

## Some Results on Maps of Trees

Fred Worth, Ph.D.  
Professor of Mathematics and Computer Science

### Abstract

In this paper, we consider some basic properties of maps of trees.

### Basic terminology

A **tree** is a finite connected union of arcs containing no simple closed curve.

A **map** denotes a continuous function.

A **homeomorphism** is a bi-continuous, one to one function from one topological space onto another.

For  $f$ , a mapping from one topological space to another, let  $f^1 = f$  and  $f^n = f \circ f^{n-1}$ . For a self map of a topological space, we say  $x$  is a **fixed point** if  $f(x) = x$  and  $x$  is a **point of period  $n$**  if  $f^n(x) = x$  where  $n$  is the least such positive integer.

If  $p$  is a point of a tree,  $T$ , the **order** of  $p$ , denoted  $\deg(p)$ , is the limit, as  $d$  goes to zero, of the number of points of  $T$  with distance from  $p$  equal to  $d$ .

### Preliminary Results

**Lemma** Suppose  $T_1$  and  $T_2$  are trees. If  $f : T_1 \rightarrow T_2$  is a homeomorphism then, for every  $p \in T_1$ ,  $\deg(p) = \deg(f(p))$ .

**Theorem** Suppose  $T_1$  and  $T_2$  are trees. If  $f : T_1 \rightarrow T_2$  is a homeomorphism then, for any  $n \neq 2$ ,  $\text{card}(\{p \in T_1 \mid \deg(p) = n\}) = \text{card}(\{p \in T_2 \mid \deg(p) = n\})$ .

**Convention** There are infinitely many different homeomorphisms between two arcs (e.g.,  $f(x) = x^n$  from  $[0, 1]$  onto  $[0, 1]$ ). Therefore, if there is a homeomorphism between two trees, there are infinitely many such homeomorphisms. Given trees  $T_1$  and  $T_2$  and homeomorphisms  $f_1$  and  $f_2$  from  $T_1$  onto  $T_2$ , we will say  $f_1$  and  $f_2$  are **non-equivalent** if there exists  $p \in T_1$ , with  $\deg(p) \neq 2$ , such that  $f_1(p) \neq f_2(p)$ .

the Homeric virtues of skill in battle and oration. For the ancient Athenians, the animal passions were carefully regulated by societal rules such as the mixing of the water and the wine at the symposium. More importantly, passions and desires could be controlled through careful introspection and self-knowledge. The man dedicated to the attentive nurturing of and care of the soul, which requires constant introspection and self-reflection, could obtain a perpetual state of contemplation, which in turn would lead to concentrated self-awareness, moral excellence, and the ability to consistently act in a *sophron* manner.

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### Biography

Dawn Higgs received her BSE in 1997, from Henderson State University. Having then taught secondary English and oral communications for six years in Arkansas public schools, she returned to Henderson State University where she completed her Master of Liberal Arts degree with a major emphasis in English and a minor emphasis in philosophy in 2005.

biographers-Cornelius Nepos (*Alcibiades* 10) and Plutarch (*Alcibiades I* 38.5)-it was his old supporter and fellow Socratic companion Critias who gave the assassination order in 403 BC. (*Critias: Political Career*, par 2).

Critias's notion that *sophrosune* is "minding one's own business" is very revealing. It indicates a self-serving mind-set and lack of introspection. Critias, and those like him, delude themselves into believing that their tyrannical actions are warranted because they believe themselves to be just. Unlike Socrates, they are unable to regulate their behaviors because they do not have an honest understanding of the forces that motivate them and they do not sincerely strive for the good.

The heroes and protagonists of the *Iliad*, the *Alcibiades I*, and the *Charmides* do not have knowledge of self; therefore, they do not understand the thoughts and desires that prompt their behaviors. They are consumed by egocentric desires, and they lack balance and the ability to focus on the greater good. Conversely, Socrates claims to know nothing and spends his life in search of self-knowledge and understanding. Since he only admits to being able to define that which he does not know, he is not guilty of the hypocrisy and self-delusion of the other characters. Many of the heroes and protagonists of Classical Athens provide a superficial image of virtue whereas Plato's Socrates offers substance. Socrates' continuous introspection and reflection guide him to an awareness of self that in turn leads to *sophron* behavior.

According to Plato, Socrates is the exemplar of *sophrosune*, so as modern-day readers we have some idea what it meant to be *sophron*, or at least which characters are not *sophron*.. Unfortunately, knowing how to define *sophrosune* leaves us no closer to understanding why it was so very important to the Athenians. In his book *Fishcakes and Courtesans*, James Davidson argues that for the Athenians, "the pleasures of the flesh, eating and drinking and sex, are also animal passions, and for all the connoisseurship a degenerate man shows around the dinner-table, he is giving in to desires he shares with the meanest of creatures" (305). Davidson explains that the Athenians recognized these urges in themselves and felt a "civic responsibility to manage all appetites, to train themselves to deal with them, without trying to conquer them absolutely" (313). For the Athenians, if uncontrolled, the primal passions inherent in each man posed a threat not only to the individual man but to the society in which he lived. The ever-present threat of tyranny fueled this preoccupation with temperance and moderation. According to Davidson, Athenians were highly suspicious of any man whose appetites outpaced his ability to support them. He describes what he calls the "tyranny of desperation" as a situation in which the would-be tyrant is forced to oppress others in order to secure the means to indulge his extravagant appetites (299).

The Athenian fascination with *sophrosune* is reflected in the Athenian philosophical texts of the era and in the anthropomorphic gods they worshiped. Dionysus stands as an exemplar of the animal passions while Apollo represents reason and civilized behavior. Through these gods and the Delphic festival they shared, the Athenians acknowledged the duality of human nature and the interconnectedness of passion and reason. Plato emphasizes the Apollonian ideal of "know thyself" as the means of cultivating the soul and de-emphasizes

to their later behaviors as members of the Thirty Tyrants. Critias's and Charmides's misunderstanding of the meaning of *sophrosune* is mirrored in the words and deeds of Agamemnon and Achilles in the *Iliad*. Each of these individuals does not have self-knowledge; therefore, each of them is deluded as to what motivates his actions. Without knowledge of the motivational factors that influence their behaviors, these men are unable to obtain intellectual excellence about moral things or *phronesis*. Because these individuals lack *phronesis*, they are unable to exert control over the forces that drive them.

