

THE MAGIC THAT BINDS US:
STRESS AND SUPERSTITION

by

DONALD THOMAS MARKLE

ABSTRACT

Magical thinking is all around us; it influences our thoughts, actions, and culture. Although magical thinking is a large part of everyday life, there has been little research attempting to determine the possible evolutionary reasons for its seemingly counterproductive existence. This thesis proposes a theory that magical thinking can be used as a moderator of anxiety in order to improve an individual's performance on a task. This study examined the correlation between magical thinking and performance, by having 70 students from the University of Georgia take a cognitive exam during which half of these students were aided by a talisman, while the others received no aid. Results are consistent with the proposed theory; however fail to provide definitive evidence to support it. Data reports that in that in low stress situations, magical thinking has little influence on performance. Further research is needed to determine the influences of magical thinking in highly stressful situations.

INDEX WORDS: Magical thinking, Stress, Anxiety, Evolution, Task performance, Superstition, Religion.

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CHAPTER 1

INTRODUCTION

Everyday people, young and old, from all parts of the world make the same logical error. They use magical thinking to substitute correlations between objects for causal relationships and fail to recognize that association. An example of this phenomenon would be a young student, who is adamant about using his “lucky pencil” to take that week's in-class spelling quiz, a conception that he has because the previous week when he used that very same pencil he got a perfect score. In this case the student wrongly believes that because the pencil was used during the first examination, the test on which he received a perfect score the pencil used during that examination then becomes a necessary component of a repeat performance. We as outside observers are aware that his performance on the spelling test is largely due to his innate spelling ability, the amount of time and effort put into studying material, as well as how motivated he was to perform. Yet, although we are often aware of more direct causal influences, people are very sensitive to these magical beliefs and choose to make many decisions in life as a result of them.

Ironically, the reality of the situation is far worse than simply missing a logical error, rather instead of identifying their assumption and acknowledging it, individuals will believe whole heartedly that they have made a sound and rational decision which is reflective of their best interests. This often repeated mental error highlights a curious cognitive conundrum, which at first glance seems to be completely counterintuitive.

One might expect that one of the key features of a cognitive system would be its ability to accurately reflect reality, insuring that an individual could base their decisions and behaviors off of a lucid representation of the world around them. The human propensity to engage in a line of thinking, which by its end results in massive and glaring cognitive errors, would seem to counter evolutionary theory. One would expect to see that throughout the course of human physical evolution that our cognitive processes and modes of thinking would be evolving as well. We assume that such processes would be modified throughout time so that our mental processes would be acutely refined so that they would abide by strongly logical constructs from which decisions about behavior would be based. However, the fact that one of the core structures are cognitive development does not rely on logical relationships, perhaps highlights some of its significance. Therefore, the essential question becomes, does the genesis of this cognitive structure have a purpose? If so, what are some of the key implications that can be drawn from it in areas which are directly related to that of human cognitive development and information processing in the field of education?

When we look at the progression that normal mental development takes, as individuals mature, we see a gradual trend towards greater accuracy, as well as a greater dependency upon logical principles (Markovits & Vachon 1989). However, there is one great mystery in our journey of cognitive development which violates an otherwise stable pattern of growth, and that is the advent and application of magical thinking. Magical thinking is a method of thinking, in which one believes that their thoughts words or actions will be able to influence reality in a way that fails to be supported by scientific evidence or causal reasoning. We typically see it employed in the form of superstitions,

magical rituals, and religious practices. When viewing the world through the lens of magical thinking, correlations between objects become the focus of thought. Everything is able to be tangentially linked through associations of proximity, temporality, or mimicry. Research has suggested that magical thinking developed in children from a very young age and is the primary mode of thinking about the world for at least the early stages of development (Piaget 1928). Then as children mature and become more cognitively advanced either magical thinking is usurped by more formal logical structure or becomes dormant as more logical methods to thinking are developed, in either case, the older children get the less they rely on magical thinking as a primary mode of interpreting the world. Although the use of magical thinking appears to wane as humans develop throughout childhood, it never fully disappears. Humans are very resistant toward completely abandoning a magical view of the world.

Individuals calculate important life decisions solely on evidence provided by sources such as astrology, mythology, folk superstitions, belief in luck, often in addition to various forms of religious faith. Even individuals who are well schooled in the areas of critical thinking and logical analysis will act in ways which directly defy their years of educational experience, purposefully behaving in accordance with superstitious statements when placed in high risk situations (Rozin, Millman, & Nemeroff, 1986). This apparent contradiction between knowledge and subsequent behavior has prompted some researchers to reexamine the fundamental assumptions which have previously been used as theoretical a framework to guide discussions about the purpose of magical thinking in humans, shifting from a view of useless foolish folktales toward an evolutionarily adaptive purpose (Wilson 2001).

Although it was once believed that magical thinking was only useful in children's fantasy and old world folk tales, magical thinking is now perceived as a real and observable part of life¹. Each day people talk to their cars in an attempt to coax a dying engine to start, others take indirect paths to avoid walking under ladders, and still more adorn talismans and pendants for protection and guidance as they go about their daily activities. Such actions defy our normal understanding of the causal workings of the world. It is known that such beliefs are unsupported by logic and consistently fail under scientific scrutiny. Yet individuals hold out hope that the laws of physics will be suspended for either their benefit or the detriment of others. It is in this disregard to causal relationships, that superstitious actions are allowed to continue to play a substantive role in the lives of humans, impacting both mundane and monumental decisions alike.

