complete removal of all Native Americans who resided east of the Mississippi River. Jackson was a strong advocate of the Indian Removal Act. Jackson contended that it would be an abuse of the federal government's power to prevent states from exercising their constitutional right to govern those people who chose to reside within their recognized borders, and that the best alternative was for the Cherokees, along with the rest of the tribes in the Southern states, to emigrate west of the Mississippi River.²⁷ The Cherokees tried on several occasions to petition the President for relief from the intrusions upon their sovereignty, but were forced to eventually acknowledge the fact that they would receive no assistance from Jackson. Chief John Ross relayed these facts to the General Council of the Cherokee on November 14th, 1829, when he said, "ourselves to abide the issue of such new relations without any hope that he [Jackson] will interfere, because it is by this to be understood, that he considers our territory to be within the ordinary jurisdiction of individual states"²⁸

But, the greatest threat to Cherokee sovereignty in the 1830s was the Indian Removal Act. This act, passed in the United States Senate on the 24th of April, 1830 and in the United States House of Representatives on the 26th of May, 1830, outlined the powers of the president to remove all Native Americans west of the Mississippi River. The president was authorized to exchange eastern lands for western lands, provide funding and supplies to tribes relocating, and to guarantee the new lands in perpetuity.²⁹ It provided the federal government with the first legislative act capable of facilitating the fulfillment of the Compact of 1802 between Georgia and the United States.

24 (Compact of 1802 1834)

25 (Ross, John. "Annual Message." Cherokee Phoenix, October 22, 1828: 1-5.)

26 (Everett, A. H. Report of the Select Committees of the Senate upon the Late Resolutions of the General Assembly of the State of Georgia. Senate Committee Report, Boston: Dutton and Wentworth, 1831.)

27 ("State of the Union Addresses by Andrew Jackson." Penn State Electronic Classics Series. Penn State Library. 1829-1836. www.hn.psu.edu/faculty/jmanis/poldocs/.../SUaddressAJackson.pdf (accessed June 12, 2012).p.2

28 (Ross, John. "Message to the General Council-State of Affairs." John Ross Collection. Box 1. Folder 1. Compiled by Western History Collection. Niles Weekly Register, November 14, 1829.)

29 (Government, U.S. "The Indian Removal Act." Civics Online. 1830. http://www.civics-online.org/library/formatted/texts/indian_act.html (accessed June 12, 2012).)

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However, the passage of this act did not imply that there was no resistance to the Indian removal policy within the federal government. There was some support for allowing the members of the Cherokee Nation to retain their ancestral lands and their ability to govern themselves as outlined in the various treaties. During the debate on the Indian Removal Act several members of the Senate spoke in defense of the Cherokee Nation. The vocal leader of opposition to the Indian Removal Act and the intrusion on Cherokee sovereignty undertaken through Georgia's legislation in the Senate was Senator Theodore Frelinghuysen of New Jersey. His primary contention was that if the United States continued to follow the path it had embarked upon of coercing the tribes east of the Mississippi River off their lands; it would forever disgrace the nation in the eyes of the rest of the world and throughout the annals of history. He also enumerated the many instances when the federal government had negotiated with the various Indian tribes as equal sovereign nations, and questioned when, and by what decree or ordinance the Indian Nations had been stripped of the sovereign rights to control their land.³⁰ John Test and Issac Bates also spoke in defense of the Cherokee in the United States House of Representatives. They both reiterated that the treaties concluded between the United States and the Cherokee Nation not only solemnly guaranteed the Cherokees' land forever and their authority to exercise political control over their lands, but also guaranteed that the federal government would hold the Cherokees under their protection from intrusion from the whites around them.³¹ However, the Senator from Maine, Peleg Sprague, outlined the issues with the Indian Removal Act and the actions of the Georgia Legislature. He began his assessment by outlining the many obligations the United States had agreed to, along with enumerating the many concessions the Cherokee had made in exchange for the promises the federal government had made. Sprague then presented the wording of Georgia's recent legislation in order to demonstrate the level of their violent resolve. He then posed a question: if one of the states of the union asked another state for military assistance, would that state then be forced to surrender its sovereignty to the state that assisted it. Finally he emphasized the contradiction that if the Cherokee did not have sovereignty, why did Georgia need the federal government to pass a law giving the president power to persuade Native Americans to remove to the west. If the Cherokees did not have sovereignty, then Georgia would already have control of the Cherokee and their land. He concluded that the Cherokee were in fact sovereign, and that Georgia was seeking the passage of this law because it was the only way to work around Article 6 of the United States Constitution which stated that "treaties are the supreme law of the land, the constitution and state laws notwithstanding."³² Nevertheless, despite impassioned speeches by several members of the Senate and House of Representatives, the Indian Removal Act passed both houses with narrow majorities and President Andrew Jackson signed it into law in 1830.

With the failure of the president to honor the terms of their treaties and the legislature having passed legislation that allowed the president to pressure Southeastern

30 (Frelinghuysen, Theodore. "Speech in the Senate of the United States concerning the Indian Removal Act." Washington D.C.: Office of the National Journal, April 6, 1830.)

31 (Bates, Issac C. "Speech in the House of Representatives on the Indian Bill." Washington D.C.: Office of the National Journal, May 1830.) (Test, John. "Speech on the Bill from the Senate for the Removal of Indians West of the Mississippi River delivered in the House of Representatives." Washington D.C.: Way and Gideon, May 21, 1830.)

32 (Sprague, Peleg. "Speech in the Senate of the United States of America upon the subject on the Removal of the Indians." Washington D.C.: Office of the National Journal, April 16, 1830.)

Native Americans to relocate west of the Mississippi River, the Cherokee Nation was forced to turn to the third branch of the federal government to seek relief. In the 1830s, there were two landmark cases heard before the United States Supreme Court: Cherokee Nation v. the State of Georgia and Worcester v. the State of Georgia.

In the first case, Cherokee Nation v. The State of Georgia, the Cherokees sought an injunction to stop the State of Georgia from enforcing its recent legislation that extended Georgia's jurisdiction over the Cherokee Territory.³³ The Supreme Court heard the case, but declined to rule on the matter due to a lack of jurisdiction. Chief Justice John Marshall presented the opinion of the court. The main question before the court concerned the status of the Cherokee. The Cherokee asserted that they were an independent foreign state, sovereign in their own territory. Their claim was that the recent laws the State of Georgia had passed violated the terms agreed upon in the treaties between the two independent nations of the United States and the Cherokee Nation. The court's opinion agreed that the Cherokee Nation was in fact a nation, but decided that they did not in fact constitute a foreign nation. Their basis for this decision was the fact that the eighth section of the third article of the United States Constitution contradistinguished the Indian tribes from foreign nations.³⁴ As a result of the court's opinion that it had no jurisdiction to issue a ruling, the injunction was denied. This was a crushing blow for the Cherokee Nation and its claim of sovereignty. Not only did this case fail to stop the Georgian state government from executing its legislation, but it established the precedent that the Cherokee Nation was not eligible to be a plaintiff in front of the Supreme Court.

The Cherokee Nation was not involved in the second landmark case of the 1830s that impacted its status. Worcester v. the State of Georgia was an appeal to the United States Supreme Court to nullify the Georgian law under which Samuel Worcester, a missionary to the Cherokee people, was convicted and sentenced to four years of hard labor in a Georgian penitentiary.³⁵ The law Worcester violated was being a white person residing in the Cherokee territory without a license from the State of Georgia and without having sworn an oath to uphold and defend the constitution and laws of the State of Georgia. It was the plaintiff's contention that the law was "repugnant to the constitution, laws, and treaties of the United States."³⁶ Chief Justice John Marshall rendered the opinion of the court. The first issue addressed was whether or not the Supreme Court had jurisdiction to hear the case. The court cited the fact that it was a case between a private citizen of the United States and a state of the Union, and was therefore under the court's jurisdiction. The court then addressed the right of discovery, which the defendant claimed gave it the right to exercise sovereignty over the Cherokee territory. It was the opinion of the court that the right of discovery, as the European powers that first settled the North American continent had outlined it, simply inferred the sole authority to purchase lands from the native inhabitants, should they choose to sell.³⁷ This right of discovery does not in anyway compromise the native inhabitants' ability to govern themselves. Moreover, the court found that the State of Georgia had willfully surrendered this right to the United States when it voluntarily approved the constitution of the United States, which gave the

33 (The Cherokee Nation v. The State of Georgia. 30 US 1 (The Supreme Court, March 18, 1831.)

34 Ibid

35 (Samuel A. Worcester, Plaintiff in Error v. The State of Georgia. 31 US 515 (The Supreme Court, March 3, 1832.)

36 Ibid.

37 Ibid.



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federal government sole rights to make war and peace with the Native Americans unless a state was invaded, and gave the union exclusive rights to engage in civil intercourse with the tribes of the native inhabitants. Hence, the laws the Georgia legislature had passed were in violation of the laws and treaties of the United States, and as such were void and the judgement was a nullity.³⁸ For the Cherokees this appeared to be a complete victory as the court had, in essence, ruled that the State of Georgia was incapable of passing legislation effective within the Cherokee territory, as outlined in treaties between the Cherokees and the United States government. Within months of the ruling, Worcester was released from prison, but chose to never return to the Cherokee Territory. However, despite the Supreme Court's ruling, President Jackson refused to intercede with the State of Georgia on behalf of the Cherokee Nation.³⁹ With this tacit support of the national executive, Georgia continued to enforce its laws over the lands of the Cherokee.

With all three branches of the federal government having failed to protect the Cherokees' sovereignty and land from intrusion from the states that bordered their territory, a modest portion of the Cherokee Nation became disillusioned at the Cherokees' complete loss of independence and began to advocate for acceptance of the president's proposal for relocation west of the Mississippi River. This small group, which later became known as the Treaty Party, entered into negotiations, under false pretenses and without the authority of the leaders of the Cherokee Nation, with the federal government to organize removal of the Cherokee Nation in its entirety west of the Mississippi River. On December 29th, 1835 this group signed the Treaty of New Echota,⁴⁰ effectively sealing the fate of the Cherokee Nation east of the Mississippi River.

