

ABSURD REALITY: A BEHAVIORAL ANALYSIS OF THE EFFECT OF MEANING
THREAT ON THE INTERPRETATION OF UNRELATED WORD PAIRS

by

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A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Arts in Psychology

Middle Tennessee State University

May 2017

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ACKNOWLEDGEMENTS

I would like to thank my arms, for always being by my side, my spine for always having my back, and my fingers because I can always count on them. I would also like to thank Christof Fehrman for not destroying me for my bad jokes and for being a wise friend and lab partner along the way.

I would also like to give thanks to Dr. William Langston for coming up to bat for me whenever I need it and being equal parts antagonistic and supportive; Dr. Cyrille Magne for teaching me the ways of EEG and not ending my life when a \$5,000 dollar piece of equipment broke when I was in training, and Dr. Dana Fuller for encouraging me to keep going when math has always been my most difficult subject and being quite frankly a fantastic statistics professor. Without all of you, my time here would have been much less enjoyable and manageable.

ABSTRACT

When situations or objects violate our expectations of the way reality is supposed to operate, certain mental processes step in to alleviate the distress, including a pattern seeking behavior. Would the propensity for pattern seeking in meaning threat translate into behavioral differences in semantic evaluation? Thirty-one participants from an undergraduate population were recruited and completed personality questionnaires. Participants then evaluated 64 sets of related or unrelated word pairs before and after reading either an absurd story by Franz Kafka or a control story. Reaction time and accuracy were recorded for all participants. Results of two 2x2x2 factorial ANOVAs indicated that there were no significant differences between the control and meaning threat groups on reaction time or accuracy. This suggests that even though people were given a story known to cause meaning threat, there seemed to be no effect on behavioral responses.

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1. INTRODUCTION

In 1855, a Danish philosopher was laid to rest at Assistens Cemetery, Copenhagen, Denmark. Søren Kierkegaard had lived a tumultuous life, but through his suffering came a deluge in the subject of philosophy (Hannay, 2003). Widely regarded as the first existentialist philosopher, he lamented often that we as humans seek to find meaning when there is none to be found, and he blamed this paradox for our misery (Kierkegaard, 1846/1997). He noted that this feeling of the absurd created by the paradox could be brought on by any inconsistency, whether by things like confronting mortality or having to act on faith when logic fails.

The paradox that Kierkegaard described persists to this day in the Meaning Maintenance Model. Of this model, there are three basic tenets: meaning is relation, humans are meaning makers, and fluid compensation is used to deal with threat (Heine, Proulx, & Vohs, 2006). The model suggests that people have an innate need for meaning. Meaning, in this context is understood as mental representations of connections and relationships between concepts, such as water being wet and associated with the ocean or it falling from the sky during storms. In essence, meaning is relation between concepts. When these relationships are threatened through instances of non-relation, the model proposes that people enter a state of meaning threat. For example, imagine drinking a glass of tea and finding a live, dry cat at the bottom of the glass. Normally such a thing would not be expected and would probably cause some distress. That kind of existential dread and distress in the face of things not making sense is what is being referred to when we use the phrase meaning threat.

When meaning threat has been created, the model also states that individuals then attempt to reaffirm alternative relationships or representations in order to regain meaning and resolve the threat (a process called *fluid compensation*; Heine & Proulx, 2010). Individuals can strengthen other associations that are unaffected to resolve the threat. One example was observed by McGregor, Zanna, Holmes, & Spencer (2001) who found that when participants were confronted with an inconsistency in their lives, they responded by becoming more rigid in their beliefs in another unrelated topic. This fluid compensation can be observed no matter which kind of threat to meaning has occurred, whether it be through mortality salience, interpersonal rejection, uncertainty, or threats to self-esteem (Heine & Proulx, 2010). People can compensate for a lack of meaning in one relationship by creating a sense of certainty in meaning in another.