Superstitions, a subset of a larger category of magical thinking, have influenced human behavior for thousands of years. The Ancient Greeks believed that any reflection of a man contained a part of his spirit; therefore special care was taken around reflections to avoid damaging the non-corporeal soul (James, 1961). Later during the height of the Roman Empire, this belief served as the catalyst for the creation of the still modern superstition that breaking a mirror will cause seven years of bad luck. In Chinese culture the number four is extremely unlucky and even an omen of impending death; this is due to the fact that the character "four" is verbally pronounced as "*sei*" which shares the same sound as the character representing "death" (Panesar, 2003). In many high rise buildings floors numbered 4, 14 and 24 are all skipped for fear of being connected with

¹ A Gallup poll conducted in the United States in 1994 showed that 79% of Americans who were polled believed in miracles, and 28% believed in communication with the dead.

death. The prevalence of magical thinking extends across cultures and may be encountered in almost every human society. This prevalence implies that all humans naturally develop with the capacity for magical thinking and that the creation of superstitions is not culturally specific but perhaps universal.

While there have been past studies, which have examined the role of magical thinking has on decision-making in adults, as well as the influence it has on the beliefs of children, there has been no research to, my knowledge, which examines the question of whether magical thinking directly influences the regulation of anxiety and overall performance of individuals. While research has been conducted which reports a strong relationship between level of anxiety and personal performance, as well as research which indicates that under high levels of stress people tend to be more superstitious, these two ideas have never been unified together as one cohesive study.

CHAPTER 2

LITERATURE REVIEW

As we move from a cultural perspective of superstition to an examination of the individual, the psychological reasons for the occurrence of magical or sympathetic thinking become increasingly clear. The idea of magical thinking began to take hold in the field of developmental psychology with Jean Piaget who chronicled the development of causal thinking in infants and children (Piaget 1928). Magical thinking was thought to be derived from pre-causal thinking, otherwise known as natural causality, a rudimentary form of logic used by young children. Pre-causal logic is believed to begin developing when a child enters Piaget's third developmental stage "Magico-Phenomenalistic Causality", which is marked by the beginning of secondary circular reactions (Piaget, 1954). The third stage which normally occurs between 3 to 7 months in age is where infants first begin to associate a connection between mental intentions and physical effects in the world (Piaget, 1954; Subbotsky, 1993). During this stage, children develop two forms of pre-causal thinking, efficacy and phenomenalism, both of which are important in the formation of magical beliefs (Piaget, 1954; Zusne & Jones 1989). Efficacy is the belief that internal feelings and wishes are the cause of events and phenomenalism is the belief that proximity in time or space between events suggests that one has caused the other. Research suggests that as children age they begin to adjust their ontological beliefs about reality. Between the ages of 5 and 9 years children move from using a primarily pre-causal understanding of the world to a primarily causal view (Piaget, 1928; Carey, 1985; Subbotsky 2004).

However the leap from pre-causal to causal thinking is in no way a fully transformative one; research supports the idea that, although cognition naturally evolves into a mode of understanding the world through causal logic, humans never completely stop from reverting back to magical thinking from time to time. Fully formed adults still use sympathetic reasoning on a regular basis. A 1986 study by Roniz, Millman, and Nemeroff found that college students were reluctant to select sugar in a clear glass shaker which had a label of sodium cyanide attached to it, even though those very same students were the ones who poured the sugar from a store bought container into the shaker and placed the label on the shaker themselves. Cottrell and colleagues (1996) noted that 93% of college students believed that they were able to feel the unseen stare of others and also believed that they could detect people staring at them (Cottrell, Winer, and Smith, 1996). In cross cultural work, participants in both Mexico and Great Britain were reluctant to place their hand inside a covered box and have the experimenter cast a magical spell on their hand, after witnessing a deception in which a spell was cast on an object placed in the same box and which was retrieved damaged (Subbotsky & Quinteros, 2002). The participants in the experiment were unwilling to dismiss the possibility of magic being the cause of the defacement. These studies collectively indicate the commonality of such mental slips back into pre-causal logic is what enables superstitions and magical thinking to take root in our everyday lives. The triggers for reverting back into a sympathetic mode of thinking hold clues for why such beliefs exist today.

The first signs that magical thinking might be directly related to level of anxiety appear with the work of Bronislaw Malinowski (1954) an anthropologist who documented the use of magical rituals in primitive societies. From field observations he

noted that the level of uncertainty members of traditional societies perceived about future events was directly correlated to their use or disuse of magical rituals. His work revealed that Melanesian Islanders would refrain from using magic for routine tasks such as planting crops, the construction of shelters or boats, and fishing in the placid waters close to the village. In these tasks the islanders had developed a strong level of confidence, based on years of tribal knowledge; the familiarity in repeating such tasks lead to a sense of certainty about the causal outcome. However, magical rituals were commonly used prior to events in which the uncertainty of the outcome was high such as when attempting to cure illness, influence weather patterns, and sail into deep ocean waters. Research conducted by Padgett and Jorgenson in 1982 indicated that public interest in superstitions rose with the decline of the German economy from 1918-1940. As the economic situation became more desperate and inflation and unemployment sky rocketed in that country, the rise in the public level of anxiety was matched by that of interest in occult and superstitious material. Additional evidence between anxiety and superstition comes from research conducted during the height of the first Gulf War with Israeli citizens. Surveys were given to Israeli citizens living in both high risk and low risk areas for scud missile attacks. The results indicated that people living in high risk areas had both higher levels of stress as well as higher levels of magical thinking, whereas people living in low risk areas had lower levels of stress and less magical beliefs (Keinan,1994). Additional research has demonstrated that high levels of stress, in this case mortality salience, led to a greater likelihood of belief in superstition compared to a control group (Norenzayan & Hansen, 2006).