38 Ibid.

39 President Jackson is often quoted as having said, "John Marshall has made his decision, now let him enforce it". There has been no evidence generated to validate this quote and typically attributed to being derived from a private letter from Jackson to John Coffee, wherein Jackson ruminates about the Supreme Court's impotence to enforce its rulings

40 (Treaty of New Echota, 1835 1904)



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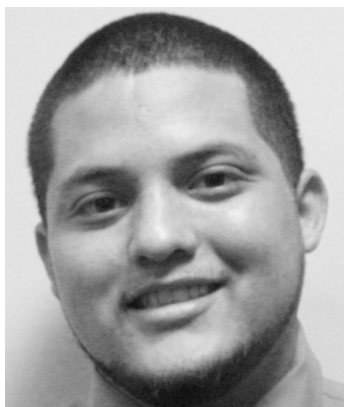
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A Bloody Price for Stability: Examining the Relationship between Political Change and Violent Crime Levels



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Abstract

The world of criminal organizations has always been characterized by violence, yet the level of violence varies in intensity over time. Nowhere is this more evident than when observing the violence perpetrated by drug cartels in Mexico, where the frequency and severity of crimes only appears to be getting worse. Numerous explanations have been proposed to explain the increase of violence in Mexico, and two pertain specifically to political factors. In particular, some attribute the increase in violent crime to change in leadership in Mexico and a more aggressive policy toward drug cartels, disrupting preexisting arrangements between government and drug cartels. Before examining the specific case of Mexico, we attempt to assess the validity of this claim at a cross-country level by conducting a cross-country analysis using linear regression, comparing homicide rates and changes in party in the office of the presidency. This is then followed by a cross-province analysis within the country of Mexico comparing drug-related killings and change in party in the office of governor. Preliminary analysis provides no support for the



argument that a change in political leadership alone is substantial to alter violent crime rates, at either national or provincial levels. In order to assess the effects of change in policy, we conduct a cross-country analysis of homicide rates and the number of police personnel. Again, findings do not support a relationship between more aggressive policing and violent crime levels. In addition to this quantitative analysis, we qualitatively examine the Mexican case more closely. The results suggest that Mexico is a special case in which more coercive measures toward criminal organizations lead to an increase in violent crime, and that other factors play a more important role in the proclivity of violence, particularly cartel rivalry and retaliation towards coercive measures.

INTRODUCTION

Mexico, a destination once recognized for its beautiful beaches, warm culture, and exotic cuisine, is now plagued with a high level of violent crime mostly perpetrated by organized drug cartels. The number of deaths have not only exceeded an astonishing 30,000 since President Felipe Calderon took office in 2006 (CNN), but the extent of the violence has also resulted in lost economic productivity and the emigration of thousands of middle-class families. Domestic political factors have been noted by others to be strong determinants of the influence of criminal organizations, and correspondingly, fluctuations in violent crime perpetrated by these organizations. Yet, Mexico is one of many countries experiencing fluctuations in violent crime at the hands of criminal organizations. This leads one to question how more coercive measures affect the level of violent crime rate perpetrated by criminal organizations? A greater understanding of the political conditions affecting fluctuations in violent crime would be applicable not only to Mexico, but to other countries, as well.


In attempting to explain fluctuations in the level of violent crime perpetrated by criminal organizations, scholars, political analysts, and policymakers have highlighted both political and socio-economic factors. Pertaining to Mexico specifically, most explanations point to changes in border security, a lack of enforcement mechanism, a weak democracy, and corruption linking Mexican politicians to drug cartels. Yet, as previously mentioned, Mexico is not the only country having experienced fluctuations in the level of violent crime perpetrated by criminal organizations.

In order to answer the question: How does political change affect the level of violent crime rate perpetrated by criminal organization, we first begin with a review of the previous literature explaining the factors that contribute to violence. This is followed by a theoretical explanation for the repercussions that more coercive measures have on the levels of violent crime. The argument is that more coercive measures increase the levels of violent crime perpetrated organization in reaction to the more aggressive policies. In order to test this hypothesis a cross-country analysis of homicide rates and the number of police personnel is conducted. As the analysis reveals, the findings do not support a relationship between more aggressive policing and violent crime levels.

LITERATURE REVIEW

In the international community there are many factors that contribute to an increase in violent crime in a country. When a country is suffering from huge influxes of violent crime, states use more aggressive measures and policy to tackle the increase of violent crime perpetrated by criminal organizations. A tough stance to prevent, enforce public security, and eliminate the criminal organizations, doesn't always lead to a change





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of events and eventually a decrease in the amount of violent crime. In some cases the more aggressive policy to address the violent crime and instability in the area actually produce and generate more violent crime. The primary focus of this study is to contribute a more comprehensive answer to the question: How does political change affect the level of violent crime perpetrated by criminal organization? Many scholars have contributed to our understanding of factors that contribute to an increase in violent crime. Increases of violent crime can be categorized and explain by factors such as weak democracies and corruption in the state between criminal organizations and government officials. As a result of a weak democracy and corruption in a state a lack of law enforcement mechanisms persist in the state.

Weak Democracies

A democracy is seen as an institution with the ability to protect and serve its citizens. If a state does not have the ability to provide civil services through the judicial, executive, and legislative branch it is seen as weak democracy. “Democratic institutions in much of Latin America remain plagued by rampant corruption, political polarization, and growing public skepticism about government and politics”(Hakim and Lowenthal, p16). The citizens of a state with fragile institutions lack the incentive to participate in government institutions because they believe that these institutions are incompetent. “Legislatures and judicial systems in much of Latin America still lack the autonomy, stature, resources, and competence needed to carry out all of their constitutional functions fully”(Hakim and Lowenthal, p.22). Police officers, judges, public defenders, and prosecutors are often under trained and under paid. Criminal’s who have been incarcerated tend to bribe government officials, and thus leaving a crime unpunished. As a result most criminals will continue to commit crimes because there is nothing from preventing them from doing so. “ In Latin America these institutions are in place, but the inability to conduct its operations legitimately have resulted in an increase in crime and violence” (Shelley, p.101). This leads to an increase in criminal activity and violent crime because the state does not have the ability to enforce the law. “ To uphold standards of justice, state authorities were supposed to identify, detain, and punish the murderers” (Smith, p.267). In a weak democracy, justice is seen as an unattainable right because the state is not able to incarcerate criminals.

Most criminal organizations use violence to accomplish their goals, and since most enforcement officials are corrupted. If a bystander observes a violent crime occurring and report the crime to a corrupt official, that citizen is in danger of being a target of the criminal organization as well. “In Latin America as well as other areas of the developing world... grim headlines reveal, writers and reporters have been subjected to all manner of harassment and intimidation: they have been fired, kidnapped, tortured, and assassinated”(Smith, p.266). In a democracy, one of the vital freedoms that an individual has is the freedom of the press. As one of the crucial sources of information, the media’s ability to report criminal activities has been obstructed by violence. Many reporters have been beaten brutally and even killed for exercising their right of freedom of the press. Decapitations, people being hanged, and other inhumane methods of torture that leads to a painful death are the methods being used by criminal organizations.

Corruption

As a result of a weak democracy, corruption between criminal organizations and government and law enforcement officials is plausible. Hakim and Lowenthal point out




that in Latin America, “Judges, for the most part, are poorly trained and paid, and they lack the funding to conduct investigations and administer justice effectively”(p.22). Criminal organizations use the lack of training that law enforcement officials to their advantage. Since criminal organizations are usually rich in resources they use their power to bribe officials to loose evidence against them. In some circumstances criminal organizations persist because of some degree of political corruption, where agreements are made between politicians, law enforcement officials, and leaders of criminal organizations. “Many states may be in constant negotiations with criminal groups to preserve an appearance of order”(Bailey and Taylor, p.4). If criminal organizations are responsible for disorder and turmoil in a state, the government has a responsibility to its citizens to stop and detain the criminal organizations. Yet, “If the state is truly unable to provide certain public goods associated with public security, organized crime may exercise informal controls over the criminal world that are a useful mechanism for ameliorating public perceptions of state weakness”(Bailey and Taylor, p.8). In many cases when the state cannot protect its citizens, criminal organizations take an initiative to protect their assets. If they are extorting a community, and another criminal organizations tries to take over their extortion ring then they will protect those individuals. This adds to the level of violent crime because the two criminal groups will kill each other for their economic gains. If the state loses credibility then the criminal organizations are the only victors because the average citizen will turn a blind eye instead of reporting a crime to avoid any confrontation with the criminal organizations. “By corrupting and sometimes penetrating the state, these crime groups create a collusive relationship, expending significant amounts of human and financial capital to influence the state”(Shelley, p. 104). Criminal Organizations use their influence and economical power to help put government officials, that are will to corroborate with them in power. Agreements between incumbent politicians and criminal organizations may be disrupted as new governments attempt to “crack down” on crime and existing criminal organizations attempt to maintain their influence, potentially leading to a surge in violent activity on the part of criminal gang members.