Now outside of a lab setting, it is difficult to think that one might be drinking a glass of tea and have such a drastic violation of expectations as a live cat at the bottom, but there are many ways where a drastic violation leading to meaning threat might come from a real-world source. For instance, individuals who have higher belief in the paranormal are also more likely to become inattentionally blind, have less working memory capacity, and have high absorption scores (Richards, Hellgren, & French, 2014). Additionally, when given word pairs that are either semantically related (like: River – Stream) or word pairs that are semantically unrelated (like: Engine – Hair), believers in the paranormal are known to make significantly more rare associations while skeptics tend to provide more common associations (Gianotti et al., 2001). Put that all together and it means that low working memory capacity can render the individual effectively blind to events that are causally linked because only a limited amount of information

from the environment is attended to and processed. That failure, such as the inability to remember moving a cup from a table to a chair, can cause a violation of expectations and a reinforcement of belief in a paranormal explanation. These kinds of violations can also happen to people who do not believe in the paranormal.

Despite the diversity of threats, individuals respond to threats of meaning in similar ways, suggesting that there is an underlying impulse to enforce a sense of meaning upon the world by strengthening undamaged mental relationships. For example, when participants were exposed to an experimenter being switched out with a different experimenter or “transmogrified” without their conscious awareness, participants dealt harsher sentences to a hypothetical prostitute for the same offense (Proulx & Heine, 2008). This effect was also seen in another experiment in which participants played blackjack with cards whose colors did not match the traditional suit color (Bruner & Postman, 1949). When people encountered a perceptual anomaly that they were not aware of, they were more protective of the status quo in both cases. Participants undergoing meaning threat are also better able to perceive the presence of patterns in letter strings and are better able to learn a novel pattern within letter strings (Proulx & Heine, 2009) suggesting a temporary enhanced propensity for pattern seeking.

It is worth noting that not everyone ends up going into a meaning threat state. A necessary condition of meaning threat is having connections or expectations that can be sufficiently destroyed to create the threat. For instance, individuals who fall within the schizophrenia-spectrum pathology named schizotypy are known to have perceptions of connectedness and causality where the average person would not (Kwapil, 1998; Lyons

et al., 1995). People who are high in schizotypy also tend to be more open to experiences, have a lack of direction, be more introverted, be antagonistic, and be more neurotic when it comes to the Big Five Personality Inventory (Kreitz, Schnuerch, Gibbons, & Memmert, 2015). Due to their natural propensity for pattern seeking and openness to experiences, it is difficult to violate expectations or connections when connections are malleable and easy to find.

It is also worth noting that a common problem for meaning threat studies is that there is rarely a manipulation check included to verify that participants actually perceived the threat (Heine & Proulx, 2010). This makes the entire literature tautological: we know meaning threat occurred because of changes in the dependent variable, and we know the dependent variable differed due to meaning threat. The goal of the research described here was two-fold. First, we wanted to evaluate the effect of meaning threat on behavioral dependent variables (reaction time and accuracy) and EEG responding. Second, we were hoping to include independent measures of meaning threat to serve as manipulation checks. We also wanted to address the potential variability introduced by personality variables such as schizotypy. This thesis will only be concerned with the behavioral data and the effects of the covariates on it.

An experiment was designed to evaluate the effect of meaning threat on detecting relationships. Two variables were manipulated. First, participants were either given a meaning threat manipulation or they were given a control manipulation. In this case, the meaning threat came from a story by Kafka that had been used in previous research. The second variable was the type of word pair participants judged. Half of the pairs were

related and half were unrelated. Participants judged word pairs both before and after the meaning threat manipulation.

The beginning of the experiment consisted of a pre-questionnaire with of the Schizotypal Personality Questionnaire – Brief (SPQ-B), the Beck Anxiety Inventory (BAI), the Big Five Personality Inventory (BFPI), and the Personal Need for Structure Scale (PNSS). The BAI is included to measure anxiety because anxiety can affect cognitive processing (Slade, 1972), and the BFPI is included because individuals who are open to experiences would be less likely to generate meaning threat (Krietz, Schnuerch, Gibbons, & Memmert, 2015). Participants then responded to a set of word pairs, read either the Kafka or control story, and responded to a second set of word pairs. The post questionnaire was the PNSS to serve as a manipulation check for meaning threat as the need for structure should increase when threat is present (Proulx, Heine, & Vohs, 2010). The experiment is presented schematically in Figure 1.