According to Plato, Socrates was primarily concerned with the cultivation of the soul and the maintenance of the well-formed soul. Socrates displays temperance in his actions. Upon seeing Charmides, the men seated at Socrates's table behave foolishly and immaturely, literally shoving each other in order to secure a seat next to Charmides (155C). Socrates is immediately attracted to Charmides' physical beauty. He says, "I saw inside his cloak and caught on fire and was quite beside myself" (155D). Socrates freely admits that he is affected by his more base urges, yet he does not give into them. He chooses instead to concentrate on whether or not Charmides has a well-formed soul. It is Socrates's knowledge of self and his awareness of how this urge may affect his behavior that enable him to control himself and not act upon those desires. Although Socrates claims that he does not know the meaning of *sophrosune*, he demonstrates the introspective behavior necessary to cultivate the soul and behave in a *sophron* manner.

Charmides's behavior is understandable because he is young and he is influenced by Critias who he perceives is wise. Critias seems to be influenced by the Homeric heroic ideal. Like Agamemnon and Achilles, he is arrogant and bloated with a sense of self-righteousness. In the *Charmides*, Plato remarks upon Critias's and Charmides's illustrious ancestry (157E). As a child of wealth and privilege, Critias enjoyed the very best education and as an adult he benefited from the company of the leading thinkers of his day. He appears to have had every advantage, yet he was not satisfied. His hubris and his lust for power and prestige eventually lead to his violent death.

Xenophon characterized Critias as a ruthless, amoral tyrant, whose crimes would eventually be the cause of Socrates' death. This negative view of Critias was continued by Philostratus, who called him "the most evil... of all men" (Philostratus 1.16). Critias's role as a leader in the group of Thirty Tyrants and the fear that they inspired is described in the following passage:

Critias was also a leading member of the Thirty, whose brutal reign of terror in 404/403 BC was vividly depicted by Xenophon (*Hellenica*, Book 2). The reign of terror unleashed by the Thirty saw summary executions, property confiscations, and the exile of thousands of Athenian sycophants, democrats, and metics. Even Theramenes, one of the founding members of the Thirty, was executed without a trial after he dared to openly oppose Critias. Another apparent victim of the Thirty was the still-exiled Alcibiades, who remained in his fortified estates in Thrace. According to the report of Alcibiades' later

The men call Charmides over on the premise that Socrates has a cure for his headaches. Socrates is careful to note that the Thracian doctor who gave him the charm warned that “one should not attempt to cure the body apart from the soul” (156D). Socrates claims that the charm in question will provide the charmed one with *sophrosune* and that when the soul acquires *sophrosune*, “it is easy to provide health both for the head and for the rest of the body” (157A). Socrates establishes an important link between the well-being of the soul and the well-being of the body. Critias claims that Charmides is already *sophron*. He notes that Charmides has “the reputation of being the most temperate young man of the day” (157D). Socrates performs an elenchus on Critias and Charmides, who would later become two of the Thirty Tyrants, and they attempt to define *sophrosune* but are unable to do so effectively.

Charmides seems to be excellent in a number of ways. He is physically beautiful, and he is known for his skill in writing poetry. When questioned about whether or not he is *sophron*, to his credit, Charmides provides a very honest answer. He hesitates to say “yes,” because he does not want to be perceived as arrogant, yet he does not want to answer “no” and insult his uncle either (158D). Charmides seems to be greatly influenced by Critias, and defers to his uncle when questioned (162B). Charmides postulates that *sophrosune* is “quietness and modesty.” He is primarily concerned with image as opposed to substance. A person may be quiet in the company of others and pretend to be modest when complimented, but the illusion of these two traits is easily contrived. Observers may be easily fooled by these illusory, superficial traits, but a tranquil countenance and false modesty do not guarantee that a person has a well-formed soul.

When Charmides is unable to define “minding one’s own business,” a definition that he had gleaned from Critias, Critias is visibly annoyed (162C). Plato gives a somewhat humorous account of Critias’s reaction. “Critias couldn’t put up with this but seemed angry at Charmides just the way a poet is when his verse is mangled by the actors” (162D). Critias’s initial notion that *sophrosune* entails “minding one’s own business” implies a focus on individual needs and desires as opposed to a frame of mind in which one is focused on the good. A self-centered focus is not necessarily negative, as long as the individual is concentrating on the cultivation of the soul. Critias’s behavior in *Charmides* and later accounts of his role as one of the Thirty Tyrants indicate that his focus on himself was not motivated by his need to improve the condition of his soul.

The discussion between Critias and Socrates quickly turns to the question of whether or not *sophrosune* is the doing of good works and whether or not the doer of good deeds must be aware that he is *sophron*. Socrates asserts that in order to be *sophron*, one must know himself and be aware of the internal and external motivations that prompt his behavior.

Neither Critias nor Charmides has taken the time to cultivate a well-formed soul. They attempt to project the image of being *sophron*, but it is clear to the reader that their “*sophron*” natures are superficial at best. Plato juxtaposes Charmides (who is proclaimed by Critias to be *sophron*) with Socrates (who claims to know nothing but who behaves in a temperate or *sophron* manner). Plato allows the reader to glimpse the characteristics that would lead them

SOCRATES. And very much, if you inquired.

ALCIBIADES. Then don't you think I might inquire?

SOCRATES. I do, if you thought you didn't know.

Socrates is aware that Alcibiades' *hubris* prevents him from realizing that he does not actually understand the meaning of what is just. His lack of life experience and self-knowledge prevent him from understanding such a complex concept.