Challenge of Criminal Organizations in a State

As a result of a weak democracy and an easily corrupted government in a state, criminal organizations thrive because of the lack of law enforcement mechanisms that are a result of these factors. Bailey and Taylor argue, “that a state’s primary objective with respect to public security is often not to maintain public order, but rather to maintain the public impression of the proper provision of public order”(p.9). The challenge of criminal organizations in a state is that they make the state appear weak, inefficient, and the inability to provide the necessary civil services to its citizens is exposed. “A criminal organization that is able to achieve its goals without disturbing the public order may be valuable to the state, especially in contrast to more fragmented criminal enterprises that compete for dominance and thus may generate politically inconvenient levels of violence”(Bailey and Taylor, p.9). A state that is not able to prevent criminal organizations from persisting and continuing there illegal activities would rather cooperate with the criminal organizations to seen as a strong government. If the latter is done where the criminal organization and the state are trying to be the prevailing party to prove to the community that they have dominant control over an area. It is more likely that that there will be bloodshed and as a result multiple lives will be taken. When a state has the inability to incarcerate individuals, criminal organizations use this to their advantage and “may exercise informal controls over the criminal world that are a useful mechanism for ameliorating public perceptions of





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state weakness” (Bailey and Taylor, p.9). Criminal organizations provide public security in the areas that they have control over, in order to protect their assets and to protect their market from other criminal organizations and competitors. Those who live in the area, where criminal organizations are protecting their assets are under the protection umbrella as result. Thus other criminal organizations that might try to extort them will have a difficult time because they are being protected. Bailey and Taylor state that, “that it is impossible to eliminate some criminal activity entirely, and efforts to eliminate it may in fact be too costly in terms of spent resources, constrained liberties, or lost lives, so best to simply disrupt such activities and make it more difficult for them to function normally”(p.10). If a states sole mission is to eliminate and diminish the illegal activities and the criminal organizations it will be a tough, overprice, and daunting procedure. A state is better off altering and interrupting the illegal activities of a criminal organization, and slowly weakening the criminal.

State Approaches toward Criminal Organizations

Bailey and Taylor argue that a state can approach the challenge of criminal organizations in three different ways. The state can choose to coexist, disrupt, or eliminate the criminal organizations. “Governments and criminal organizations employ evasion and corruption to co-exist in equilibrium relationships in which each continually adjusts to the other’s perceived evolution”(Bailey and Taylor, p.8). Co existence amongst Criminal organizations and local law enforcement officials can be seen when police officers are bribed to look the other way when a crime is occurring. When local law enforcement officials are bribed, it allows criminal organizations to stay under the radar and evade any future consequences for their illegal activities. In most cases governments choose to disrupt the operations of criminal organizations because, “ efforts to eliminate it may in fact be too costly in terms of spent resources, constrained liberties, or lost lives” (Bailey and Taylor, p.10). Elimination of criminal organization is seen as a drastic option because it is perceive to be bloody and violent tactic. Instead states choose to disrupt the daily operations of criminal organizations in hopes that the daily illegal activities will be interrupted and therefore the criminal organizations will lose money and change or stop the illegal activity.

Criminal organizations also use confrontation to their advantage because they have the inability, power, and resources to do so. Criminal organizations target law enforcement officials such as police, prosecutors, or judges because they are easily corrupted because they are often underpaid and undertrain. “Confrontation offers useful leverage, allowing criminal actors to point to state cooptation or corruption by crime, intimidate the most malleable members of the state apparatus, and even remove or eliminate specific state officials” (Bailey and Taylor, p.12). Since criminal organizations are rich in resources they can bribe, threaten, and frighten law enforcement officials, citizens of a state, and anyone whom they choose to accomplish their goal. Yet, “the potential costs are extremely high, and may include (1) external costs such as greater public awareness of the organized criminal groups’ existence and activities, higher levels of government repression, and public repudiation; and (2) internal costs, such as members’ defection, declining business, and risks to members’ personal security” (Bailey and Taylor, p.11). Complete elimination of criminal organizations is costly to the state in many ways because it allows the state to truly show its colors. If the state was weak and unable to provide services it will be exposed to the community. Criminal organizations will not go without a fight, and they will use their resources to defend their stance and presence in the area. Criminal organizations will use violent tactics to scare off the community, law enforcement officials, and eventually make



the state back off and defect because the price of complete elimination would be high. The community as a whole would be intimidated with the bloody and gruesome tactics used by criminal organizations. This method is seen as a more coercive measure because the state has a tough on crime stance against criminal organizations.

That would then lead into your argument, which would focus on the unintended consequences of coercive approaches to criminal organizations

Theory


The literature review discussed the research of previous scholars pertaining to the factors that contributed to an increase of violence in a country. Most scholars have identified that the increase of violent crime is due to factors that relate to corruption and a weak democracy in a state. These two factors contribute to a lack of law enforcement mechanisms that lead criminal organizations to be left unpunished for the crimes they committed. Bailey and Taylor argue that criminal organizations challenge the validity and make states appear weak when they cannot prevent, incarcerate, or punish criminal organizations. Therefore states should approach and tackle criminal organizations in a strategic manner, if they do not want to be exposed as a weak government who has little control over criminal organizations. Radical measures such as a tough stance towards criminal organizations can lead to unintended consequences. When state leaders implement more coercive measures towards criminal organizations, the criminal organizations are more likely to retaliate and increase the level of violent crime in a country.

The government of a state adjusts to the conditions that their state is facing. When a state is suffering increases and surges of violence and cannot control or prevent these criminal events from occurring. The states natural reaction is to change the direction of how it is tackling the crimes and the criminal organizations that participate in the crime. More coercive measures such as expansions of the police force or deployment of the military to zones with relatively high rates of violent crime perpetrated by criminal organizations are implemented to combat the increase of violent crime. States use more coercive measures when a situation is getting out of control. States use these drastic methods because they believe that tougher policies will lead to the incarceration and prevention of violent crime and ultimately will deteriorate the criminal organizations. What follows is an explanation of why more coercive measures lead to an increase of violence perpetrated by criminal organizations.

These coercive measures affect the criminal organizations economically, socially, and politically. When an increase amount of police officers and with presence of the military there are new players who have not been corrupted. The use of new police officers and military personnel who sole mission is to prevent the criminal organizations from committing violent crime disrupts the operations of the criminal organizations. These control mechanism prevent the criminal organizations from extorting people, using their influence to get what they want, and with a new enforcement mechanism it is harder for previous agreements with corrupt politicians and other government officials to occur unnoticed. This disruption ultimately leads to a loss of economic gains that the criminal organizations live for.

Once their illegal activities are disrupted with the use of coercive measures, the criminal organizations are willing to do whatever it takes to regain their power. The criminal organizations retaliate by committing multiple acts of aggression towards the community, other criminal organizations, and ultimately the state and the government officials who implemented the coercive measure or who are enforcing the coercive measures. This is





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depicted in the following hypothesis:

H1: The more coercive measures toward criminal organizations, the higher level of violent crime perpetrated by criminal organizations in a state in reaction to more aggressive policies.

H2: Where there is political change, there is an increase of violent crime perpetrated by criminal organizations.

If theoretical arguments are correct it is expected to see changes in the level of violent crime following the implementation of coercive measures towards criminal organizations and political change in the national and provincial level . Otherwise, we would conclude that more coercive measures have no statistical and substantive effect on violent crime.

RESEARCH DESIGN

In order to assess how political change affects change in violent crime rates, we assess the effects of (a) change in political leadership and (b) policy change. One does not necessarily imply the other, and thus we are examining them separately. We utilize both quantitative and qualitative methods, detailed below.

QUANTITATIVE ANALYSIS - CHANGE IN POLITICAL LEADERSHIP

Some scholars have pointed to the change in presidential leadership in Mexico as an explanation for the increased violence, arguing that relations between the previous administration and drug trafficking organizations were disrupted. If this hypothesis is correct, we should also observe this relationship in countries other than Mexico. In order to assess the relationship between changes in political leadership and the incidence of violent crime generally, we conduct a preliminary, quantitative analysis (i.e., without including controls) using a sample of all Latin American countries with democratic, presidential forms of government for the years 1995-2010. The unit of analysis is country-year, providing 228 observations.

National Level

Dependent Variable: Homicide rates, provided by United Nations Office on Drugs and Crime (UNODC) and can be found at <http://www.unodc.org/unodc/en/data-and-analysis/statistics/data.html>). Although these data do not discern whether the act of violence was perpetrated by a drug-trafficking organization, it serves as a proxy for overall crime rates.

The primary independent variable is political change, a dummy variable assessing whether there was a party change in presidential leadership in the year prior to the executive level. This variable will have a value of “1” if there was a change, and “0” otherwise.

Method: We will first examine descriptive statistics comparing the mean homicide rate for country-years that experienced a change in leadership in the year prior to those that did not experience a leadership change in the year prior in order to identify any discernible difference. This will be followed by regression analysis that will determine the statistical and substantial significance of any relationship between political leadership

change and homicide rate.

Provincial Level

In addition to the national level, we also assess the relationship between change in political leadership and change in violent crime at the provincial level within Mexico. The sample includes all Mexican provinces for the years 2000-2010. The unit of analysis is province-year and generates 320 observations.

Dependent Variable: The number of drug-related killings were retrieved from www.justiceinmexico.org, (a research site maintained by the Trans-Border Institute at the University of San Diego) for the years 2000-2010 for all Mexican states.

Independent variable: A variable indicating government change at the provincial level received a value of "1" if there was a change in party for the governor's office in the year prior, and a "0" otherwise.

Method: We will first conduct descriptive statistics and compare the mean change in drug-killings between those observations experiencing government change in the year prior ("1") and those not ("0"). This will be followed by regression analysis to determine the statistical and substantial significance between government change and the number of drug-related killings.

QUANTITATIVE ANALYSIS - CHANGE IN POLICY

Some scholars point to the effectiveness (or lack thereof) of more aggressive methods for reducing violent crime. These include expansions of the police force or deployment of the military to zones with relatively high rates of violent crime perpetrated by criminal organizations. In order to account for the effects of a change in policy, particularly a shift toward a more aggressive policy, we conduct cross-country analysis using a sample of Latin American countries with presidential democracies for the years 2004-2010. The unit of analysis is country-year and generates only 38 observations due to missing data for various country-years. We only examine this relationship at the national level, as we have not identified a reliable source of data indicating the number of police personnel at the provincial level.

Dependent Variable: As with analysis pertaining to change in political leadership at the national level, we again use the homicide rate, provided by the UNODC.

The primary independent variable is the number of police personnel per 100,000 for the year prior. These data are provided by the UNODC (<http://www.unodc.org/unodc/en/data-and-analysis/statistics/data.html> "Total Police Personnel at the National Level").