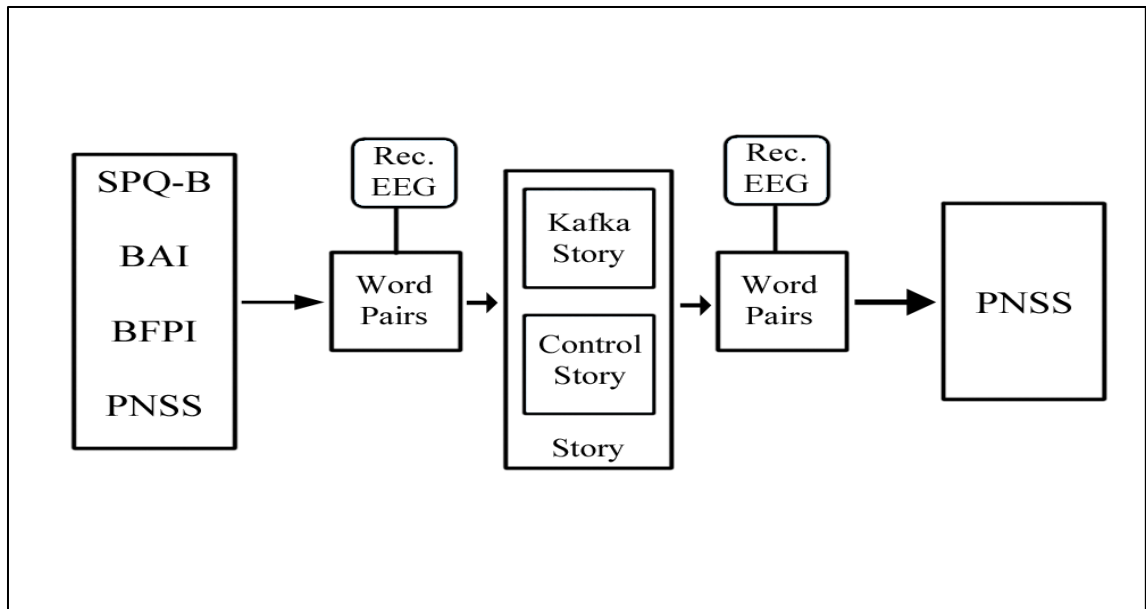


Figure 1. Structure of the Two Halves of the Experiment. SPQ = Schizotypal Personality Questionnaire- Brief, BAI = Beck Anxiety Inventory, BFPI = Big Five Personality Inventory, and PNSS = Personal Need for Structure Scale.

The experiment was designed to test the following hypotheses:

Hypothesis one: Given that people in a state of meaning threat see more patterns within noise (Proulx & Heine, 2009), participants within a state of meaning threat will see more word pairs as semantically related. Therefore, if given series of word pairs, accuracy for unrelated word pairs after the induction of meaning threat should decrease (decrease because they will be likely to say “related” when the answer is “unrelated”).

Hypothesis two: If participants within a meaning threat state are more likely to see things as semantically related we would also expect to see a decrease in reaction time

for unrelated word pairs in the meaning threat group during the second set of word pairs as associations between related pairs are typically faster than associations between unrelated word pairs, and they will see these pairs as related (Gianotti et al., 2001).

2. METHODS

2.1 Participants

Thirty-one participants (18 Males, 13 Females) were recruited using the MTSU participant pool. Participants who were left-handed, non-native English speakers, or who were wearing extensive hair products were excluded from the experiment due to the restrictions of the electroencephalogram (EEG) portion of the study. The average age of the participants was 21 years old. Of the thirty-one participants, sixteen participants were part of the control group, and fifteen were part of the manipulation group. Participants who scored two standard deviations above or below the average on most scores were eliminated as possible outliers. Of the original participant pool, twenty-four participants (12 male, 12 female) were used in the analyses. The rest were eliminated, leaving eleven in the treatment group and thirteen in the manipulation group. The average age remained the same.