Alcibiades claims that his knowledge of what is just has been gleaned from the "many" (9. 10). Socrates quickly discounts this response saying, "Not in serious teachers are you taking refuge in appealing to the many" (9. 11). Socrates skillfully points out that the "many" cannot possibly teach one what is just or unjust because they do not know what is just themselves. The "many" cannot possibly share an enlightened consensus on the meaning of what is just.

In section ten of *Alcibiades I*, Socrates asks Alcibiades if he has learned what is just from Homer's *Iliad* and *Odyssey* and from the heroic exploits of past generations of Athenians. Alcibiades agrees that his understanding of what is just has been garnered from these very sources, and Socrates questions how he could gain insight on the meaning of what is just from those he has not known personally. He points out that it is impossible for Alcibiades to have no knowledge of what is just because he has learned is from anyone nor does he know it himself (10. 56-60). Plato uses this exchange between Socrates and Alcibiades to call attention to the flawed nature of the Athenians understanding of not only what is just but the Athenian reliance upon the concept of Homeric virtue as a measure for proper behavior. Plato reveals that introspection and the care of the soul are necessary to achieve a *sophron* state of being and moral virtue.

Whether or not this exchange actually occurred between Alcibiades and Socrates is questionable; however, it is clear that Alcibiades never conquered his *hubris* and continued to act for his own benefit rather than that of the state. Alcibiades was often praised for his valor in battle, but his shifting loyalties and erratic behavior during the Peloponnesian war and his susceptibility to flattery reveal that he never achieved a *sophron* nature. Alcibiades will be forever immortalized as a drunken blustering fool who bursts in on Agathon's symposium, ignoring the rules of consumption and drinking the wine without mixing it with water. His rumored affairs with married and unmarried women further enhance an image of a man who is not in control of his desires.

In stark contrast to the aforementioned characters, Plato attempts to provide an exemplary model of the essence of *sophrosune* through his depiction of Socrates in the *Charmides*. At the beginning of the dialogue, Socrates asks those who are gathered about "the present state of philosophy and about the young men, whether there were any who had become distinguished for wisdom or beauty or both" (153D). Critias immediately singles out Charmides as an extraordinary beauty and describes him as a philosopher and poet as well (154C).

and I think that except for Cyrus and Xerxes  
you believe no one has existed worthy of a word.  
So that you have this hope, I know well and am not guessing

and I think that except for Cyrus and Xerxes  
you believe no one has existed worthy of a word.  
So that you have this hope, I know well and am not guessing. (2. 36-44)

One must keep in mind that when Plato created this dialogue, Alcibiades had already displayed the tyrannical behavior that is only hinted at in the text. Plato wrote the dialogue in retrospect to what had already taken place, and he had the benefit of hindsight. It is plausible that Plato is not only allowing the reader to gain a historical perspective of what motivated this enigmatic and powerful figure but to point out the moral deficiencies that exist in Alcibiades.

One of the most significant aspects of the dialogue is Socrates' insistent questions regarding Alcibiades' qualifications as a leader and his ability to council others on "peace and other affairs of the state" (5. 3-4). Socrates performs an elenchus with Alcibiades to determine how it is that he knows when it is the appropriate time to go to war and with whom.

SOCRATES. So what then?

On which are you counseling the Athenians to war,  
those doing the unjust or the just?

ALCIBIADES. This you are asking is tricky;

for even if someone decides that it is necessary  
to war on those doing the just, he would not admit it.

This particular exchange reveals Alcibiades' willingness to perjure himself in order to achieve his own selfish ends. In section eight of the text, Socrates questions Alcibiades about how an individual can discern the just and the unjust in order to better advise others.

SOCRATES. How so, dear Alcibiades?

Has it escaped your notice that you do not know this,  
or did it escape me  
your learning and attending school with a teacher,  
who taught you to discern the more just and the more unjust?  
And who is he?

And tell me so that you may introduce me too as his pupil. (8. 1-7)

Socrates points out the ridiculousness of Alcibiades' claim to know what is "the more just and the more unjust." Alcibiades becomes defensive and claims that Socrates is mocking him and asks Socrates, "Don't you think I could know about justice and injustice in any other way?" (8.13-14). In the following exchange, Socrates reveals the root of Alcibiades inability to gain knowledge of what is just and unjust.

SOCRATES. Yes, if you could discover it.

ALCIBIADES. But don't you believe I could discover it.

Stronger I am than you, and the next person will wince  
At the thought of opposing me as an equal.

His intellectual excellence is employed for his own personal gain rather than the cultivation of the soul; therefore, he lacks moral excellence. Achilles and Agamemnon are consumed with their own egocentric desires, and they are both willing to sacrifice the lives of their men to fulfill these yearnings. They each possess certain excellences, but they do not possess the right combination of these excellences to achieve a *sophron* nature.

It is also important to note that neither of these men, especially Achilles, is consistent in his behaviors. Achilles is driven by his emotions; therefore, his actions are erratic. In Book twenty-four of the *Iliad*, the kindness that Achilles shows Priam reveals that Achilles does possess compassion, but he only performs this selfless act at the end of the epic (557-565). In Aristotelian terms, Achilles could be defined as incontinent. His erratic behaviors are motivated by sentiment, not reason or contemplation. Throughout the course of the *Iliad*, Achilles seems unable to grasp the egotism of his behaviors because he lacks self-knowledge. When one considers that Agamemnon and Achilles, who behave like petulant children, are considered two of the most virtuous heroes in Greek lore, it is easy to understand why Athenian men may have been confused about the meaning of *sophrosune*.

Alcibiades, as he is portrayed in the text of *Alcibiades I*, also possesses rhetorical and athletic excellence, but these gifts are eclipsed by the chaotic nature of his career in politics, diplomacy, and war. The *Alcibiades* dialogue is set in 432 BC, when Alcibiades is approximately eighteen years old. It is most likely a middle dialogue, and unlike some of the earlier dialogues, it seems that Socrates does have an agenda and that he does know the answers to the questions that he poses. Socrates is portrayed as mentor who attempts to guide the young Alcibiades to make the best use of the excellences that he possesses. In the following lines, Socrates comments upon young Alcibiades's extreme ambition and hubris.