Magical Thinking and Psychological Variables

Evidence of the correlation between magical thinking and anxiety has come from researchers studying Obsessive Compulsive Disorder (OCD). Many people who suffer from OCD have also developed complex rituals and superstitions in an attempt to reduce their levels of anxiety they feel. Einstein and Menzies (2006) administered psychological tests for magical ideation and OCD symptoms which revealed a strong positive correlation between magical thinking and OCD severity. Work by Ivarsson & Valdergaug (2006) conducted with 213 patients at an anxiety clinic for treatment for anxiety or OCD indicated that 33% of participants relied on magical thinking. Other research suggests that there exists a strong connection between obsessive-compulsive characteristics and magical thinking in non-clinical subjects (Frost, Crause & McMahon 1993; Zebb & Moore, 2003). The research conducted on the topic of anxiety disorders and superstitions suggests that magical thinking is primarily used in adolescents and adults as a form of coping.

Anxiety and stress may have debilitating effects on a person's lifestyle and happiness. Research evidence supports the assertion that participants who are experiencing stress perform significantly worse on mental tasks that require the use of working memory than participants who are stress free (Darke, 1988). Schell and Grasha (2000) found a similar outcome when, participants were placed into a simulated pharmacy situation in which they were to dispense the correct prescription and number of pills for each order. In that study, stress was applied as amount of time given to complete the task. The researchers found that there was a direct relationship between anxiety and accuracy in a performance when higher levels of anxiety were created, the participants

committed more errors. Other research that has focused on the forced removal of a superstitious behavior, previously used during a task which is performed in an anxiety producing environment, decreases the performance level of individuals (Foster, Weigand & Baines, 2006).

Providing a Theoretical Framework

One method of interpreting magical thinking and superstition is through the framework of evolutionary psychology. The field of evolutionary psychology attempts to explain mental states and psychologically controlled behaviors as adaptations which have evolved either through the process of natural or sexual selection. When investigating psychological traits from this philosophical lens one can examine the possible function of a trait by the possible survival benefit it would induce. In theory traits which have the greatest degree of fitness for individuals in a specific environment, would allow those individuals to prosper and easily pass on their genes to future generations. In contrast, individuals who lacked such a trait would in turn have less fitness, and struggle to pass their genes to the next generation. Following this line of logic we can assume that many of the behaviors in an individual today represent various forms of fitness that had use in the past.

When magical thinking and superstition are thought of as operating within an evolutionary framework, there is a potential gain in inclusive fitness for an individual who is able to revert back to using precausal thinking, specifically in situations of high stress and anxiety, over one who fails to possess such ability. In a situation where one lacks a complete understanding of a state of affairs, as often is the case in life, it becomes

difficult to use a purely logical method to abate the stress of the unknown. There are too many missing variables, which are unable to be accounted for, to be able to deduce a rational answer as to how to properly respond to the event. However, with the use of precausal logic, the gaps in knowledge can be filled in using a belief set containing imaginary correlations between the known and the unknown. In constructing a view of the world using this magical thinking, possible methods for mitigating or coping with stress and anxiety become apparent through the false correlations. By behaving in ways that satisfy one's correlated beliefs between the known and the unknown, stress and anxiety will abate. As the stress level of an individual is reduced, so is the load being placed on an individual's working memory from that stress, in turn the freed working memory can be allocated for more productive uses. The increase in mental productivity would be a survival advantage to the individual. This theory may help explain why humans retain the ability to switch between precausal and causal thinking even after the latter is fully developed. In many cases the more accurate logical processes usurps the less logical processes which came before it. The development of the mental rule of conservation is a good example of this; young children will often mistake stating the amount of water has changed after seeing one of two equally filled vials poured into a differently shaped vessel (Bjorklund, 2005). Once a child has come to understand that matter is conserved regardless of the shape it takes, he abstains from falling back to his pre-discovery belief set. The ability to change how logic is used no longer exists once the upgrade is made, it is a permanent change. However with causal and precausal thinking this is not the case.

In Malinowski's (1954) ethnographic work he elucidates how an island tribe uses magical rituals to prepare for risky fishing in the unfamiliar deep water. If one was to contrast the islander Malinowski describes, with one who lacks the ability to use pre-causal thinking, clear survival differences between the two would emerge. For example, if the two individuals were placed into the unfamiliar and stressful situation of having to fish for food in the unknown deep waters off of an island. The individual being equipped with the mental faculties which allowed him to use magical thinking would prepare for his dangerous journey by performing the necessary magical ritual, in effect calming his anxieties and freeing his working memory for the task ahead. The individual who could only use a purely logical form of thinking would be forced to think about the events ahead, but by having no way of knowing what could happen, he lacks the ability to rationally calm his fears. In this example neither of the fishermen knows what awaits them in the deep, and in reality it is impossible for them to know. However, for the one able to use magical thinking to reduce anxiety by performing an action or ritual before his journey is an evolutionary advantage.

Although this line of research has theoretical implications for evolutionary psychology, as well as those interested in the early development of religious beliefs, pragmatists can look towards education and clinical counseling for a more practical use of research on magical thinking. In the field of education, the topic of test anxiety has been a great concern to educators since the pioneering research conducted by Walter, Denzler, and Sarason (1963) which strongly suggests that test anxiety is a significant factor in negative test performance, however lacks significant correlation to a student's GPA; entailing that even a strong student can be overwhelmed by test anxiety causing

him to perform poorly. A meta-analysis of 562 studies found that there is strong evidence supporting the claim that test anxiety causes poor test performance (Hembree, 1988). In studies as varied as a driver's license road test (Fairclough, Tattersall, & Houston, 2006), to specific working memory tasks such as digit span recall (Hadwin, Brogan, & Stevenson, 2005), test anxiety degrades the quality of human performance. Evidence suggests that test anxiety causes a student to need more time to complete a task compared to a stress free student (Richards, French, Keogh, & Carter 2000; Hadwin et al., 2005).