Method: We first conduct descriptive statistics identifying the mean rate of policy personnel per 100,000 (lagged by one year) for a given country-year. We then compare the mean homicide rates for those with a police personnel rate above the mean to those below the mean to identify any discernible difference. This is followed by regression analysis to determine if there is any statistical and substantive relationship.

QUANTITATIVE ANALYSIS

Before examining the case of Mexico specifically, we begin with some preliminary analysis to assess the plausibility of the claim that there is a general relationship between change in political leadership and violent crime, followed by change in policy and violent crime. The former is examined across countries, and then across provinces within Mexico. The latter is examined only at the country level.

Given that this is a plausibility probe of the relationship between these variables,

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we begin without incorporating controls. As will be observed, preliminary results indicate no relationship. The results of the quantitative analysis are detailed throughout the rest of this section.

Descriptive Statistics

Table 1 below depicts descriptive statistics for the change in political leadership at the national level. In the cross-country presidential analysis for the national level, the descriptive statistics show that mean homicide rates are higher for country-years experiencing no change in the year prior than those in which there was a change. This does not support the hypothesis expecting higher levels of violent crime following a change in party of the president's office.

Table 1. Descriptive Statistics

Mode	Mean	SD	Median	Range	
Homicide Rate (Country-Year), 228 observations	21.22	19.54	13.35	2.5-117.3	(114.8)
Change in Party of President's Office in Year Prior (1=change, 0 no change)	0 (193 obs)	N/A	N/A	N/A	N/A
Homicide Rate (No Change In Presidents Party)	21.62	20.23	13.8	2.5-117.3	(114.8)
Homicide Rate (Showing Change in Presidents Party)	19.04	15.23	12.7	2.7-66	(63.3)

Inferential Statistics- Regression

Linear regression is used to test the hypothesis that political change affects the level of violent crime perpetrated by criminal organizations in a country as illustrated in Table 2 below. In the national level a p value of .474 indicates that change in party of the president for the year prior is not a statistically significant determinant of homicide rates. There is no support for the hypothesis that a change in presidential leadership leads to a change in homicide rates. Thus, the null hypothesis expecting no relationship between



these two variables must be accepted. The r-squared value also indicates that a number of other factors excluded from the model are more significant determinants of homicide rates, since the model only explained .002 percent of the variance.

Table 2. Linear Regression of Presidential Change on Homicide Rates

The cross- province analysis of drug-related killings in Mexican states shows that there are only 12 observations of change in party of the governor’s office. The descriptive statistics, as shown below in Table 3, indicate that there is a higher mean number of drug-related killings when there is no change in party of the governor’s office than when there is change. This does not support the expectation that crime will be higher when there is a change in party in the governor’s office. In order to determine if one particular party was associated with a higher number of drug-related killings, the relationship between these two variables was also examined. Descriptive statistics reveal that a governor’s office with PRI in power is associated with the highest mean number of drug-related killings. This does not support the argument that having PRI in power lowers drug-related crime at the provincial level, although there are also more province-years where the governor’s office is controlled by the PRI than by any other party.

Table 3. Descriptive Statistics

In the cross-province analysis a linear regression of drug- related killings illustrated in Table 4 below is used to further test the hypothesis that political change affects the level of violent crime perpetrated by criminal organizations. Given a p-value of .451 shows that change in party of the governor’s office is not a significant determinant of the number of drug-related killings. The r-squared value also indicates that model is incomplete, since it only explained .002 percent of the variance in drug-related killings.

Table 4. Linear Regression of Drug-Related Killings

The relationship between party (not change in party) and drug-related killings was also examined to see if one party could be associated with higher numbers of drug related killings than others at the provincial level. Table 5 below depicts the relationship between party and drug related killings. The p-value of .136 indicates that party is not statically significant determinant of drug-related killings. Despite that, the descriptive statistics appear to show that the PRI was associated with more drug-related killings. Given the lack of statistical significance, however, the null hypothesis is accepted that there is no relationship between party and drug-related killings. The r-squared value also indicates that model is incomplete, since it only explained .007 percent of the variance in drug-related killings.

Table 5. Linear Regression of Drug- Related Killings to Party (Not Party Change)

Descriptive statistics for policy change, which is measured quantitatively as the number of police forces per 100,000 in the year prior, is compared to homicide rates. There were many missing data pertaining to police forces by country, leaving only 37



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observations, and thus the results should be interpreted with caution.

Table 6. Descriptive Statistics

The results of a linear regression presented in Table 7 indicate a p-value of .894, showing that change in number of police is not a statistically significant determinant of homicide rates. Thus, the null hypothesis expecting no relationship between the number of police forces and homicide rate is accepted. The r-squared value also indicates the model was unsuccessful at showing a relationship between number of police forces and homicide rates, since it explains .000 percent of variance in homicide rates.

Table 7. Linear Regression of Homicide Rate to Number of Police

THE CASE OF MEXICO

Despite the fact that there is no statistical significant relationship between more coercive measures against cartels and an increase in the level of violence, Mexico serves as a special case that shows the relationship between more coercive measures and the level of violence in a country perpetrated by criminal organizations. More coercive measures such as the expansion of the police force and an increase presence of the military to combat criminal organizations have led to an increase in violence.

Unlike the passive stance that previous administrations, the Partido Revolucionario Institucional (PRI), had towards criminal organizations, the Partido Acción Nacional's (PAN) implementation of coercive policies are a new dynamic that where enacted by PAN presidents, Vicente Fox and Felipe Calderon. During Vicente Fox's candidacy, there was a slight increase in violence when he ordered a small number of Mexican troops to the border area of Nuevo Laredo. Once Felipe Calderon was in power, he declared an all out war against the drug trade and the cartels. This ultimately sparked up and increased the violence in Mexico to what it is today. Felipe Calderon's intentions of the war on drugs were not to leave innocent civilians in constant danger and in fear, but to weaken and ultimately dismantle the cartels.

The War on Drugs has done the opposite, instead of crippling the cartels; it has generated motives to increase the power of a cartel. If a Cartel leader is killed or arrested the Cartels are organized and replace the leader with the next person in the chain of command. The Cartels have used their influence to bribe municipal districts, local mayors, police officers, and other organizations that enforce the law. When a crime occurs the victims have nowhere to report the crime, since the police cannot be trusted. In some cases local jurisdiction have been abolished completely, so the only form of law enforcement is the Mexican military. Yet, they do not have the power to enforce the law, or arrest anyone. When civilians try to report a crime they have nowhere to go. If they go to the military bases to file a report, there are no arrests or investigations because the military is not an enforcement agency. In many cases most victims stay quite because the cartels will react in brutal and gruesome ways. The military is being used as a means to stop the cartels and weaken them, but they do not have the authority to arrest or prosecute any of these individuals. Since the military is limited to its task, the Cartels bribe the agencies that can prosecute them and stop their operations.

More coercive measures have led to areas that no longer have a dominant presence of a single cartel. This leads to instability in the area as well as a pathway for other



cartels and criminal organizations to control a new territory. Rivalry amongst the cartels is therefore inevitable. “The arrest of Joaquín Guzmán-Loera (El Chapo) triggered attacks by the Gulf Cartels and their paramilitary to take over Sinaloa supply routes” (Carpenter, p409). Violence increased since the head lieutenant of the Sinaloa cartel was arrested. Not only did the Sinaloa cartel increase violence towards innocent civilians and law enforcement officials, but were also victims of a new emerging rival. “The resulting violence broke apart two Sinaloa Cartels that had been allied for decades” (Carpenter, p.409). Avarice drove two cartels, the Gulf cartel and the Sinaloa cartel, to turn on each other. The Gulf cartel saw a weakness in one of the largest cartels, the Sinaloa cartel, and decided to act on it. The Gulf cartel was willing to escalate violence to gain more influence and territory in the illegal drug trade, since they believe that without the leader of the Sinaloa cartel they would lose power. “Having beheaded the Gulf cartel by jailing its leader, Osiel Cardenas, the Mexican federal authorities refused to endorse a successor or allow another cartel to take over the Gulf Cartel operations peacefully” (Payan, p.869). By eliminating a key player in the Gulf cartel, the Mexican government left the area of Nuevo Laredo, Mexico in a power struggle. Since the balance of power was disturbed, other Cartels where in war against each other for this area of land. In this case, the Cartels increased violence in Nuevo Laredo, but the Mexican Government was ultimately responsible for the rise in violence. The president of Mexico, Felipe Calderon, launched the War on Drugs that served as a tipping point to an increase of violence in Mexico. “A decades-long war, which has claimed some 20,000 lives so far,” has serve as a form of retaliation from the Cartels toward the government (Kellner and Pipitone, p.30). Scholars have argued that before the War on Drugs, was launched violence was limited in comparison to today’s 20,000 plus deaths.

Increases in border security, as well as an increase in military personal in key areas of Mexico have prevented the Cartels from achieving the production and transportation of illegal drugs. The Cartels answered back to Felipe Calderon and to the citizens of Mexico by enacting acts of violence not only to rival cartels, but also on innocent civilians. As Peter Wallenstein (2002, p. 34) points out, “A classic understanding of conflict sees it as a dynamic phenomenon: one actor is reacting to what another actor is doing, which leads to further action.”. The increase in violence can also be accounted to the fact that the Cartels no longer have one sound enemy. They have multiple organizations against them, the rivalries amongst cartels and the Mexican government. “Inter cartel rivalries were responsible for a large number of drug smuggling-related deaths” (Payan, p.877). Cartels are adding huge numbers of deaths because of the direct competition. The Cartels are fighting for the same product, distribution zones, production, and transportation areas that are inter-connected with high-end revenues.