SOCRATES. For you seem to me, if some god should say to you,  
"Alcibiades, do you wish to live having what you now have,  
or to die immediately,  
if you are not to be permitted to gain greater?"  
It seems to me you would choose to die. (2. 13-17)

Much to Alcibiades' irritation, Socrates continues to elaborate upon the depth of Alcibiades' hunger for power and his arrogance. Socrates notes that if the same god mentioned above allowed Alcibiades to have power only in Europe and did not allow him to interfere with the affairs in Asia, he would not accept these terms either. The character Socrates attempts to present these negative aspects of Alcibiades' character to him so that he may acquire some level of self-awareness.

SOCRATES. if you are not to fill with your name and your power  
all, as one might say, of humanity;



was so preoccupied with the notion of *sophrosune*, very few of the historical figures measure up to the ideal. Perhaps the Athenians' attempts to reconcile the Homeric virtues with the notion of *sophrosune* produced some of the confusion over the meaning of *sophrosune*. Socrates, as he is portrayed by Plato, is one of the few if not the only person who seems to live up to this ideal.

In classical Athens, Homeric virtue was the measure of a man's worthiness. The heroic figures of a Homer's *Iliad* reveal much about the values of Athenian culture. The characters Agamemnon and Achilles, supposed heroes of the *Iliad*, lack self-knowledge and suffer from *akrasia* or they are incontinent. Although Agamemnon is praised for his cleverness, and Achilles is praised for his god-like stature and skill in battle, it is clear that neither of these men is introspective or concerned with the "good." Instead, Agamemnon and Achilles are motivated by the need to attain glory and the desire to satisfy their more base urges. Each character contends that his actions are just, yet each man's actions reveal the pettiness and selfishness of his actions.

Agamemnon and Achilles are arrogant and bloated with a sense of self-righteousness. In Book One of the *Iliad*, the Greek army has been plagued and punished by Apollo because Agamemnon refuses to return Chryseis, Chryses's daughter. He accuses Calchas of fabricating a prophesy that demands that he return Chryses's daughter in order to end the misery of his men and guarantee their safe voyage home (112-120). After a bitter argument, Agamemnon reluctantly agrees to return the girl but demands Achilles's "prize," Briseis (111-120). Achilles cries like a child and appeals to his mother, the goddess Thetis, to beg Zeus to help him get his revenge.

Hem the Greeks in between the fleet and sea. Once they start being killed, the Greeks may appreciate Agamemnon for what he is, and the wide-ruling son of Atreus will see what a fool he's been because he did not honor the best of all fighting Achaens. (425-431)

Achilles willingly sacrifices the lives of his fellow soldiers so that others may be aware of his greatness in battle and to secure revenge against Agamemnon. He feels justified in his actions because he has been wronged, but he does not take the time to analyze his motivations and acts with haste.

Agamemnon possesses intellectual excellence and the ability to reason, but he applies his intellectual skills selfishly to obtain what Aristotle would characterize as the "goods of the body" and "external or instrumental goods." His excessive *hubris* is evident in his treatment of Achilles regarding Briseis.

Since Phoebus Apollo is taking away my Chryseis,  
Whom I am sending back aboard ship with my friends,  
I'm coming to your hut and taking Briseis,  
Your own beautiful prize, so that you will see just how much

## The Sophrosune Problem

Dawn Higgs

Mentor: Dr. Kevin Durand  
Department of English, Foreign Languages, and Philosophy

### Abstract

“The *Sophrosune* Problem” attempts to define the meaning of *sophrosune* as it was understood by the ancient Greeks using the philosophical texts of Plato, Homer’s *Iliad*, and Thucydides’ the *Peloponnesian War*. Although the ancient Athenians were preoccupied with the notion of *sophrosune*, very few of the historical figures measure up to the ideal. Perhaps the Athenians’ attempts to reconcile the Homeric virtues with the notion of *sophrosune* produced some of the confusion over the meaning of *sophrosune*. Socrates, as he is portrayed by Plato, is one of the few if not the only person who seems to live up to this ideal.

The term *sophrosune* has been commonly translated as “temperance,” “moderation,” and “control of self.” The difficulty in defining this term as it was understood by the classical Athenians is challenging. In order to accurately define what the term *sophrosune* meant to the Athenians, it is necessary to examine the philosophical texts, historical commentary, and the literature of the era.

“Control of self” seems to be a more accurate definition for the term *sophrosune* because “temperance” and “moderation” are the result of controlling one’s impulses. If *sophrosune* is defined as “control of self,” then it is logical to suppose that in order to control one’s self, one must have a deep understanding of the desires that motivate his or her behavior.

Greek texts describing historic events and the superhuman and cunning exploits of many heroes reveal the flawed nature of the Athenian understanding of *sophrosune*. Although the “heroes” of Homer’s *Iliad* and the central protagonists of Thucydides’ the *Peloponnesian War* possess the Homeric excellences of skill in battle and the ability to inspire other warriors, they lack the introspective natures necessary to cultivate a *sophron* state of being or moral excellence. Many of these characters are *akratic* because when they do have moments of clarity or revelation, they often do not have the strength of will necessary to act upon the insight they have gained, or they sometimes act in direct opposition to what they know on some level is the greater good. It seems that “control of self” is not sufficient grounds for proclaiming that an individual is *sophron*. Perhaps a more complete definition of *sophrosune* may be the vigilant cultivation of and care of the soul, which requires constant introspection and self-reflection. This perpetual state of contemplation leads to concentrated self-awareness, moral excellence, and the ability to consistently act in a *sophron* manner.