The majority of research suggests that student's accuracy fails to be impugned by stress when given enough time. Mental recall of a backwards digit span task required on average ~150 seconds for the control group and ~450 seconds for the high anxiety group (Hadwin et al. 2005). Sadly, in everyday situations most tests are bound by logistics to adhere to some measurement of time, and therefore anxiety will often impact a student's score by causing them to run out of time. When test anxiety is reduced student performance on difficult material improves, returning to the same level as low anxiety students (Hembree 1990; Shobe, Brewin, & Carmack, 2005). Research also suggests that it is within the power of teachers to employ methods to help mitigate test anxiety in their classrooms (Supon, 2004).

A clear understanding of working memory is essential for grasping how it is that magical thinking may be influencing performance. Working memory for the current study is defined as the mental faculties used for manipulating information and temporarily storing information. On a more basic level, working memory may be thought of as conscious thought, or as a mental work bench from which we do mental analysis.

The voice you hear in your head when you are reading, or the mental picture you get when thinking of the Mona Lisa are both examples of working memory in action. Although we all have very intimate and intuitive knowledge of what experiencing working memory feels like it is difficult to express in words.

There are many theories which describe working memory, but the original was first proposed by Baddeley and Hitch (1974). They proposed that the working memory was comprised of two subsystems which were controlled by one executive system. One of the subsystems named the phonological loop is used in the repetition of language and sounds, the other subsystem named the visual-spatial sketch pad is used in mental maps, visualizing images or objects, and spatial manipulation. It was believed that these two subsystems were then monitored by the central executive serving as a traffic cop, for information; focusing the mind on pertinent and relevant information, and suppressing information which was currently irrelevant. Any time one has experienced wandering or distracting thoughts your executive system is failing at it's job.

Even though constructing a complete definition of working memory is clearly a difficult task, researchers have made progress in coming to understanding some of the core facets of how working memory functions. A universal characteristic of human working memory is the total number of objects that it can hold onto at one time, which has been set as seven plus or minus two (Miller 1956). This means that most people can actively manipulate seven units of information at once, without losing or forgetting information. As an example most people can hear a list of seven random numbers read to them consecutively, and afterward they can recite the entire list correctly. They are able to recount all seven numbers because the mind was able to hold onto a mental

representation of each number read to them, while still being able to focus on the incoming information of each number being read. However, if the quantity of random numbers was increased to fifteen, we would see that people are unable to remember the entirety of the larger list because the mind cannot hold onto that many units of information at the same time. In one sense we simply run out of space to hold onto information all the information which we are perceiving; much like a glass which is full of water, any more water added will overflow.

The working theory used in this research is that magical thinking and more directly the use of superstitions are examples of inclusive fitness, which are employed by humans as one method of dealing with extreme stress or anxiety. During these times of high anxiety, the mind permits the creation of pre-causal connections between events when previously there was none, establishing a level of understanding and comfort where once there was only ambiguity and fear. To date, no research has adequately tested the effect of equipping a person with a superstition and consequently measured their performance in a controlled setting. Therefore, the research question proposed for this investigation is the following: during a stressful event does the use of a superstitious belief have an effect on performance? The hypothesis is that superstitious beliefs will have a positive effect on the performance of a task during a stressful situation by freeing working memory which would otherwise be consumed by anxiety.

The data gathered for the study is by its very nature directly linked to each individual who participates in the study; however it is expected that the results established by the participant pool will be able to be generalized out to the much larger segment of the total human population. The previous assertion is based on the strong

evidence that superstitions and magical thinking exist in almost every recorded human culture in the world (Frazer, 1922); therefore an assumption being made by this researcher is that the possible benefits of magical thinking would be able to be generalized to all humans, regardless of cultural up-bringing, race, gender, or age.

CHAPTER 3

METHODOLOGY

Participants

Convenience sampling was used to gather the population for the study, which was comprised of 70 undergraduate students from the University of Georgia; all of whom were enrolled in a psychology course at the university which requires student participation in the psychology research pool. These students are required to participate in various psychological experiments to gain insight into the process of psychological experimentation, as well as for class participation credit. Therefore, all students who participated in the study were recruited from the University of Georgia psychology research pool. The participants in this study were 37 females and 33 males, between the ages of 18 and 22. The participants' ethnicity was representative of the UGA undergraduate student profile. No potential participant was excluded from being able to participate in the study, based on their intellectual capability, as all tasks which the participants were asked to complete, should have been able to be easily accomplished by any undergraduate student at an American university. All participants in the study self-selected this particular experiment out of a list of many that were available from which to choose.

Before the analysis of the data, two participants were removed from the experiment and are not represented in the final data set. One of the participants was removed for failure to follow the experiment protocol and, the other was over seven standard deviations above the mean on the amount of time that the individual needed to

complete the exam, and was unable to complete the examination without attempting to use a cellular phone as a calculator.

Procedure

The first stage in becoming a participant in the study was for UGA students in the psychology research pool to sign up for the experiment using the Internet and accessing the university's research database. When the participants self-selected the experiment, they also choose an appointment time in which to participate. Participants arrived at their selected date and time and began by signing the informed consent paperwork. Once participants signed the informed consent form, they were randomly placed, but controlled by gender, into either the control group or the experimental group. Gender was used to insure equal male and female representation in both the control and experimental groups. The time involved for participants in the study totaled approximately 20 minutes from consent to the completed debriefing.