When more coercive measures implemented by the PAN, it was the opening that Cartels needed to maximize power and territories. An increase in rivalries led to the deaths of multiple cartel members. Cartels maximize their areas of control for economic gains. By doing so, they create war’s amongst themselves and are increasing violence in areas which were not affected by violence in the past. An increase amount of violence is also seen when key cartel members are killed or imprison by rival Cartels or by the Mexican government. This creates a power struggle since the leaders are not there to enforce their rules and to protect their territories. The Mexican drug Cartels are organizations that have a common goal, and are willing to do anything to achieve economic growth in the lucrative business that they are in. “Drug Cartels are organizations, structured as enterprises, whose intent is to control the market in which they operate” (Carpenter, p.404). In order to increase their economic statuses Cartels have to maximize their influences in different territories. The





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more territories a cartel controls the greater the ability to generate profit. “As earnings shot up, so did violence. Starting in the mid-1990s, drug gangs in Mexico grew more independent and began fighting for more control and larger territories” (Kellner and Pipitone, p.30).

The cartel members are driven by greed, and use aggressive, brutal, and cruel methods to satisfy their hunger for power and economic wealth. In order for the cartel’s to gain the necessary territories and areas, they “contract killers (sicarios) to defend their territories or to compete for new territory” (Carpenter, p.408). The sicarios are specialized individuals who are train and are paid to kill. Their job is to kill people, whether they are innocent civilians or a rival cartel that is trying to take over a territory. Violence has increased because there is competition for key areas that are used to produce and transport illegal drugs that generate billions of dollars in profits. A hunger for power and money has driven Cartels to fight for the illicit drug territories that are generating a bloody war amongst the Cartels and the Mexican Government.

CONCLUSION

The primary goal of this has been to contribute to our broader understanding of how more coercive measures affect the level of violent crime in a country perpetrated by criminal organizations in reaction to more aggressive policies. There was no statistical significant relationship between more aggressive policing and violent crime levels, but these findings should be taken with a grain of salt since there where limited amounts of observations. The results suggest that Mexico is a special case in which more coercive measures toward criminal organizations lead to an increase in violent crime, and that other factors play a more important role in the proclivity of violence, particularly cartel rivalry and retaliation towards coercive measures.

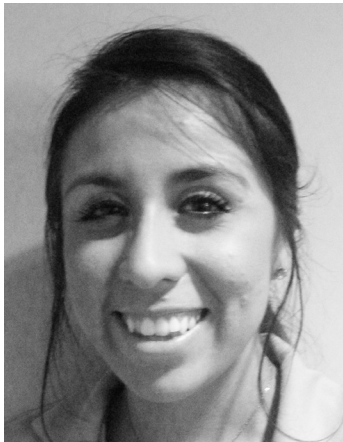


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The Role of Capacity Building in the Success or Failure of Non-Profits



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Abstract

This study will research characteristics of effective capacity building initiatives in nonprofit organizations. Using case studies of very diverse nonprofits in San Antonio, Texas, this study will illustrate the fact that the meaning of and goal of capacity building will vary among nonprofits. The roles of the Directors of MERCED Housing of Texas, The Community Leadership Institute of Texas, and The Socially Responsible Investment Coalition will be compared and contrasted focusing on organizational capacity building. Also, a board member of ACCION Texas will be interviewed to ascertain the role non-profit board members play in organizational capacity building.

The study will begin with an overview of scholarly research on the meaning of, significance of and effectiveness of organizational capacity building. Case studies of the four nonprofits and key points made by the four interviewees will follow. The last part of the paper will be an analysis of capacity building efforts in the four nonprofits.





Introduction

A healthy, vibrant nonprofit sector is critical to the strength and vitality of a community. Today there are over 1.5 million nonprofit organizations in the United States. In San Antonio, Texas, the nonprofit sector is constantly growing with over 3,600 registered in 2011. (Current, 2011)

There are many different types of nonprofit organizations, each focusing on a specific issue. However, small or large, whatever the issue, capacity building is a common element for the success of nonprofits. Organizations are an organic blend of people and systems. The strength of a nonprofit depends on its Director and staff, Board members, and embracement of capacity building. "The term nonprofit encompasses a huge diversity in itself" thus, there is no "one size fits all" definition for capacity building; each definition ought to fit the mission of the nonprofit. (Wing, 2004) Building capacity involves a continuum of interventions that assist nonprofits with basic functions as well as support for healthy organizational cultures. (Linnell, 2003)

Since there is no universal definition of capacity building, each form of capacity building used, presents unique aspects. Generally speaking, capacity building can be described as a relational process for organizing and creating an organization's stability. It encompasses: 1) generating development that results in strengthening of the organization while allowing it to adapt. 2) performing functions in a sustainable manner and solving problems without changing set missions; and, 3) the ability of organizations to carry out their functions and achieve desired results. (De Vita and Fleming, 2001) Capacity building is an approach used by individuals and organizations to understand the obstacles prohibiting them from reaching their goals and sustaining their mission. Over time, capacity building will enhance abilities that will allow a nonprofit to meet its developmental changes and acquire sustainable results.


When capacity building is successful, it strengthens a nonprofit's ability to fulfill its mission, and enhances the nonprofit's ability to have a positive impact on lives and society. Capacity building is important because it enables the leadership of a nonprofit to evaluate its abilities to perform in a complex environment. (Dane, 2010) This research will analyze the understanding of certain characteristics of effective capacity building initiatives and focus on whether these capacity building initiatives produced desired organizational change in the four nonprofits studied.

Methodology

The research strategy for this project will be a series of standardized, open-ended interviews of three directors of non-profits in San Antonio, plus one board member of a large Texas non-profit. The same open-ended questions will be asked to each person interviewed. The participants will be four people who are leaders in the San Antonio nonprofit sector. They have been employed and exemplified leadership in four distinct nonprofits. These interviewees were chosen based on their experience and proven leadership in the community. (See Appendix A for Biographical Sketch). The non-profits selected are quite diverse so the role of capacity building can be examined in contrasting organizational settings.

Directors, staff member, and Board member will be asked questions about their understanding of capacity building and what they feel is necessary in order to have a successful organization. The focus will be on capacity building initiatives in order to evaluate the extent to which desired organizational change occurred. Each non-profit will





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be analyzed as a unique case. Responses given will then be compared in order to compare and contrast significant characteristics.

Literature Review

Jacqueline M. Stavros states that there are four key elements to capacity building: 1) capacity building is multi-level; 2) capacity building is relational; 3) capacity building involves participatory learning; and 4) appreciative inquiry facilitates the capacity building process. Capacity building involves pushing boundaries, developing and strengthening, and making an individual or organization better able to serve not only in the primary interest of its targeted population groups as well as all of its stakeholders. (Stavros, 1998) Capacity building is what makes an organization strong, and the effectiveness of an organization stems from the capability of the individuals which comprise that organization, ultimately making that organization more operative than others. (Stavros, 1998) Capacity is often referred to as “the resources, effective leadership, skill and sufficient staff, a certain level of institutionalization, and links to the larger community from which an organization might draw help.” (Eisinger, 2002)

Under uncertain and dynamic circumstances, capacity building is needed in order for an organization to survive. As an organizational activity, capacity building is a “purposive action” undertaken to accomplish some specific mission-related objective, leading to improved infrastructure and increased mission performance. Nonprofits use capacity as their ability to achieve their mission effectively. (Linnell, 2003)

Capacity building activities include group trainings, work that involves nonprofits with similar missions working collaboratively, with individualized organizational activities. Practicing capacity building has a significant positive impact on organizations and their outcomes, the goal of which is to produce stronger organizations capable of sustaining improvements over time. (Millesen and Bies, 2005)

Prior research and studies of the impact of nonprofit capacity building have concluded that more centralized access to capacity builders is needed. Many do not have the means to obtain training and the right tools to participate fully in capacity building; research has also determined that nonprofits benefit from sharing resources and interacting with their peer organizations. (Backer & Oshima, 2004)

A study conducted by The LBJ School of Public Affairs at the University of Texas at Austin & The Bush School of Government and Public Service at Texas A&M University, found that many nonprofit executives defined capacity building in terms of two key inputs: funding and qualified staff. On the topic of who provides capacity building in each nonprofit, a significant majority of nonprofit executives indicated their organizations rely heavily on “internal capacity building” from board members and staff, followed by peer-exchange networks.

One barrier found in providing capacity building was lack of board understanding of and support for capacity building, as well as staff difficulty understanding the need for support. Organizations most likely to engage in capacity building were characterized as “proactive” and open to change and constructive criticism. (An Analysis of the Nonprofit and Volunteer Capacity-Building Industries in Central Texas, 2006)

Nonprofits’ motives for capacity building included a desire to create stronger organizations and attempts to secure additional funding. Some organizations engaged in capacity building in response to a crisis or in an effort to gain support from colleagues. (An Analysis of the Nonprofit and Volunteer Capacity-Building Industries in Central Texas, 2006)

United Nations Environment Program (UNEP) described capacity building as “building abilities, relationships and values that will enable organizations, groups and individuals to improve their performance and achieve their development objectives. Capacity building was also described as initiating and sustaining a process of individual and organizational change that can equally refer to change within a state, civil society or the private sector, as well as a change in processes that enhance cooperation between different groups of society. (UNEP, 2006)

The definition that UNEP provides puts emphasis on three aspects they believe to be important. The first states that capacity building is the catalyst and constant fuel for a process of change. The importance of building institutional capacity that includes the involvement of a wide range of different groups in society. (UNEP, 2006)

Training, formal education, capacity building projects, networking are all approaches available to build capacity; which approach will be most effective strongly depends on the specific objective to be achieved. UNEP states that the ultimate goal of capacity building is to sustain a process of individual and organizational change and to enable organizations, groups and individuals to achieve their development objectives. Any capacity building activity needs to be carefully designed so that it contributes to this goal.

Capacity building is a relational process of building an organization’s future, and yet it is not organizations which build capacity - it is people.” (Stavros, 1998) Capacity Building an Appreciative Approach by Jacqueline M. Stavros uses a model that puts a leader’s sense of hope, self-worth and capability as the fundamental building block to form a strong organization. Leaders who possess these attributes inspire other members to feel the same. The effect that comes from the leader transforms the organization into a strong base from which the community is affected. The study refers to this as the “ripple effect”. (Stavros, 1998)

For nonprofits and NGOs the key ingredients of success are finding partners with “a positive approach to gaining support for their mission” (Stavros, 1998) and people who will create programs and that will continue to grow with the organization. When funding becomes scarce and organizations compete for grants, loans, and innovative ideas, this hampers the ability to build capacity.