Although many prominent Athenians claimed to be *sophron*, it is clear that they did not completely comprehend the meaning of the term. It is interesting to note that in a culture that

These three states represent only 8% of the total U.S. state lotteries so it would be premature to conclude that the misery index is absolutely not a predictor of lottery sales. Additional analysis will need to be completed to determine if the misery index is an indicator of lottery sales in the U.S or perhaps other factors are indeed the driver for lottery sales. However, these preliminary results contradict those that would believe that lotteries benefit when the economy worsens.

### **Biography**

Ms Clark has been with Henderson State University (HSU) since 2003. Ms. Clark teaches a variety of courses in information systems in the School of Business. Prior to coming to HSU Ms. Clark taught at the Dona Ana Branch of New Mexico State University. She has extensive experience in web-based teaching tools along with practical experience as a former vice-president for the New Mexico Lottery. Ms. Clark earned a BS and BA at the University of Missouri and her Masters of Business Administration at New Mexico State University.

Mr. Ken Green, Jr. is an Assistant Professor of Management at Henderson State University. He received his D.B.A. at Louisiana Tech University in November, 2001. His research interests include Ethics, Strategic Human Resource Management, and JIT Selling.

Dr. Paul J. "Jep" Robertson is an Associate Professor of Accounting at Henderson State University. Dr. Robertson received his Doctor of Business Administration degree from Mississippi State University in 1989 and has authored a number of articles in both academic and practice oriented journals. Dr. Robertson has also served on the governing board of the American Accounting Association, consulted with leading academic publishers and has had extensive experience in the financial services industry.

Missouri	Pearson Correlation	* -.742
	Years	18
Texas	Pearson Correlation	-.214
	Years	12

\* - Correlation is significant at the 0.01 level (2-tailed).

The regression analysis is presented in Tables 3; it includes results associated with the adjusted lottery sales as the dependent variable and the misery index as the independent variable. The results indicate that variation in Louisiana lottery sales is not sufficiently explained by variation in the misery index. The standardized beta is not significantly different from zero. The misery index cannot, therefore, be used to predict Louisiana lottery sales.

The Missouri sales figures are significantly and negatively related to the misery index. The coefficient of determination (R Square) is .55 indicating that 55% of the variation in Missouri sales is explained by the variation in the misery index. The standardized beta (-.742) is significant at the .000 level indicating that the misery index is a good predictor of Missouri lottery sales.

The results of the Texas lottery sales and misery index regression indicate that variation in Texas lottery sales is not sufficiently explained by variation in the misery index. The standardized beta (-.214) is not significantly different from zero (p-value = .504). The misery index cannot, therefore, be used to predict Texas lottery sales.

Table 3. Regression Analysis for Lottery Sales

State	Beta	t-value	Sig
Louisiana	.139	.466	.651
Missouri	-.742	-4.423	.000
Texas	-.214	-.692	.504

Based on the results of the study of these three states, it is not possible to conclude that the misery index is a good indicator of lottery sales for all states. Louisiana has many other forms of gambling available in many parts of the state which perhaps impacts on these results. Further complicating the results is the fact that Missouri has riverboat gambling available in some areas, but not to the extent of Louisiana, which probably impacts the level of lottery sales in a negative manner. Texas has had gaming available on Indian reservations in the past, but it has been discontinued, Texas has also had prize payouts severely limited by legislative action in the past. All of these things in addition to game design, advertising, etc. may have impacted sales in these states.

lottery sales should increase. Therefore we chose to compare lottery sales to the misery index to determine if there is a correlation.

**Methodology**

To assess the relationship between lottery sales in the states surrounding Arkansas and the misery index, lottery sales data for Texas, Missouri, and Louisiana were extracted from the North American Association of State and Provincial Lotteries (NASPL) database and U.S. inflation and unemployment rates were taken from the *2003 Economic Report of the President*. Annual lottery sales figures for Missouri were available for the period from 1986 through 2003. For Texas, figures were available for the period from 1992 through 2003. Sales figures for Louisiana were available for the period from 1991 through 2003. The lottery sales figures were adjusted for inflation using inflation rates computed from the consumer price index series using current methods that were introduced in June 1999. The adjusted lottery sales figures for these states were then analyzed descriptively and correlated with the misery index. Finally, simple linear regression analysis was performed for each state with adjusted lottery sales as the dependent variable and the misery index as the independent variable.

**Results & Conclusion**

Table 1 includes the descriptive statistics for adjusted lottery sales and the misery index. Table 2 displays the correlation matrix for the Louisiana, Missouri and Texas adjusted lottery sales and the misery index. The correlation coefficient, representing the relationship between the misery index and Louisiana lottery sales, is .139 with an associated significance probability of .651. The coefficient for the Missouri lottery sales is -.742 with an associated significance probability of .000. The coefficient for the Texas lottery sales is -.214 with an associated probability of .501. Only the Missouri-sales/misery-index coefficient is significant and negative as expected.

Table 1. Adjusted Lottery Sales and Misery Index Statistics

	Years	Minimum Sales	Maximum Sales	Mean Sales	Std. Deviation
Louisiana	13	\$123,516,510	\$373,839,638	\$241,933,504	\$74,300,423
Missouri	18	\$142,920,585	\$435,016,955	\$265,603,290	\$84,259,868
Texas	12	\$780,673,355	\$2,447,320,002	\$1,864,870,348	\$441,260,991
Misery Index	18	6.06	11.01	8.84	1.59

Table 2. Lottery Sales and Misery Index Correlations Matrix

		Misery Index
Misery Index	Pearson Correlation	1.000
	Years	18
Louisiana	Pearson Correlation	.139
	Years	13

**Lottery Ticket Sales:  
An Empirical Analysis of the Misery Index as a Predictor of Sales**

**Rena K. Clark**  
Assistant Professor of Information Systems

**Kenneth Green, Jr., DBA**  
Assistant Professor of Management

**Paul J. "Jep" Robertson, DBA**  
Associate Professor of Accounting

**Abstract**

This study investigates the correlation of lottery ticket sales with the widely cited misery index. The misery index is often used as an indicator of an economy's performance. The misery index was initiated by Chicago economist Robert Barro in the 1970's. In its basic form the misery index is the sum of the unemployment rate and the inflation rate. However, some economists add interest rates as an additional factor. Observers of lotteries often suggest that as the economy worsens people tend to pursue their economic dreams by purchasing more lottery tickets. This paper analyzes the validity of this hypothesis.