Participants who were placed into the control group were led to a room which contained only a desk and two chairs, and were asked to sit at the desk. The participants were then provided with their choice of a pen or a pencil with which to write. Participants were verbally told that they were about to take a cognitive test, and that they should, respond to each question to the best of their ability, and asked if they had any questions about what they should do. After the participants confirmed that they were ready to begin they were given a copy of the cognitive test, on which they could write. Once the participant was in possession of the exam, the experimenter started a stopwatch and waited for the subject to indicate that they had finished the examination, at which time

the stop watch was stopped. After the completion of the examination the test was taken from the participant and placed into an envelope. The participant was then given a copy of the debriefing form, and which was explained by the researcher, and in addition the experimenter gave further explanation into the hypothesis of the study as well as the central research questions the study was aiming to answer, namely that the study was measuring the impact of magical thinking on test performance during a low stress situation for young adults (i.e., cognitive testing).

All participants who were assigned to the experimental group followed the same procedure as that of the control group, save for one key difference; before the participants in the experimental group were allowed to take the examination they were told about the superstitious significance of the Pictic knot, an ornamental design used in Celtic history. Participants were told that the knot was used as a charm by warriors who were going into battle for good luck and protection. After being told about the importance of the knot, participants were asked to hold a bracelet sized knot, which had a Celtic design and was made out of hemp twine and seashells. The participants were then told that they were to continue to hold onto the knot in their non-dominant hand for the entire amount of time that it took them to complete the cognitive test and that this knot would aide in their performance on the examination by increasing their luck. In addition, they were told that other participants who had held onto the talisman had performed exceedingly well on the cognitive examination. The participants were then asked to be open to the possibility that the assertions about the luck of the knot are true. All other aspects of the experimental group's experience of participating in the study were the same of that of the control group.

CHAPTER 4

RESULTS

This chapter presents results of a series of analyses conducted between experimental and control groups. The first examines the length of time measured between groups to complete the cognitive task. The second is a comparison of the total score on the cognitive task between the experimental and control groups. In addition, a correlational analysis was performed to examine the relationship between the participants' total score and the length of time to complete the cognitive task. Subsequent analyses were also conducted to examine gender differences on both time to completion and total score. A regression analysis was performed to assess whether gender of the participant or experimental condition would predict the amount of time required to complete the cognitive task.

Analysis 1

The first analysis performed was to test for differences between the experimental and control groups on the time required to complete the cognitive task. The length of time was measured in number of seconds to complete the task. There were 35 participants in each of the experimental and control groups. Levene's test was conducted to examine for equality of variances. This test was not significant ($F(1,68) = .120, p = .73$). An overall significant effect was not found between the two groups when a t-test was performed. This analysis indicated that there was not a statistically significant mean

difference between the two conditions. However, while not significantly different, the control sample did on average take a longer period of time to complete the task. The data for this analysis is found in Table 1 below.

Table 1

T-Test on Length of Time to Complete Task

Group	<i>n</i>	<i>M (sec)</i>	<i>Sd</i>	<i>t</i>	<i>p</i>
Experimental	35	740.74	248.03	-.997	.32
Control	35	798.91	239.97		

Analysis 2

Like the analysis conducted on length of time to complete the task, a similar analysis was conducted on the total score achieved on the cognitive task (see Appendix A for the cognitive task form). This analysis was conducted on the same participants who comprised the experimental and control groups. A Levene's test was again used to examine the equality of variances. This test was not significant ($F(1,68) = .625, p = .43$). A t-test was then performed to assess the mean differences between the experimental and control groups. No significant difference was found between the two conditions,

indicating that the overall score on the cognitive test was not influenced by the independent variable, The data for this analysis is tables in Table 2 below.

Table 2

T-Test on Total Score on the Cognitive Task

Group	<i>n</i>	<i>M (sec)</i>	<i>Sd</i>	<i>t</i>	<i>p</i>
Experimental	35	5.20	1.13	0	1.00
Control	35	5.20	1.26		

Analysis 3

To further examine the relationship among the two dependent variables, score and length of time, a correlational analysis was conducted on the entire sample. The correlation between the score that a participant received on the cognitive task and the length of time in seconds to complete the task was .08 ($p = .52$). Therefore, it can be determined that the length of time to complete the task did not have an influence on the total score that the participants received.

Analysis 4

Based on some assertions made in the review of the literature that there would likely not be any differences among individuals for differing ethnic or gender groups, two

one-way analysis of variance tests were conducted on the participants' data. The first analysis examined the differences between males and females in the sample on the length of time required to complete the task. No significant differences were found in the data. This finding is consistent with the trends in this area of evolutionary psychology. The means, standard deviation, and statistics for the analysis of variance can be found in Table 3 below.

Table 3

Gender Differences on Length of Time to Complete Task

Group	<i>n</i>	<i>M (sec)</i>	<i>Sd</i>	<i>F</i>	<i>p</i>
Females	37	757.16	235.36	.209	.65
Males	33	784.03	256.27		

A second analysis of variance was conducted to examine gender differences on the total score received on the cognitive task. No significant difference was found between males and females in this analysis. The means, standard deviation, and statistics for the analysis of variance can be found in Table 4.

Table 4

Gender Differences on Total Score on Cognitive Task

Group	<i>n</i>	<i>M(sec)</i>	<i>Sd</i>	<i>F</i>	<i>p</i>
Females	37	5.16	1.17	.079	.78
Males	33	5.24	1.23		

Analysis 5

A final analysis was conducted to determine if gender of participant or the experimental condition might predict the amount of time to complete the task. A regression analysis was performed with time to complete task used as the outcome variable. Both gender and experimental condition were entered into the analysis. The resultant conclusion was a model that predicted 2% of the explainable variance. This analysis suggests that the level of stress that may have been present in the experiment may have not been high enough to influence length of time on task. This analysis was also performed on the total score received. While both variables were entered into the prediction, the overall model did not explain any variance.