2.2 Materials

The MTSU consent form, complete with contact information was used (See Appendix A). A short series of questionnaires were given before the EEG portion of the study, consisting first of the Beck Anxiety Inventory. The Beck Anxiety Inventory is a 21 item self-report measure of anxiety. It is answered using a 4-point Likert scale format, indicating how much the participant has been bothered by the symptoms described during the past month, ranging from “*Not at All*” to “*Severely – it bothered me a lot.*” The column totals are summed to achieve a grand score. Scores can range from 0 to 63; a grand score between 0-21 indicates low anxiety, a sum between 22-35 indicates moderate

anxiety, and a sum that exceeds 35 indicates high anxiety (Beck, Epstein, Brown, & Steer, 1988.) The Beck Anxiety Inventory is reliable over an average time lapse of 11 days ($r = .67$). It proved highly internally consistent as well (Chronbach's alpha = .94) (Fydrich, Dowdall, & Chambless, 1992.)

Next, the Personal Need for Structure Scale was given as a manipulation check (Neuberg & Newsom, 1993). The Personal Need for Structure Scale is a 12 item scale that is meant to measure the extent of which an individual needs structure within their life. Participants respond on a Likert scale from 1 (*Strongly Disagree*) to 6 (*Strongly Agree*) of how much they agree with statements like: "It upsets me to go into a situation without knowing what I can expect from it." Questions 2, 5, 6, and 11 are reverse scored. It has been shown to be a reliable indicator of whether or not meaning threat has occurred in some experiments (Proulx, Heine, & Vohs, 2010), so it was included as a manipulation check.

Next, the Schizotypal Personality Questionnaire – Brief (SPQ-B) was given. It is a 22 item self-report scale for the assessment of schizotypal personality, based on the DSM-III-R diagnostic criteria. The scale breaks down into several subscales, such as Cognitive-Perceptual factors, Interpersonal factors, and Disorganizational factors (Raine & Benishay, 1995). Each question of the scale is a Yes/No question, with each "yes" counting as one point, with total scores ranging from 0 to 22. Scores of the subscales are derived by simple summation of relevant subscale raw scores. Reliability for the scales averaged at .76 and scale scores correlate significantly with DSM-III-R schizotypal traits at an average of $r = .62$.

Finally, the Big Five Inventory (BFI) was administered. It is a 44-item inventory that measures an individual on the Big Five Factors of personality; Openness vs Closed to Experience, Neuroticism vs Emotional Stability, Agreeableness vs Antagonism, Extraversion vs Introversion, and Conscientiousness vs Lack of Direction. Each of these dimensions can be further broken down into other personality facets. Participants responded to it with a Likert scale of 1 (*Disagree Strongly*) to 5 (*Agree Strongly*) to how much they agree with statements of their personality such as questions as: “Do you agree that you are someone who likes to spend time with others?” The alpha reliabilities of the Big Five Inventory subscales range from .75 to .90 and average around .80. Test-retest reliability ranges from .80 to .90 at three months. Evidence suggests it is a substantially reliable and valid measure of the five factors of personality (Oliver & Srivastava, 1999).

After the initial questionnaire, the EEG portion of the experiment began. Participants were presented with word pairs that were either semantically related or unrelated in equal proportions. The word pairs presented to the participants were displayed at random. The words used were monosyllabic and singular. The mean word length and letter frequency were similar for related vs unrelated pairs, which was determined using *t*-tests. A *t*-test on the final list of pairs showed a non-significant difference between the log HAL frequency of the related (9.26) and unrelated target words (9.13), $p = .56$. To ensure that the word pairs were related and unrelated, the Latent Semantic Analysis (LSA) values of related pairs ($M = 0.47$, $SD = 0.18$) were compared to the LSA values of unrelated pairs ($M = 0.07$, $SD = 0.06$), $t(67) = -16.89$, $p < .001$. See Appendix B for list of related and unrelated word pairs.