Stavros found Capacity building is a process that made up of different levels. The first level is organizational capacity which occurs when individuals begin to work together. These leaders work together “to build the internal relational components of the organization so it can better use its resources (e.g. people, time and money) to achieve its mission, attain its vision and goals/objectives to sustain its existence.” (Stavros, 1998)

To build an organization’s internal capabilities, members must work together and cooperate. This is the base of the pyramid because this is the stage where the organization assumes its identity and defines its mission. Capacity building is a relational process. The next level that forms the pyramid is multi-organizational capacity. This is when an organization works with other organizations in order to create a link that facilitates an efficient and effective way to carry out the mission. Capacity building results in a participatory learning process for those organizations involved. Capacity building can be facilitated through appreciative inquiry. In order to build capacity in an organization, leaders must learn a common language in the field and come to appreciate their strengths whether past or present, and be mentally and organizationally prepared to deal with what comes in the future.

In the case studies that Stavros conducted she found that visible outcomes of

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capacity building are:

- clarity of vision, mission, goals and objectives
- openness to assistance from the outside and new ideas/opportunity
- self-confidence, self-reliance and self-respect at the local level
- organizations and its people taking responsibility for their existence and future
- participatory organization development process where everyone is free to voice concerns and opinions
- new knowledge is created that is practical and useful
- important issues and needs of targeted population are addressed
- new relationships and responsibilities understood and accepted that will build capacity at other levels

According to Paul Charles Light, author of *Sustaining Nonprofit Performance*: the case for capacity building and the evidence to support it, nonprofits are driven to do more with less thus leading the nonprofit down a path of no training, poor technology, and little support from other organizations.

Organizational capacity refers to everything an organization uses to reach its mission, from people to desk and chairs. Activities such as raising money, forming partnerships, and generating ideas are all measurements of capacity. Kennard T. Wing states that the difficult question for the nonprofit field is finding a way to measure the effectiveness of capacity building.

Grant Makers for Effective Organizations (2003), an association of grant makers who support capacity building, has developed a working definition of organizational effectiveness: "The ability of an organization to fulfill its mission through a blend of sound management, strong governance, and a persistent rededication to achieving results." Paul Charles Light (2004) argues that nonprofits suffer from persistent underinvestment in basic organizational infrastructure. Organizations are driven to do more with less, denying their employees the training, support, and technologies needed to do their jobs effectively. Light states, that 70 percent of Americans believe nonprofits had the right programs but were inefficient. Light states that there is very little evidence that capacity building produces a significant rate of return because there is no measurable record of it. The most common form of capacity building mentioned were investments in new technology, strategic planning, staff training, fund-raising, and board development. (Light, 2001) 36 percent of the 318 respondents in Light's study defined capacity building as a way to increase organizational resource or inputs, including "obtaining or developing strategies to have the resources necessary to serve your clients? 30 percent defined the term as a way to measure an organization's activities. One respondent stated "Capacity means the numbers served, but capacity building means the most efficient and effective means of increasing the number of clines served with limited resources." (Light, 2001)

In Light's survey, there were four categories of organizational improvement. External relationships of capacity building included greater collaboration, strategic planning, strengthening of fund-raising, and engagement in some form of media relation. Internal structure included team building, added staff, enhancement in staff diversity, and reorganization. Internal systems of capacity building included new technology, staff training, program evaluation, and outcomes measurement. In the leadership category of capacity building engagement of board development was included, change in leadership, and a new plan of greater delegation of the responsibilities of the organization(Light, 2001)



Light concluded that capacity building can be high-yield, low-cost investments that can enhance program and organization performance. “Just as businesses must spend money to make money, nonprofits must build capacity to have capacity.” (Light, 2001) Light also stated, “Capacity-building activities such as planning, reorganizing, training, and communicating lead to increased capacity measured by organizational outputs such as improved morale, focus, efficiency, and productivity.”

Before one can build capacity, one must establish why capacity development is needed, whose capacity needs developing, how this capacity will be developed, what capacity currently exists, and how the capacity will be used once developed (Wachira, 2009). This process known as the “capacity audit”. The purpose of the audit is to enable mission fulfillment.

Light suggests that there are four key elements needed to determine the scope, and success of any capacity building project. The desired outcome; the change in the strategy to help realize the goal, the champions guiding the efforts, and the resources such as time, energy and money that was invested in the process. (Light, 2004)

Light produced a logical chain that would have grant makers, evaluators, and organizations measure the outcomes of capacity initiatives. The three levels of the chain are: 1) grant outputs—were the immediate objectives of the grant met? 2) organizational outcomes—did the engagement improve the functioning or performance of the organization? and 3) mission impact—did the engagement allow the organization to more effectively serve its mission? (Light, 2004)

There is little information on what works and what does not in the building of capacity. Nonprofits tend to focus on creating new programs and keeping their cost low instead of building the capacity necessary to achieve their aspirations effectively and efficiently. It takes a certain kind of leader, or personality to combine not only the right skills, but also the commitment to tackle capacity building proactively and be willing to push it throughout the organization. Many nonprofit managers’ simply do not have the time money, or awareness to put adequate effort into capacity building.

Case Study 1:

Merced Housing of Texas President Susan Sheeran

The mission of Merced Housing Texas is to create and strengthen healthy communities by providing quality, affordable, service-enriched housing for individuals and families who are economically poor.


*“Don’t go chasing after dollars that are not part of the mission.
You can’t hear of funding on a certain matter, and try and integrate it into
the program just to receive the money.”*

-Susan Sheeran

Merced Housing of Texas was formed in 1995 as a subsidiary of Mercy Housing Inc. in Denver Colorado. Merced Housing of Texas was created by nine different congregations of Catholic Sisters, who wanted to be able to make an impact on the shortage of affordable housing. It is difficult to make an immediate impact in a newly created organization due to the limit of funds, no financial history, and an unknown name in the community.

As an adult, Susan Sheeran was deeply involved in her community. Her focus





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became affordable housing. She was working at The San Antonio Housing Authority when the job opportunity with Merced Housing of Texas arose. She was hired as the agency's first Director. Susan first worked to develop an affordable housing complex for low income senior citizens in Somerset, Texas. Somerset is a small community, so the first project of building 28 units for seniors was a big accomplishment for the city. When Mercy Housing came to view the project and the progress that Merced Housing of Texas was making, they did not feel that it was making the impact that they would like and threatened to shut down Merced Housing of Texas. Susan and the Board members had no alternative plan under consideration when Mercy Housing decided to close the San Antonio office.

Susan Sheeran and Benedictine Sister, Susan Mika, called a board meeting to discuss the next action that needed to be taken. A Board member of Merced Housing of Texas, Oblate Father Rufus Whitley, an attorney, recommended that Mercy Housing Inc. leave the arrangement of partnering with Merced Housing of Texas. Using innovation, education, and creativity they were able to reorganize themselves, so that Mercy would no longer have control over them. Mercy Housing Inc. realized that they would no longer have liability over the cooperation and on July 1, 1999 Merced Housing of Texas was created as an independent non-profit organization. They had relied on Mercy to give them support in accounting and human resources and a major issue was making payroll. Merced Housing of Texas was initially funded through loans from the founding religious congregations. Thus Mercy Housing did not fully understand the future potential of this organization. "This happens all the time in the world of business and nonprofits," stated Ms. Sheeran. They continued to receive loans from the religious orders, gradually finding a way to work towards the goal of affordable housing and maintaining healthy communities.

Mercy Housing Inc. had a certain template of how to do affordable housing. Using this model of low-income housing tax credits for constructing multifamily units, Merced Housing of Texas was able to research San Antonio and develop a creative approach to affordable alternative housing, focusing on the poorest of the poor. As an independent organization they were able to respond to community needs differently than when it was part of Mercy Housing Inc. An example of a unique program started by Merced Housing of Texas was called "Serve our Seniors," where funds were raised to hire contractors to do repairs in the homes of low income seniors. As of June 2012 Merced Housing of Texas has repaired over 500 homes of low income seniors in San Antonio. Merced Housing of Texas has been a pioneer in successfully owning and managing low-income multi-family housing.

Merced Housing of Texas has remained true to its original mission. The staff, religious orders and Board members continue to conduct research on the greatest needs in the community. Since its beginning, Merced Housing of Texas continues to think creatively in the area of alternative affordable housing. The Sisters who started Merced Housing of Texas were prophetic risk takers in deciding to fund Merced Housing of Texas. The Congregations themselves were struggling financially, therefore, were reluctant to lend money to begin programs that were not proven to be successful in promoting social justice. Today, Merced Housing of Texas is meeting its social justice mission more completely by effectively integrating funding from the public, private and nonprofit sectors.

A common goal of all nonprofits is to find funding to continue their work, without jeopardizing their mission. They constantly do research about different sources of funding. Merced Housing of Texas will only apply for loans that they know they can repay and which fits the mission statement. "Today we have a loan payment due for a housing



property that will cost us \$85,000. We carefully look to see how we can bear paying that loan without a significant impact on the organization. We currently have money from a loan of \$200,000 that was given to us by Bank of America. Fortunately, Merced Housing of Texas is able to make our payments without having to touch the principal.”

Current projects that Merced Housing of Texas is working on, includes multi-family housing. This includes refinancing loans on multifamily properties, which can lower interest rates from previous years in order to keep rent affordable for the residents. This frees up funds to help other properties. For example, Merced Housing of Texas recently received a \$100,000 grant from the City of San Antonio to repair 17 homes on the East Side.