Summary

These five analyses are consistent with the initial hypothesis, but do not fully explain the resultant outcomes. It appears that the level of stress induced in the participants was not significant enough of a level to produce anxiety. However, the experimental group showed a trend toward better performance on the task as well as efficiency of the task. It may be that if provided with a more stressful task to complete that these results would have produced statistically significant results.

CHAPTER 5

DISCUSSION

Results

The data collected for this thesis provided evidence that human performance fails to be influenced by magical thinking when there is little to no perceived anxiety for an individual when involved in the performance of a cognitive task. A result which would likely be expected because of the reasons we believe such magical beliefs are used by humans in the first place; as moderators of anxiety. In a situation where there is little to no anxiety experienced by an individual, one would expect to see the implementation of a psychological mechanism which is used primarily to mitigate anxiety as superfluous, and to impart limited influence on an individual's overall performance. An outcome which appears to be highly probable for this experiment; given that the participants in this study were aware at all times that the situation was under the complete control of the researcher and that as long as they performed in the tasks asked of them, they would be assigned credit for participating. In being assured that trying their best would be sufficient to give them the class credited they needed, and that all of their provided answers were anonymous, it may be that there was no pressure created by the research situation resulting in little anxiety or stress.

The results of the study, although not in anyway a dramatic revelation, are consistent with the hypothesis expressed in this thesis; specifically that individuals rely upon magical thinking as a means of moderating the levels of stress and anxiety which

they perceive while interacting with various objects and agents in world. However, even though the results are consistent with the overall hypothesis, they alone fail to provide sufficient evidence to warrant acceptance of the hypothesized theory at this time. In addition, the data collected would prevent one from rejecting the original hypothesis as well. In essence the research conducted ended up being unable to provide clear data on the hypothesis as it was originally asserted, and instead the research produced evidence which is consistent with, yet at the same time does not entail, the original hypothesis. A result which provides strong encouragement for continued exploration along this line of research.

Although the results for this study could be considered somewhat lack luster in nature, the data provide important empirical evidence from which to build a more complete case in support of magical thinking which may function as a moderator of anxiety. A crucial component of the argument to be able to assert that magical thinking has statistically insignificant influence on human performance in low stress situations has been revealed in this study. With evidence now supporting such an assertion, it can serve as a basis for future comparisons to be made about the influence of magical thinking on different experimental situations which have higher degrees of stress and anxiety being placed on the participants. In future experimental situations that are designed to place high degrees of stress on the participants in the study, any change in performance between the control and experimental groups would reflect an instance of possible influence by magical thinking.

Implications

The results of the current study suggest that the use of magical thinking fails to impact performance when an individual is experiencing a low level of anxiety. If this data is connected to the work of Keinan (1994), in which individuals reported that under higher levels of stress they became more likely to employ magical thinking, it may appear to be a connection between stress and reliance upon magical beliefs. It is clear that magical beliefs seem to be called upon when a person experiences high levels of stress, however what is still unknown is how such a reliance in turn impacts that person's productivity and performance in a measurable task. It seems as argued in this thesis that it is logically consistent to assume that magical thinking will lead to an increase in performance, however empirical evidence to support such an assertion is as of yet missing from the conversation.

Although it is premature to speculate too far as to what the possible implications of this line of research could be, there are benefits in understanding the areas in which magical thinking appears at least anecdotally to influence. If the theory of magical thinking as a means of anxiety modification is continued to be supported by future research, insights may be gained in areas such as human belief development and belief characteristics, how the mind is able to consecutively hold onto two beneficial yet contradictory beliefs, the formation of basic education concepts, religion and spiritual beliefs, and ritual and superstitious facets of cultural anthropology. Each of these academic areas may be served by furthering research in magical thinking, such research may provide a sense of scope as to what the area of influence is for a psychological phenomena which some view as being unimportant or trivial.

Limitations

One of the goals of this study was to attempt to examine how magical thinking influences performance under moderate levels of stress. However, due to the use of individuals from a psychology pool by the researcher for convenience, an unforeseen consequence arose from the sample population. The participants as a whole were extremely nonchalant about the experimental process, mainly due to their knowledge that regardless of how they performed they would be receiving class credit for their time. Leading to what would equate to an extremely low stakes cognitive exam. The culmination of this intervening factor led to there being almost no anxiety experienced by the participants during the experiment. Because of the time and resource restraints placed on the researcher these logistical errors may have been unavoidable, however they are important to note. Another limitation of this research is that the level of stress felt by the participants is assumed; although we believe that this assumption is a valid one, based on statements made by the participants and personal observations made by the researchers. The participants were never specifically asked to rate the level of anxiety they were experiencing from the testing situation in any form.

Future Research

Although this research has begun to lay a foundation for explaining the circumstances and situations in which the employment of magical thinking has little impact on human performance; further research is needed at the opposite end of the stress spectrum to uncover the role of magical thinking on performance when individuals are under moderate to high degrees of stress and anxiety. One of the main issues with

developing a research study of this kind will be managing the delicate balance between the very important ethical obligations of keeping the participants safe and insuring that the research leaves no lasting mental strife on the individuals; as well as at the same time assuring the participants themselves are experiencing a high enough level of anxiety so that they hypothesis can be tested in confidence. One idea that might suit both of these necessary conditions for meaningful future research would be to use public speaking as the cognitive task used in the experiment. It has been well documented that many people have a strong aversion to speaking in front of groups of people (Furmark, Tillfors, Everz, Marteinsdottir, Gefvert, & Fredrikson, 1999); more than likely relating back to evolutionary or cultural issues of social status and fear of public embarrassment. If an experiment could be designed in such a way that the members of the control group were to give a speech to a large audience without the aid of any superstitions, and the experimental group members were allowed to use some sort of a charm or magical talisman, one might be able to effectively measure the influence that magical thinking has on performance. We would have to assume for this example that the level of anxiety the speakers were feeling at the time of their speech could be recorded, to account for individual difference and to assure a high enough level of anxiety to be meaningful to the study. In addition, further research might benefit from having a mixed methods approach that incorporates the use of participant interviews along with the experimental task. Such an approach would allow for detailed self-reporting of participants experiences along with their task results. Individuals who are skilled at metacongnition might provide important insights which are not readily revealed by other means.