EEG was recorded continuously from 128 Ag/AgCl electrodes embedded in sponges in a Hydrocel Geodesic Sensor Net (EGI, Eugene, OR, USA) placed on the scalp (See electrode layout in Appendix C.) The sampling rate of the EEG acquisition was 500Hz, and impedances were kept below 50 kOhm. EEG preprocessing was carried out with NetStation Viewer and Waveform tools (EGI, Eugene, OR, USA). Trials contaminated by artifacts (e.g., eye movements, blinks, amplifier saturation, electrode drifting or muscle activity) were excluded from further analysis.

After the word pairs were given to the participant while hooked up to the EEG, participants then read “The Country Dentist,” a short story by the author Franz Kafka or the related control version of the story. The story is discordant in nature, using odd phrasing, unrelated pictures, confusing and often contradictory story elements which leaves the reader disoriented after reading it. The story has been found in related experiments to generate meaning threat reliably (Proulx & Heine, 2009), which is why it was included. The control story followed the same narrative as the Kafka version, a country dentist going to see a patient, but followed a more traditional route towards telling the story that did not create such disorientation. Participant’s reading times were recorded as a check to make sure that they read the short story. To that end, participants ACT verbal scores were also collected to account for confounds from poor reading ability. ACT scores that were two standard deviations above or below the average pointed out possible outliers for reading comprehension.

After the story, participants were exposed to a second set of unrelated and related word pairs different from before, then the EEG portion of experiment ended and they were given the Personal Need for Structure Scale again (Neuberg & Newson, 1993) as a manipulation check. Research suggests that people who undergo a state of meaning threat are more likely to have high scores on need for structure.

2.3 Procedure

Upon recruitment, participants went to the specified location for the experiment and were greeted by experimenters. The participant went through a short screening process to minimize the chances of EEG recordings being affected by outside variables. Individuals who were left-handed, non-native English speakers, or were wearing extensive hair products were excluded from the experiment due to the tendency of these elements to create interference with EEG recordings and the data. Participants who met the criteria for the study were then given the consent form. Those who wished to participate received the beginning questionnaire, consisting of the Beck Anxiety Inventory, the Big Five Inventory, the Personal Need for Structure Scale, and the Schizotypal Personality Questionnaire – Brief. Before participants began the survey, a measurement of their head was taken, in order to properly gauge what EEG net size was to be used.

While participants were completing the questionnaire, the electrode net was soaked in a solution of 11g of potassium chloride, 1 liter of water, and 5ml of baby shampoo for approximately 10 minutes. After the net was soaked and the participant

finished the questionnaire, the vertex of the participant's scalp was measured and marked. The participant was then fitted with the electrode cap for the experiment.

Before beginning the EEG portion of the experiment, the participants were assigned to their conditions via a pre-made counterbalancing sheet. The sheet was made without knowing which participant would be in which group, alternating control and meaning threat conditions and which buttons meant 'yes' and 'no'. During the experiment, participants were seated in a sound-proof room and were instructed to avoid moving their eyes, head, or other body parts during the experiment except when a series of X's appeared on the computer screen between each trial. After a short session of training to acclimate them to the EEG, participants were then exposed to a series of semantically related and unrelated word pairs. To minimize eye movements, each word pair were presented word-by-word on a computer screen using the software program E-prime (PST, Inc., Pittsburgh, PA.) Participants were then instructed to silently read each word pair and judge whether it was semantically related or not. Word pairs were presented in white on a black background, each word pair trial began with the presentation of a fixation cross for 1000 ms. Each word was presented for 300ms followed by a blank screen for 400ms. Following the last word of a word pair, participants were instructed in the beginning to quickly make a decision of whether or not the words presented were related or not. Before the beginning of the next trial, a series of X's were displayed on the computer screen for 2000 ms to indicate that the participants could blink or move their eyes. In other words, following each of the semantically related or unrelated pair of words the participants could relax and blink for a moment before beginning the next section.