Another Merced Housing Project is the Residence Services Program where assistance is provided to residents in multifamily housing. Initiating the Residence program is one way to begin a business line; enabling that program to sign a contract with a management company. The independent newly created private company manages Merced Housing properties. In this way Merced Housing of Texas is building capacity to provide service and growth in the community.

The most important aspect of growth and success is staying focused on the mission and vision of the organization. Susan Sheeran stated, “Don’t go chasing after dollars that are not part of the mission. You can’t hear of funding on a certain matter, and try and integrate it into the program just to receive the money.” Susan Sheeran has learned so much about nonprofits and capacity building from networking. She believes that “Success did not just happen.” Networking and Divine inspirations are the foundations for success according to Sheeran.


Capacity building is systemically integrated into Merced Housing of Texas. When Merced Housing of Texas becomes a partner in a development process it brings certain areas of expertise to the table, such as, tax exemptions or certain kinds of financing which enables for-profit developers to join Merced Housing of Texas projects. When a limited partnership is created, the developer of a for-profit enterprise and the nonprofit cooperate to serve the targeted population. Both organizations cross train one another so that staff in small nonprofits have the skills to multi-task. Thus, once cross training is established one person can always step in and do the job of another.

Characteristics that are needed to be a nonprofit leader include the ability to stay focused no matter what happens and the ability to maintain equilibrium in the middle of ongoing constant change. Flexibility is also part of that. A sense of humor is important. It is significant for leaders to look for a support network to assist in maintaining that center and stamina.

All nonprofit organizations have a board. The number of members on the board varies with each organization. There are twelve board members for Merced Housing of Texas. The board is made up of individuals who focus attention on the community and who care a great deal about social justice. They contribute their time and talent to the organization. Most importantly, each board member is committed to the mission of Merced Housing.

When looking for a board member Merced Housing of Texas is looking for diversity and individuals who will be truly involved. It is important that an individual demonstrate the will to be involved. It is not necessary to find someone with previous experience in subsidized housing. If there is interest in the community, Merced Housing of Texas provides the orientation for them. When an organization recruits directors they try and find a cross section of people in the community. A good cross section of ethnicity,





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wealth, knowledge, skills, and age is necessary for a balanced board. Board members make it possible for the organization to complete its mission. One aspect that is unique about nonprofits is board members are not compensated for their service.


The role of the board is to ensure legal and ethical integrity while enhancing the organization's public standing. The board needs to provide proper financial oversight and strive to produce effective organizational planning. Board members act in accordance with the mission of the organization and make decisions based on the best interests of Merced Housing.

The Merced Housing board contributed to capacity building of the nonprofit by hiring a consultant trained in strategic planning processes that effectively integrates the board with the staff. Together Merced Housing board members have gone through a process of reflection on the strengths and weaknesses of the board. There is an ongoing Board effort to support capacity building. Occasionally there are Board retreats where the board members interact with strategic planners.

Building basic support of organizations is a top priority for creating long lasting success. Board members and staff need to be very creative about whom to go to for funding. "Federal funding is decreasing; funding has been cut way back. It forces the organization to be in competition to fight for the funds that are left. That is the biggest challenge today," stated Susan Sheeran.

Case Study 2:

ACCION Texas Inc. Treasury and Finance Audit Committee Dr. Thomas Madison



The mission of ACCION Texas Inc. is to provide credit and services to small businesses that do not have access to loans from commercial sources and to provide leadership and services to the microlending field on a national level.

ACCION International is an organization known for its successful efforts of microlending in Latin America. ACCION International wanted to see if the concept of "helping people help themselves" would work in the United States. In the early 1990s ACCION opened offices in San Antonio, Chicago, San Diego, and Albuquerque.

There was interest right from the start in San Antonio. The president of Chase Bank and then chairman of the Greater San Antonio Chamber of Commerce, Al Martinez-Fonts, got the project started. \$125,000 was offered at zero percent interest from Chase Bank, Frost Bank, Wells Fargo, and Broadway Bank. A grant of \$50,000 from Levi-Strauss was offered soon after. The 501 (c)(3) was established in March 1994. Janie Barrera was, and continues to be the President. Having only three staff members ACCION Texas Inc. made its first loan in June 1994. The organization worked on securing additional grants from socially responsible foundations. The team worked as loan officers, collectors, marketers, and fundraisers to provide funding to small businesses who could not secure a loan from a bank. Now, the organization also receives grants from private foundations and individuals, nonprofit organizations, banks, and religious congregations.

ACCION Texas Inc. is a nonprofit, small business lender and multi-state microlending company that helps entrepreneurs successfully grow their businesses through development services and affordable loans. ACCION Texas Inc. prides itself in building personal relationships with borrowers to ensure loan payback. ACCION Texas helps small businesses who do not meet bank guidelines. They help "business owners with weak credit, but good capacity to repay the loan."

In 2011 ACCION Texas Inc. merged with The South Texas Business Fund (STBF) and the Community Development Loan Fund (CDLF). Each organization was focused on loans to small businesses. With the merger came the inclusion of board members from each organization to sit on the board of ACCION Texas Inc.


Thomas Madison, Ph.D., CPA, is a faculty member of the Bill Greehey School of Business at St. Mary's University and former board member of the CDLF. Dr. Madison is a member of the National Community Tax Coalition, the American Institute of Public Accountants, and coordinates the St. Mary's University Volunteer Income Tax Assistance. Dr. Madison has been a board member of ACCION Texas-Louisiana since January 2011. As a board member his role is to ensure that the management of the nonprofit is operating properly with the mission. There are currently 18 members serving on the board and within the board there are different committees. Dr. Madison serves on the Finance Audit Committee, which is made up of 3-5 board members. The board has discussions on whether the organization and grants they receive are consistent with the mission. A staff member is assigned to work with each committee. When looking for a board member ACCION Texas is looking for someone with banking experience and someone who can raise money for the organization. Each board member is elected for three year terms. They can serve two consecutive three year terms. The board selects and approves new board members. The bylaws specify that one third of the board members have to be bankers. The rest of the board is made up of the diverse general public. Each year there is a board retreat focused on planning and training. There is always the risk of loans going bad due to changes in the macro economy. ACCION Texas has grown substantially since its founding. A focus has been maintaining the rational growth while staying consistent with the mission. Government grants and government loans that change in policy in Washington D.C can pose a risk to the loans given out by ACCION Texas-Louisiana. ACCION Texas-Louisiana currently has 87 staff members who are geographically separated by office. The staff seeks out and identifies grant opportunities both private and governmental.

In order to be granted a loan, an application processes is used. Each entrepreneur has had to have already gone to a bank and be denied. The banks will then refer them to ACCION. The loans given from ACCION will help build credit enabling these small businesses to become stronger and established the point where they will qualify for a regular bank loan.

Unlike other nonprofits, ACCION has not worried about mission drift. ACCION Texas has a broad mission committed to being a source of cash flow creating economic development.

Capacity building efforts have led ACCION Texas-Louisiana to recently expand operations into the Mississippi Delta Region. A capacity concern is developing partners in the new areas of the Delta. There is the need for more partnerships with private banks in the Delta Region.

ACCION is now the largest nonprofit microlender in the U.S. providing lending and business in Missouri, Mississippi, Kentucky, Alabama and Arkansas. Loans can range from \$50,000 to \$250,000. Microfinance loans are typically more flexible in their features than a standard bank. They are tailored to the needs of low and moderate-income families. The loans flexible features include size, repayment terms and collateral requirements. There are 17 offices and over 2220 active clients. ACCION is 50% self-sufficient. ACCION Texas-Louisiana is building the capacity of thousands of small businesses. Business owners need access to capital in order to expand inventory, marketing and



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advertising, in order to buy new equipment, or expand their work force. Capacity building is critical to the success of ACCION Texas-Louisiana. And, the success of ACCION means the creation of or expansion of small privately owned businesses in low income areas.

Case Study #3

Community Leadership Institute Former Executive Director Maria Alejandro

CLI provides community leadership development, training, and mentorship--strengthening Texas Communities.

The organization is focused on transforming individuals into who are committed to improving condition in their communities into servant-leaders. Servant leader is based on Robert Green Leaf's definition, which states that you are compelled to serve first and that prompts you into a leadership position. There are specific characteristics such as empathy, compassion, listening, and being invested in the growth of others; which is a measure of success.

Community Leadership Institute is an organization of capacity builders. CLI is always ahead on new capacity building training and made it a goal to keep learning. CLI delivers this knowledge to other nonprofits, neighborhood associations, alternative high schools and other organizations. The organization does this by practicing leadership with the individuals in the program. This free-program focuses on public speaking, communication, and conflict resolution. Leaders of the program made the decision to make it free so that it would be accessible to the most grassroots leaders. This becomes a challenge later when the program started attracting big nonprofits. One strategy was to try and develop relationships with those nonprofits so that CLI could tap into their professional development dollars, so that it could continue to not charge small organizations.

The curriculum for the program started in 2000. The course institute ran in 2001. It started as a program to capacitate housing boards. It was exclusive to the west side of town. The program was developed so that the leaders could sit on the board with the executive board and develop their leadership skills. Thus creating a leverage of the power. The initial institute ran for 7 years under the national organization, Enterprise Community Partners.

The program began to transition to a 501 (c)(3) and it was looking for a program assistant. Maria Alejandro had been working in community development for years. When approached with the opportunity, she accepted and became the program director, which later led her to become the executive director. The definition of capacity building that Maria Alejandro gives is, "Being able to effectively carry out the operations of the organization. In program delivery, evaluation, fundraising, marketing, all aspects of the organization."

The program had been running for 7 years very well-funded by Enterprise and by banks. In 2008 when it transitioned into becoming a 501 (c)(3), there was a funding short fall. Funding immediately switched to the needs of housing, clothing, and food. It was difficult in 2008 to make an argument on way capacity building was a priority. Banks were the biggest funders and their donations went from \$30,000 to \$5000 to \$1,000 all in one year. That was the major funding shift. The Community Leadership Institute when to its main funder to find an organization who would want the program and who could fund it. They found new founders, but the transition could not happen fast enough. "It takes time to foster relationships with funders."