This study has added to the research literature in producing data which suggests that in situations which produce little to no stress, individuals performance is not improved in statistically significant ways by the introduction of magical thinking. A finding which is consistent with the larger theory that magical thinking is often used as a moderator of anxiety by individuals. The study also provides evidence that suggest that magical thinking is not, in and of itself, detrimental to the performance of various mental tasks. The results of this study provide a solid foundation from which to design new research that can further investigate the influence of magical thinking on human performance.

REFERENCES

- Baddeley, A. D., & Hitch, G. J. (1974). "Working memory." In G. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory*, Vol. 8. New York: Academic.
- Bjorklund, D. F. (2005). *Children's Thinking: Cognitive Development and Individual Differences*. Philadelphia, PA: Wadsworth Publishing.
- Carey, S. (1985). "Are children fundamentally different kinds of thinkers than adults? In S. F. Chapman, J. W. Segal, & R. Glaser (Eds.), *Thinking and learning skills*, Vol. 2. Hillsdale, NJ: Erlbaum.
- Cottrell, J. E., Winer, G. A., & Smith, M. C. (1996). "Beliefs of children and adults about feeling stares of unseen others." *Developmental Psychology* 32(1): 55-61.
- Darke, S. (1988). "Effects of anxiety on inferential reasoning task performance." *Journal of Personality and Social Psychology* 55(3): 499-505.
- Einstein, D.A, & Menzies, R. G. (2006). "Magical thinking in obsessive-compulsive disorder, panic disorder and the general community." *Behavioural and Cognitive Psychotherapy* 34(3): 351- 357.
- Fairclough, S. H., Tattersall, A. J., & Houston, K. (2006). "Anxiety and performance in the British driving test." *Transportation Research Part F* 9: 43-52.
- Evans, D. W., Milanak, M. E., & Medeiros, B. (2002). "Magical beliefs and rituals in young children." *Child Psychiatry and Human Development* 33(1): 43-58.
- Frazer, J. G. (1922). *The Golden Bough*. New York, NY: Touchstone.
- Frost, R. O., Krause, M. S., & McMahon, M. J. (1993). "Compulsivity and superstitions" *Behavior Research Theory* 31(4): 423-425.
- Foster, D. J., Weigand, D. A., & Baines, D. (2006). "The effect of removing superstitious behavior and introducing a pre-performance routine on basketball free-throw performance." *Journal of Applied Sport Psychology* 18(2): 167-171.
- Furmark, T., Tillfors, M., Everz, P. O., Marteinsdottir, I., Gefvert, O., & Fredrikson, M. (1999). "Social phobia in the general population: Prevalence and sociodemographic profile." *Social Psychiatry and Psychiatric Epidemiology* 34: 416-424.

- Gallup, G. H. (1987). *The Gallup Pole*. Wilmington, DE.
- Hadwin, J. A., Brogan, J., & Stevenson, J. (2005). "State anxiety and working memory in children: A test of processing efficiency theory." *Educational Psychology* 25(4): 379-393.
- Hembree, R. (1988). "Correlates, causes, effects, and treatment of test anxiety." *Review of Educational Research* 58(1): 47-77.
- Hembree, R. (1990). "The nature, effects, and relief of mathematics anxiety." *Journal for Research in Mathematics Education* 21(1): 33-46.
- Ivarsson, T., & Valderhaug, R. (2006). "Symptom patterns in children and adolescents with obsessive-compulsive disorder (OCD)." *Behavior Research and Therapy* 44(8): 1105-1116.
- James, E. O. (1961). "Superstitions and Survivals." *Folklore* 72(1): 289-299.
- Keinan, G. (1994). "Effects of stress and tolerance of ambiguity on magical thinking." *Journal of Personality and Social Psychology* 67(1): 48-55.
- Keinan, G., & Sivan, D. (2001). "The effects of stress and desire for control on the formation of causal attributions" *Journal of Research in Personality* 35: 127-137.
- Malinowski, B. (1922). *Argonauts of the Western Pacific*. Prospect Heights, IL: Waveland Press.
- Markovits, E. M., & Vachon, R. (1989). "Reasoning with contrary-to-fact propositions." *Journal of Experimental Child Psychology*, 22: 398-412.
- Miller, G. A. (1956). "The magical number seven, plus or minus two: Some limits on our capacity for processing information." *The Psychological Review* 63(2): 81-97.
- Norenzayan, A., & Hansen I. G. (2006). "Belief in supernatural agents in the face of death." *Personality and Social Psychology Bulletin* 32(2): 174-187.
- Padgett, V. R., & Jorgenson, D. O. (1982). "Superstition and economic threat: Germany, 1918-1940." *Personality and Social Psychology Bulletin* 8(4): 736-741.
- Panesar, N. S., Chan, N. C. Y., Li, S. N., Lo, J. K. Y., Wong, V. W. Y., Yang, I. B. & Yip, E. K. Y. (2003). "Is four a deadly number for the Chinese?" *The Medical Journal of Australia* 1-15(179): 656-658.
- Piaget, J. (1928). *The Child's Conception of the World*. London: Routledge and Kegan Paul.