Participants were next given either a control story or the Country Dentist by Franz Kafka. The participants were asked to read silently to themselves at their own leisure. Once the participants finished reading the story, they were again presented with semantic word pairs in the same way as before. After they finished the second series of semantic word pairs, the EEG cap was removed and the participants then received the Personal Need for Structure Scale. Once they finished the Personal Need for Structure Scale, the participants were then thanked and the experiment ended. Students were compensated for their time by receiving class credit.

3. RESULTS

Of the thirty-one participants in the study, twenty-four were used in the behavioral analyses. Participants were eliminated if their scores fell two standard deviations away from the mean in a particular condition to remove outliers.

The effect of meaning threat should appear only in the meaning threat group. Within this group, meaning threat would manifest as an interaction in a 2 X 2 ANOVA with the factors session (pre- and post-manipulation) and word pair type (related and unrelated). In particular, There should be a larger difference between related and unrelated word pairs on the pre-test than on the post-test (the effect is reduced by meaning threat). Overall, there would be a three-way interaction with the factor of condition (meaning threat or control) since the two-way meaning threat interaction would not occur in the control group.

3.1 Accuracy

See Table 1 for descriptive statistics for the accuracy dependent variable. A 2 x 2 x 2 factorial ANOVA ($\alpha = .05$) was performed to analyze the factors of participant condition (meaning threat or control; between participants), session (pre- and post-manipulation; within participants), and word pair type (related and unrelated; within participants) on accuracy. If hypothesis one were supported, we would expect the three-way interaction to be significant. The three way interaction was not significant, $F(1, 22) = 0.013$, $MSE = .002$, $p = .91$, $\eta^2_p = .001$. A further 2 x 2 factorial ANOVA was performed on the factors of session and word pair type for just the meaning threat group to evaluate the effect of meaning threat. The predicted interaction for this ANOVA was

also not significant, $F(1, 12) = 0.069$, $MSE = .002$, $p = .80$, $\eta^2_p = .006$. These data are illustrated in Figure 2.

As a measure of validity, a significant overall main effect for related/unrelated was found, $F(1,22) = 12.77$, $MSE = .005$, $p = .002$, $\eta^2_p = .37$. This shows that participants were sensitive to one of the manipulated variables, even though they did not show any evidence of experiencing meaning threat.

Table 1

Descriptive Statistics for Accuracy Across Groups and Conditions

	Pre		Post	
	Control (SD)	Meaning Threat (SD)	Control (SD)	Meaning Threat (SD)
Related	.91 (.05)	.90 (.08)	.88 (.07)	.91 (.07)
Unrelated	.98 (.03)	.92 (.07)	.95 (.03)	.94 (.06)

Note. Scores are averages. N = 11 for control, N = 13 for Meaning Threat.