With an increasing number of public constituencies relying on the profits of government-sponsored lotteries, the ability to more accurately predict lottery sales would be of great interest. Although the preliminary study findings for a single state (Missouri) indicate that lottery ticket sales are highly correlated to the traditionally measured misery index, a further analysis found that one of the three states reviewed had a slightly lower correlation. Thus, future research is needed to determine if some other factor would be a predictor of lottery sales.

**Introduction & Background**

In North America every Canadian province, 40 U.S. states, the District of Columbia, Mexico, Puerto Rico, and the U.S. Virgin Islands all offer government operated lotteries. Elsewhere in the world lotteries operate in over 100 countries on every inhabited continent. Total sales for U. S. lotteries in 2003 exceeded \$44 billion. While there is much controversy regarding the benefits and drawbacks of government sponsored lotteries, recent studies indicate that 57 percent of American adults have purchased a lottery ticket in the last 12 months. Proceeds from government sponsored lotteries provide a stream of revenues to a wide range of beneficiaries, including educational scholarships, quality of life programs, and general funds.

What drives lottery ticket sales is a much discussed topic within lottery managers and lottery vendors. Many feel that it is driven by a combination of game design, advertising, prize payout, competition, income levels, discretionary income, etc. This study takes a simpler approach and considers whether sales might be driven by the misery index. Some feel that the poor are the primary lottery players. It might be expected that as the economy worsens, unemployment rises and/or inflation increases. That is, if the misery index increases, then

## Biography

Shanta Sharma received her first M.A. in Political Science from Jabalpur University in India, and second M.A. in Sociology from Bowling Green State University, Ohio. PhD from Wayne State University, Michigan, and Post-doctoral from University of Michigan and Wayne State University. Shanta was a recipient of Fulbright Fellowship and was on Board of Fulbright Fellowship Committee in India. She received National Science Foundation, Department of Transportation, and Department of Education grants before came to Henderson State University. She taught at Wayne State University, Northern Michigan University, Shaw College, Alma College and University of Michigan, as an associate professor. In 1989 joined Henderson State University, and received, Faculty Excellent Award, two Faculty Merit Awards, President and Dean's discretionary travel awards to present papers in International Organization. Since, 1989 Shanta has received 17 Faculty Research Awards, and a number of Faculty Development Awards. Chaired, organized and presented a number of papers in American Gerontological Scientific Society, Southern Gerontological Society, Mid-South Sociological Association, Southern Sociological Association, Michigan Sociological Association, and Arkansas Sociological and Anthropological Association. In 2002, Shanta was President of The Arkansas Sociological and Anthropological Association and since 2001 until 2004 was on Editorial Board of "Spectrum" which is a Mid-South Sociological Association Journal. Currently, she is a member of Women's Committee, Minority Committee, and Professional Committee of Mid-Sociological Association, and Membership Committee of Southern Gerontological Society. Shanta has published numerous articles in professional journals; reviewed books, and abstracts for Gerontological Scientific Society, Southern Gerontological Society, and Southern Sociological Association.

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would create profitable endeavors in order to reduce poverty permanently and irreversibly (Lodge 2002).

## CONCLUSION

In sum, it can be concluded that globalization has significantly improved the world economy, but due to unbalanced and uneven economic growth the world's social and poverty problems are magnified. The interconnectivity among world nations has created a need for a global collective action to combat the world poverty and create a humanitarian and sustainable global world in the 21<sup>st</sup> century. In order to make globalization sustainable and viable requires focus from below which involves interdependence at the grassroots level that aims to protect, restore, and nurture the environment; to enhance ordinary people's access to the basic resources they need to live a dignified existence to democratize local, national, transnational political institutions, and to ease tensions and prevent violent conflict between power centers and authority structures (Brecher, Childs & Culter 1993).

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enhances the others. These priorities can allow the poor to have greater independence and security in their day-to-day lives: for example, (a) empowering women and other socially disadvantaged groups expand their range of economic opportunities, and (b) strengthening poor people's organizations and their involvement in decision making processes enable them to press for improved services and for policy choices that respond to their needs. Finally, making poor people less vulnerable makes it easier for them to take advantage of potential market opportunities (P.2.). These priorities can allow the poor to have greater independence and security in their day to day lives, and would create opportunities to participate in the market.

Further, World Bank in World Development Report (2003) made the following suggestions to work with the problem of the poverty which involves cooperation at local, national and international levels.

1. New alliances are needed at the local, national and global levels to better address the problem of poverty. The burden for development must be shared widely.
2. Rich countries must further open their markets and cut agricultural subsidies that deplete income in third world farmers, and they must increase the flow of aids, medicines, and new technologies to developing countries.
3. Governments in the developing world in turn must become more accountable and transparent, and ensure that poor people are able to obtain secure large tenure, as well as access to education, health care, and other basic services. The burden of guaranteeing sustainable development must be shared locally, nationally, and globally.
4. Developing Countries need to promote participation and subscribe democracy; inclusiveness and transparency as they build the institutions, need to manage their resources.
5. Rich countries need to increase aid, cut poor country debts, their markets to developing countries exporters and help transfer technologies needed to prevent diseases, increase energy efficiency and bolster agricultural productivity.
6. Civil Society organizations contribute when they serve as a voice for dispersed interdependent provides independent verification of public, private and non-governmental performance.
7. Private firms contribute when they commit to sustainability in their daily operations, and create incentives to pursue their interests while advancing environmental and social objectives.

Lastly, the World Development Corporation (WDC) proposed a corporation of all multinational corporations to bring technology credit access to world markets and management know-how to improvised areas. Its projects would need to be subsidized at first but should become profitable in the long run. In addition, linking global corporations to local projects

economic growth has raised a question can this gap between the rich and poor nations will be narrowed rather than widened in the future? This question has made professionals and global society to rethink about the impact globalization and future of rich and poor countries (Renzetti and Curran 1998).