- Piaget, J. (1954). *The Construction of Reality in the Child*. New York, NY: Basic Books.
- Richards, A., French, C. C., Keogh, E., & Carter, C. (2000). "Test-anxiety, inferential reasoning and working memory load." *Anxiety, Stress, and Coping* 13: 87-109.
- Rozin, P. L., Nemeroff, C., & Wane, M. (1986). "Operation of the laws of sympathetic magic in disgust and other domains." *Journal of Personality and Social Psychology* 50(4): 703-712.
- Rozin, P., Markwith, & M., Ross, B.(1990). "The sympathetic magical law of similarity, nominal realism and neglect of negatives in response to negative labels." *Psychological Science* 1(6): 383-384.
- Schell, K. L., & Grasha, A. F. (2000). "State anxiety, performance accuracy and work pace in a simulated pharmacy dispensing task." *Perceptual and Motor Skills* 90(2): 547-561.
- Shobe, E., Brewin, A., & Carmack, S. (2005). "A simple visualization exercise for reducing test anxiety and improving performance on difficult math tests." *Journal of Worry and Affective Experience* 1(1): 34-52.
- Subbotsky, E. V. (1993) *Foundations of the Mind*. Cambridge, Mass: Harvard University Press.
- Subbotsky, E. V. (1996). "Explaining impossible phenomena: Object permanence beliefs and memory failures in adults." *Memory* 4(2): 199-223.
- Subbotsky, E. V. (2001). "Causal explanations of events by children and adults: Can alternative causal modes coexist in one mind?" *British Journal of Developmental Psychology* 19: 23-45.
- Subbotsky, E. V. (2004). "Magical thinking in judgments of causation: Can anomalous phenomena affect ontological causal beliefs in children and adults?" *British Journal of Developmental Psychology* 22(1): 123-152.
- Subbotsky, E. V., & Quinteros, G. (2002). "Do cultural factors affect causal beliefs? Rational and magical thinking in Britain and Mexico." *British Journal of Psychology* 93(4): 519-543.
- Supon, V. (2004). "Implementing strategies to assist test-anxious students." *Journal of Instructional Psychology* 31(4): 292-296.
- Walter, D., Denzler, L. S., & Sarason, I. G. (1964). "Anxiety and the intellectual performance of high school students." *Child Development* 35: 917-926.

- Wilson, D. S. (2001). *Darwin's Cathedral: Evolution, Religion, and the Nature of Society*. Chicago, IL: The University of Chicago Press.
- Zebb, B. J., & Moore, M. C. (2003). "Superstitiousness and perceived anxiety control as predictors of psychological distress." *Journal of Anxiety Disorders* 17(1): 115-130.
- Zusne, L., Jones, W. H. (1989). *Anomalistic psychology: A study of magical thinking* (2nd ed). Lawrence Erlbaum Associates.

APPENDIX A

Cognitive Abilities Test

Directions: Read each question carefully and write your response in the area provided. The test you are taking is timed, and the amount of time used to complete the exam will be factored into your final score.

- 1) You are walking in a park; you look up and see that there are seventeen squirrels in a tree. As you watch, four squirrels leave to find food elsewhere, and two of the remaining squirrels have no tails. How many tails and feet remain in the tree?

Answer _____

- 2) $7 + 5 + 6 + 1 + 2 - 13 + 4 - 2 + 18 - 3 + 7 =$

Answer _____

- 3) $(4 + 9 + 23 + 5 - 3 - 8 + 1 - 4 + 13 - 2) \times 3 =$

Answer _____

- 4) Read the following passage:

A beautiful golden light enter into the large room. The intricate pattern on the marbled floor was finally fully illuminated. I marveled at how anything so detailed could have been made over seven hundred years ago without any of our modern technologies. The complex recessed patterns in the marble made me glad I had elected to wait in the long museum line for two hours. I decided then and there that this was the highlight of my trip; although I had seen the green grassland of the country side, and the bustling traffic of the clogged city streets, this ancient design was what I had come to the medieval styled parts of Europe to see.

How many times is the word “the” used in the above paragraph?

Answer _____

How many adjectives are used in the above paragraph?

Answer _____

5) Using the number for identification, put the following in alphabetical order starting with the fifth letter:

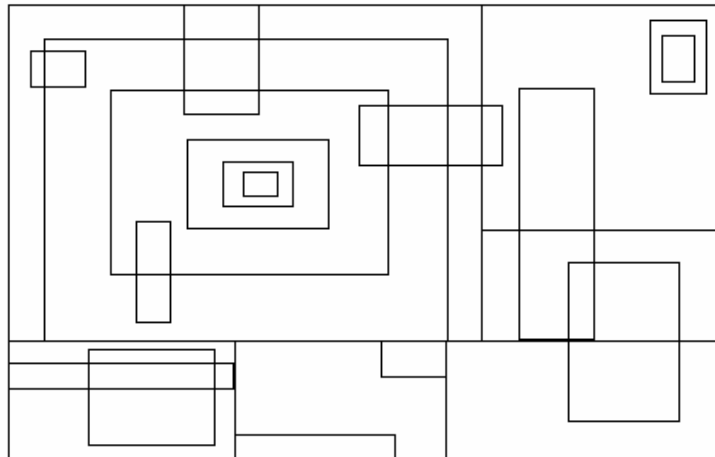
1. Reindeer
2. Plmazia
3. Elucidate
4. Fables
5. Qoptvw
6. Knights
7. Zztrsnaq
8. Snowfall
9. Philosophy
10. Weirma
11. Nintendo
12. Aspirin

Answer: a) ___ b) ___ c) ___ d) ___ e) ___ f) ___ g) ___ h) ___ i) ___ j) ___ k) ___ l) ___

6) $97 - 14 - 54 + 6 - 23 - 7 + 12 - 27 + 14 =$

Answer: _____

7) How many boxes are in the image below: (note – a box is a 4 sided object)



Answer: _____