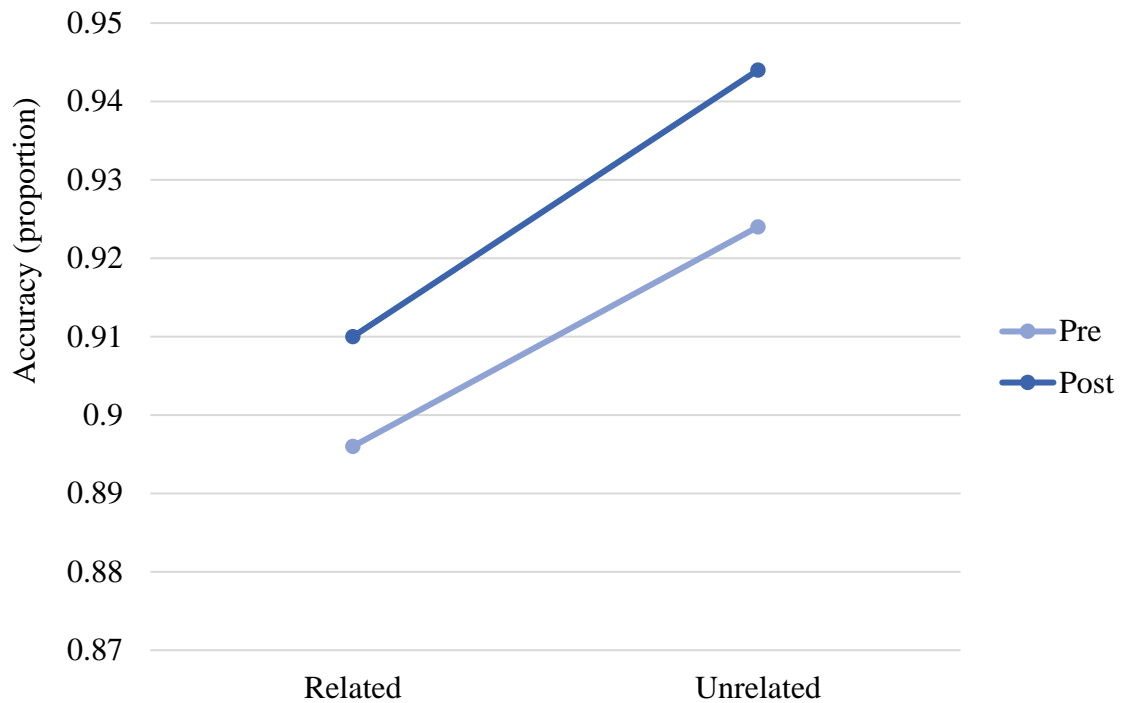


Figure 2. The Two-way Interaction Between Session and Word Pair Type for the Accuracy Data.

3.2 Reaction Time

See Table 2 for descriptive statistics for the reaction time dependent variable. A $2 \times 2 \times 2$ factorial ANOVA ($\alpha = .05$) was performed to analyze the factors of participant condition (meaning threat or control; between participants), session (pre- and post-manipulation; within participants), and word pair type (related and unrelated; within participants) on reaction time. If hypothesis two were supported, we would expect the three-way interaction to be significant. The three way interaction was not significant, $F(1, 22) = 0.098$ $MSE = 1517.88$, $p = .76$, $\eta^2_p = .004$. A further 2×2 factorial ANOVA was performed on just the factors of session and word pair type for just the meaning threat group to evaluate the effect of meaning threat. The predicted interaction for this ANOVA

was also not significant, $F(1, 12) = 0.001$, $MSE = 1661.51$, $p = .98$, $\eta^2_p = .000$. These data are illustrated in Figure 3.

As a measure of validity, significant overall main effect for word pair type was found, $F(1,22) = 35.43$, $MSE = 2827.09$, $p < .001$, $\eta^2_p = .62$. Additionally, a significant overall main effect for pre/post was also found, $F(1,22) = 6.04$, $MSE = 3689.17$, $p = .022$, $\eta^2_p = .22$. This shows that participants were sensitive to differences in word type, even though they did not show any evidence of experiencing meaning threat. It also shows that there was a training effect as the experiment went along, as participants responded faster as the experiment went on.

Table 2

Descriptive Statistics for Reaction Time Across Groups and Conditions

	Pre		Post	
	Control (SD)	Meaning Threat (SD)	Control (SD)	Meaning Threat (SD)
Related	368.17 (82.66)	430.32 (112.16)	349.51 (72.59)	392.16 (82.52)
Unrelated	428.67 (104.57)	503.81 (128.46)	400.67 (109.20)	466.31 (110.95)

Note. Scores are averages in ms. N = 11 for control, N = 13 for Meaning Threat.