#### RETHINKING AND SUGGESTIONS TO NARROW THE GAP

A number of social scientists believe that it is possible to narrow the gap, but they stress that our goals must be reordered. Instead of concentrating on the rate of economic growth, social scientists and policy makers should pay more attention to the quality of economic growth. Economic growth for the human development, such as improvement in health and education; higher standards of living, and sustain natural resources, should be the priority if we want to avoid future world “gargantuan in its excesses grotesque in its human and economic inequalities” (United Nations Development Programme 1996, P.8). If we continue to focus on the rate of economic growth only, we will likely to create a world where people will be “jobless, voiceless, rootless, futureless, and ruthless (United Nations Development Programme 1996).

Ahmed (2002), proposed that “ ----the only real way to address the escalating social, economic and political problems faced by the majority of the world’s population as a result of globalization is to transfer the unjust structures responsible for these problems. The current world order is geared inherently to fulfill the interests of corporate elite based primarily in the West, directly at the expenses of the rights, and well-being of hundreds of millions of people around the world. Unless World order undergoes a meaningful and drastic transformation of structure the basis of a fundamental re-evaluation of values, ethics and world view, this order will continue to be increasingly engulfed by a crisis of its own making with devastating consequences”(P. 27 ).

A detailed World Bank study (2000/2001) concluded that economic growth is crucial but often not sufficient to create conditions in which the world’s poorest people can improve their lives. But we also recognized the fundamental role of institutions and social changes to strength the development processes and the inclusion of poor people. The study made recommendations that the developing countries, governments at all levels, donor countries, international agencies, N.G.O.’s, civil society, and local communities mobilize behind three priority areas:

1. Opportunity: Expanding economic opportunity for poor people by stimulating economic growth, making markets work better for poor people and working for their inclusion, particularly by building up their assets, such as land and education (P.2.).
2. Empowerment: Strengthening the ability of poor people to shape decisions that affect their lives and removing discrimination based on gender, race, ethnically and social status (P.2.).
3. Security: Reducing poor people’s vulnerability to sickness, economic shocks, crop failure unemployment, natural disasters and violence and helping them cope when such misfortunes occur. Advances in these areas are complementary. Each is important in its own right and each

and jobless adults are roughly the same. The practice [i.e., child labour] perpetuates poverty. These children grow up to become the next generation of uneducated and untrained adults (Jehl 1997). With the World Trade Organization legislating for the rights' of corporations in the name of "free trade: nations are unable to prohibit child labour without violating international trade rules enforced by Western institutions The response of the Western Powers to this state of affairs is instructive. The U.S. Government for instance has resorted only to the insignificant public relations stunt of requesting companies to adopt a 'voluntary' code of conduct (Collingsworth 1997). According to International Labor organization children's work conditions are frequently exploitative and abusive. Work long hours in unhealthy environment for subsistence wages. In Pakistan, for example nearly 10,000 children under the age of fourteen work 10 hours a day hard-sticking leather soccer balls, for a daily wage of about \$1.20 (Greenhouse 1997). Children beating, imprisonment, homeless, and abandonment by parents are common. Children of six years can be found on street. Nearly 13 million children on streets in Latin American countries. In most Latin American cities begging, selling sex or drugs or stealing is in order to survive. Children sleep on the sidewalks, in alley under bridges and even in sewer tunnels (El Nasser 1994). In Brazil, several hundred street children are murdered each year by the police (Larmer 1992).

"The rise of global inequality and impoverishment within the current order has therefore been enormous, systematic and relentless. Western pro-corporate policies are however, domestic as well as international, resulting in the increase in domestic impoverishment and inequality. Thus, even within the richest countries inequalities have widened and poverty increased "(Ahmed 2002., P. 13).

#### WHERE ARE WE WITH GLOBALIZATION?

The evidence suggests that in the past century more advances have been seen in global prosperity and more people lifted out of poverty than in all human history. There are many reasons for this achievement, but globalization has played an important catalytic role. World poverty has fallen dramatically in the past 30 years. For example, since 1970's the development in China and India has played a significant role in reduction of the world poverty. However, economic growth is not balanced across the globe. Some countries have witnessed tremendous growth and others have fallen in poverty. For example the Sub-Saharan Africa requires greater focus to deal with poverty (Barro 2002). The present uneven economic growth trend has widened the gap between developed and developing countries. According to economic forecasts if the current pattern of uneven economic growth continues, the poorest countries of the world will grow even poorer while the richest countries will become even richer. For example it is estimated that by 2030, global production will triple. However in Sub-Sahara Africa, per capita income will fall to just \$32 a year, whereas in high-income countries, average per- capita income will approach \$40,000. Many of the countries of East Asia are expected to catch up to the high-income countries in terms of per-capita income. By 2050, china's per capita income is not likely to approach that level until at least 2080, and India's will not reach the \$40,000 per capita mark until about 2130 the twenty second century (United Nations Development Programme 1996). The present world unbalanced and uneven

## ECONOMIC INEQUALITY AND POVERTY

The United Nations Development Programme (1996) created three basic minimal essential criteria which are essential for human requirements (to be well nourished, to be able to reproduce, and to be educated) to measure the poverty, which was defined as Capability Poverty. According to Capability Poverty as a measure, the number of people who are poor world wide increased from 1.3 billion (33 percent) to 1.6 billion (37 percent). Capability poverty appears to be most widespread in South Asia. In Africa, both income poverty and capability poverty are high. In contrast many countries in Latin America have done well in addressing capability poverty but income poverty remains severe. The global poverty is disproportionately found in the United States among women and children also (Renzetti & Curran 1998).