The Community Leadership Institute ran out of money in 2012. The staff of the



Community Leadership Institute had no benefits and had stopped receiving their salaries. The organization went to the Area Foundation. The new CEO of the Area Foundation loves the program. The board of the Area Foundation is letting the program run for a year, and will consider adopting it as a program for the foundation. The new CEO raised \$50,000 in less than a month. The money he raised still has not been transferred over the CLI. The Area Foundation could not decide how to disburse the money.

The organization has a graduation at the end of the year and there was an effort to attach a fundraising component to the end of that graduation. The fundraiser was unsuccessful in the terms of how much money was made. The most money that was made was \$3000 and with a program with a \$7800 monthly expenditure, it did not help as much as they hoped.

At that time there were eleven board members. The culture of CLI is very participatory. "One of my goal was to get the board to be more engaged. That was one of the grants that I had. It was on hold because there was no money. The intention was to create a participatory strategic plan for the organization so that everyone could have a role. One or two people couldn't do everything. The organization needed a working board," stated Maria Alejandro.

There are currently five members who remain on the board. The power has shifted to an autocratic leadership role. There is no balance of power. Board members became discouraged because the culture no longer reflects the participatory nature of the organization.

CLI has an alumni base of 249 of people who have gone through the program. One requirement of the board is to have two-thirds alumni. Originally board members were brought in according to skills sets that were needed on the board. These skill sets included funders and people who knew accounting. There were alumni who did not have the financial networks, but knew the program and knew the integrity of the program. Another requirement is to have someone serve on the board who is a community member.


"Even though we brought all of those different people to serve on the board, there was no process, which causes them to work against each other."

In four years there was only one board retreat when the program was transitioning, which every board member attended. When the Community Leadership Institute applied money to conduct board training, it was bad attendance and board members had started to transition off. There was a challenge to find new people to serve as board members. The board was fun by a founding member of the organization which gave off the impression that the board was established. The board was working under the Capacity of governing board rather than a working board.

The programs that the institute uses have evolved but are currently at a standstill. It had developed an Executive leadership series led by an executive coach. The coach used the theoretical framework of Peter Senge and Daniel Goldman, which uses experimental methods based on Jacob Moreno's work. Participants were intentionally recruited by business sector, small nonprofit, big nonprofits and very grassroots organizations so that they would develop a peer locking. This program is currently at standstill because of the organization longer has the capacity to carry the program out.

In 2010 adaptive leadership was considered the best tool to develop more socially innovative approaches and was considered more of a resource. Adaptive leadership is





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when you can adapt to any situation and create new solutions, which had been the basis of CLI's programs. The institute applied for a grant from the One Star Foundation. The grant was a capacity building grant, which the organization would teach other organizations about adaptive learning, while gaining capacity building for itself.

The organization prevented funds from driving the agenda by having a founding member on the staff, which kept the program rooted and balance the power with the board; which was constantly trying to steer the organization in the way of money.

Important leadership skills that one needs to work in a nonprofit include stress management, clarity, fiduciary responsibility and relationship skills.

The organization has welcomed change adapting its new program to use new technology. The essence of the program has remained consistent; the faculty has been the same faculty since the beginning and the modules remain constant. The faculty who give the presentations are paid per session. The board wanted to change this, and find speakers who would do the program for free. Maria Alejandro stated, "We got a lot for free. I wanted to protect the integrity of the curriculum and not depend on it being free."

The faculty that worked at the Community Leadership Institute worked well with grassroot leaders and were culturally sensitive making the program more effective. There were only 2 full time staff members and one part time. Then the number went down to two, and now there is only one staff member.

One third of the CLI graduates remain engaged in the sense they volunteer to help staff and go to the graduations which helps new graduates form networks. Alejandro said, "I always wanted to take that those graduates who formed a community circle to meet with a council representative or bring in speakers to talk to them. We had Quarterly lunches but we never had the capacity to sustain that. When the funding was gone that was the first thing to go off of the budget."

Personal sacrifices that Maria Alejandro made were general livelihood issues. She went without a salary for months and this job provided her with no benefits.

She stated, "I stayed for so long because I believe in the organization and felt they were on the brink of where we needed to be. It was hard for me to let it go and in retrospect we really do need to let it go. We come first, my family comes first, and I found myself in disbelief that we have had the challenges we did. I was shocked that not everyone was running to save it when it was going down. I feel like I can leave now because I have left it on more finically stable grounds."

Case Study #4

Socially Responsible Investment Coalition Executive Director Sister Susan Mika

Justice and Peace through corporate responsibility

Camino a la Paz which was founded in 1984, was an intercongregational office focused on justice and peace. The goal was to bring about awareness of social justice and the religious orders worked together to make this their goal. The Texas Coalition of Responsible Investment (CRI) was placed as a program under Camino a la Paz in 1982. In 1997, Camino a la Paz ended its mission and Texas CRI incorporated as a 501 (c)(3) with a new name Socially Responsible Investment Coalition.

Socially Responsible Investment Coalition is a religiously sponsored non-profit organization. The Socially Responsible Investment Coalition started its work by educating individuals and groups about the importance of corporate responsibility. Members of SRIC work to balance economic policies with faith and social concerns. Early projects of the non-profit included participation in the boycotts of Campbell's Soup and Nestle Products,



and contributed to actions to end the apartheid in South Africa.

Susan Mika, OSB, is the current and formerly first executive director of the Socially Responsible Investment Coalition. Sister Susan Mika has devoted her life to justice and continues to bring passion to her work every day.

The goals of the Socially Responsible Investment Coalition are to educate members about social issues relating to corporate responsibility and accountability. Using a variety of different strategies including dialogue and filing shareholder resolution, SRIC enables changes in corporate policy. Membership provides networks that can be used for research information and strategies. There are different levels of membership which include donor, individual, associate, and institutions.

In order to raise questions and produce resolutions to the corporation's that are not in accordance with social corporate responsibility, SRIC must own a share of stock in that company. As investors and shareholders, SRIC is able to act directly with the corporations. As shareholders they are able to continuously bring questions to meeting and pressure the companies for answers. "To hold stock allows us to raise or voice if we agree or disagree. By owning these shares we are able to work within the system."

In the 30 years SRIC has been challenging corporations about their practice, language and technology has changed dramatically. SRIC has embraced these changes and has increased its capacity by using them. "In the beginning, we would write letters and resolutions, then mail them out and hope for a reply." Now with the internet's numerous websites and social media networks, there is a modern convenience that allows them to hear about concerns faster and work more effectively to try and solve them.

In 1985, 15 groups filed 12 resolutions with 12 companies. In 2012, 33 resolutions were filed with 30 companies. Countless resolutions have been passed due to the questions being raised by SRIC but numerous issues remain the same. "Perseverance is key in continue to raise the hard, unpopular, inconvenient questions about climate change, impact on our planet, human rights, access to capital, access to water, supply chain management, and the consequences of having only a short-term focus."

Current projects include raising awareness about human trafficking during Super Bowl XLV in Arlington, Texas. SRIC team of volunteer contacted 38 local hotels near the Super Bowl site and called managers to urge adoption of the "End Child Prostitution, Child Pornography and Trafficking of Children for Sexual Purpose" (ECPAT) Code. The template SRIC created was given to the group who worked on the 2012 Super Bowl and will be shared with those working on future sporting events. Say on Executive Pay was a provision written into the Dodd Frank Wall Street Reform and Consumer Protection Law. The goal is to raise resolution on executive pay on proxy ballots.

The mission of SRIC has not changed. Sister Susan Mika says they have been blessed with no board problems. "The board meets four times a year. If someone cannot make it, they are there in a conference call." There are currently 25 people on the board. A packet is made before every meeting. It contains research and information about issues that are current so that board members do not have to use their time researching it on their own. Sister Susan Mika hears about these problems from the news, newspapers, and now on the internet.

Once a year a fundraiser is hosted. They set a goal for the fundraisers and the prices are set in a way to ensure a successful fundraiser. SRIC raises money through membership and sponsorships. SRIC is always soliciting donations if anyone wants to help and started putting donation card at the back of its newsletter.

Conclusion





The Role of Capacity Building in the Success or Failure of Non-Profits

Capacity building is needed for the success of a nonprofit. It will take time, funds, and a combined effort from board and the staff. There is little research on what works and what does not in terms of capacity building and it is difficult to find a way to measure the effectiveness. Merced Housing of Texas built its capacity by having board retreats, maintaining diversity within the staff and board, making connections, having a network of support, and making sure that the organization does not chase after funding that does not fit the mission.

ACCION Texas-Louisiana Inc. has maintained growth while staying consistent with its mission. The organization has built its capacity cautiously by expanding into different regions of the United States. ACCION has also merged with smaller organizations to ensure that the community is getting the best resources.

The Community Leadership Institute was building its capacity by making sure that the board was completely emerged in the progress and projects that were on going. Community Leadership Institute was building its capacity by creating new programs to have a more engaged board and had new grants to make these changes when the organization lost its primary source of funding. The impact of lost funding for this small non-profit resulted in lost capacity. Without that capacity the CLA no longer has a successful board. The CLA board went from eleven members to five. When the organization does not have the means to solicit new funding, CLA it has lost capacity building capability. When the roles of the board are no longer visible they no longer have the capacity of a working board.

The Socially Responsible Investment Coalition has successfully created capacity by recognizing the changes that have occurred throughout the years, making sure they keep up with technology, news, and laws/regulations that are constantly changing. SRIC has created a network of connections and has the capacity of a well working, integrated board.

The lack of capacity building can lead to “mission drift”. If a nonprofit does not have the means to find proper funding consistent with their mission, they will chase funding, and often stray away from their root cause. Every nonprofit in this research built their capacity by making connections. Even though there is not a lot of prior research that can measure the effectiveness of capacity building, these four nonprofits studied have shown that it is definitely needed. Three of the four have continued to build their capacity while one has lost the capacity building it once had. As a result it is now failing.