## GENDER AND GLOBAL POVERTY

Few societies in the world treat women as well as men. Inequality between men and women are not necessarily less in high income countries, but in disadvantaged countries on global scale, women are likely to be even more disadvantaged. Women in these countries experience double deprivation. The deprivation of living in a poor country and deprivation imposed because they are women. According to United Nations women represent 60 percent of world population and perform nearly two-thirds of all working hours, they receive only one-tenth of world income and own less than one percent of world property (United Nations Commission on the status of women 1980).

Further, across the strata women are more likely than men to be illiterate. It is estimated that 24 percent of the world's adult population is illiterate, of that 30 percent of the world's female adult population is illiterate. In low income countries the illiteracy rate for women is nearly 46 percent (United Nations Development Programme 1996). Indeed in most countries throughout the world, women are the most disadvantaged of the disadvantaged.

## CHILDREN AND GLOBAL POVERTY

The burden of poverty is spread unevenly throughout the world with population of low income countries suffering is far greater due to more severe poverty than other countries in the global stratification hierarchy. In low-income countries the poorest households tend to be those with the greatest number of children or economically dependent members (elderly or diseased people). Twenty five million children between the ages of five and fourteen are in the paid labor free in virtually in all countries, including United States, it is particularly prevalent in Asia, where 150 million children are in the labor force and in Africa where approximately 80 million children are working (Renzetti & Curran 1998). According to Development Specialist Susan George (1999), "Half of these millions of child labourers working in "outrageous conditions" are under 14 years old. The advantage for corporations is that they receive "three compliant and defenseless children for the price of one adult. The result of repression is to drive down wages and replace adults". For example in India, the numbers of working children

## GAP IN EDUCATION

The gap in education and quality of life is particularly striking. Only about 20 percent of school-age children in poor countries enrolled in Secondary School compared to 90 percent in affluent countries. In wealthy countries 40 percent of college age people go to college; in poor countries only 30 percent do. The number of children die before the age of five is nearly 20 times higher the age of poor countries than in rich one (Bradshaw and Wallace 1996).

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## GAP IN MEDICAL TREATMENTS

The vast majority of HIV infected people around the world don't have access to the effective drug treatments that are available in the west. Consequently, the AIDS cases and AIDS deaths are dropping in Western industrialized countries but are increasing dramatically in less developed countries. According to the United Nations, of the 26 million people worldwide infected with HIV virus, 30 million are poor by world standards; living on less than \$2 a day. Impoverished countries in Sub-Saharan Africa, alone, account for 69% of the World's victims of HIV and AIDS (Will 2000). In Botswana and Zimbabwe, for instance, one in every four adults is infected. In some major cities, 70% women in prenatal clinics test positive for HIV (Altman 1998). In 1999 alone, more than 2 million Africans died of AIDS. That's more than five times the number of AIDS-related deaths in the United States in nearly two decades (Will 2000), and it is estimated that between one half and two thirds of 15 years olds in these African countries will eventually die of AIDS (Altman 2000).

## THE GLOBAL ECONOMIC INEQUALITY

Trends in global inequality are found both between and within countries. Inequality between the countries has been characterized by two divergent trends in recent decades. The gap between the richest and the poorest countries over the past 40 years has been widened and a significant number of countries have fallen further behind compared not only to industrial countries but to other developing countries also. The income distribution between countries has consequently worsened. However, at the most populous ones, the gap between their average incomes and that of industrial countries has begun to narrow. Overall, inter-country inequality weighted by population has decreased as a result, China and India account for the bulk of this improvement while inter-country inequality has improved; however inequality within many of the most populous countries with a large number of poor has increased modestly (World Bank, October, 2002).

lower-class people within a society similarly, wealthy countries can exploit poor countries in the global market place. In consequence of it the global economic gap has widened (Newman 2002).

#### GAP IN INCOME

The average per capita yearly income in Western Europe, the United States, Canada, and Japan is about \$22,000. In the less developed countries South America, Asia, and Africa it's a little over \$300 (Bradshaw and Wallace 1996). Thus, wealthy countries contributing 20% of the world's population accounts for 65% of the world's income. In contrast, less affluent developing countries account for 67% of the world's population but only 18% of its income (McMichael 1996). Assets held by the world's 200 wealthiest individuals total \$ One-trillion, for an average of five billion each. After doubling since 1995, their total wealth equals the combined annual income of the world's 2.5 billion poorest people, meanwhile eighty nations reported incomes lower than a decade ago. Sixty countries have grown steadily poorer since 1980. Three Billion people presently live on \$2 or less per day while 1.3 billion get by on \$1 or less (Jeff 2001). The richest three individuals in the world have assets that exceed the gross domestic product of the 48 least developed countries (Crossette 1998). "For instance, the 400 wealthiest U.S. citizens hold financial assets equivalent to one-eighth of the gross domestic product of the world's largest economy Their personal wealth grew by an average \$940 million each from 1997 to 1999 – a per capita daily increase averaging \$1,287,67 (\$225,962 per hour). Eighty-six percent of stock market gains between 1989 and 1997 flowed to the top 10 percent of U.S. households while 42 percent went to the most well-to-do one percent" (Jeff, 2001 P.2). Further eye-opening statistics reveals disparity between the over-consumption and under-consumption between the wealthy and poor countries (cite in Newman 2002):

1. Wealthy countries consume 85% of the world's supply of paper, 79% of its steel, 80% of all commercial energy, and 45% of all meat and fish (Crossette 1998; Kerbo 1991; & Schor 1991, cited in Newman 2002).
2. Grains fed to U.S. Livestock equal the amount of food consumed by the combined human populations of India and China (McMichael 1996, cited in Newman 2002).
3. A single child born in Western Europe, Japan, or the United States uses as much of the earth's resources as an entire village of African children (Steiner 1998, cited in Newman 2002).
4. Americans spend about \$8 billion a year on cosmetics-\$2 billion more than the estimated annual amount needed to provide basic education for everyone in the world (Crossette 1998, cited in Newman 2002).
5. Europeans spend about \$2 billion a year or more on ice cream than the estimated amount needed to provide clean water and safe sewers for the world's population (Crossette 1998, cited in Newman 2002).