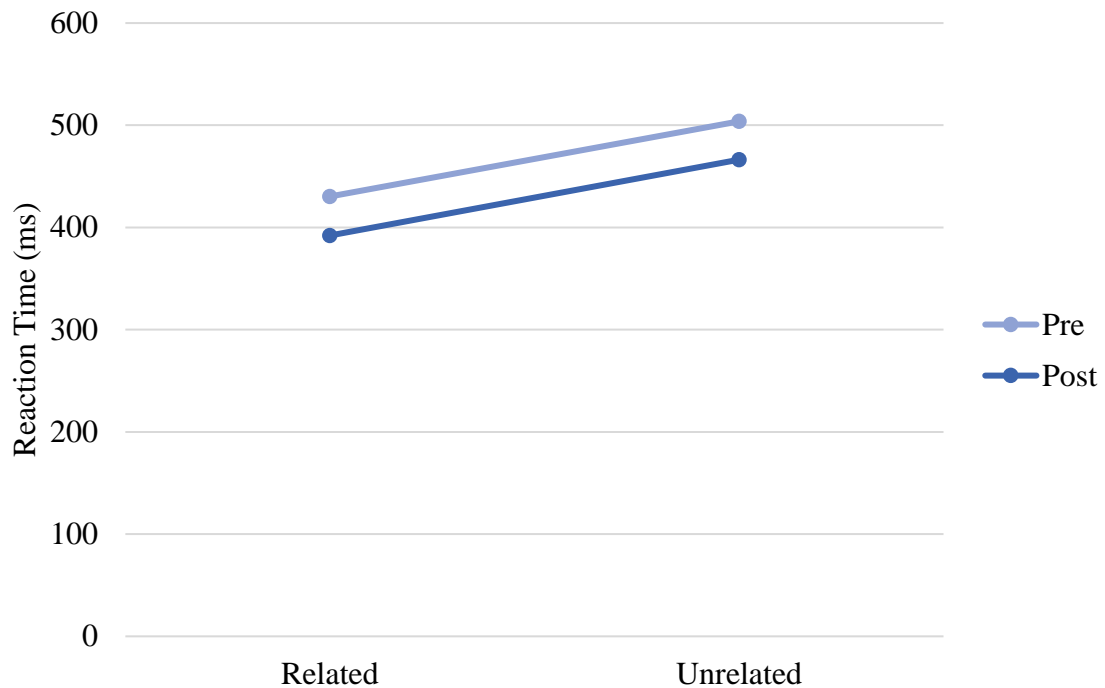


Figure 3. The Two-way Interaction Between Session and Word Pair Type for the Reaction Time Data.

3.3 Additional Analyses

Proulx, Heine, & Vohs, (2010) indicated that in their study, people who went through a meaning threat state showed higher scores on need for structure. It was because of this that the Personal Need for Structure Scale was included. A 2 x 2 factorial ANOVA ($\alpha = .05$) was performed to analyze the factors of participant condition and pre and post manipulation on the dependent variable of Personal Need for Structure Scale total scores. See Table 3 for descriptive statistics for PNSS scores. If there was meaning threat generated, we would expect the interaction of this analysis to be significant and there to be differences in personal need for structure for the meaning threat group. The two-way interaction was not significant, $F(1, 21) = 0.007$ $MSE = 6.37$, $p = .93$, $\eta^2_p = .000$.

Furthermore, an additional paired samples t -test ($\alpha = .05$) indicated that there were no statistical differences between PNSS scores before or after the manipulation for the meaning threat condition, $t(11) = 1.64, p = .13, \hat{d} = 0.13$. See Figure 4 for a line graph of PNSS scores for the different conditions.

Table 3

Descriptive Statistics for PNSS Scores Across Groups and Conditions

	Pre		Post	
	Control (<i>SD</i>)	Meaning Threat (<i>SD</i>)	Control (<i>SD</i>)	Meaning Threat (<i>SD</i>)
Avg. Scores	43.73 (7.85)	44.58 (12.05)	42.27 (6.86)	43.00 (12.66)

Note. $N = 11$ for Control, $N = 12$ for Meaning Threat.

Spearman's rho correlations were also performed between accuracy for related word pairs before the experimental manipulation, accuracy for unrelated word pairs before the experimental manipulation, reaction time for related word pairs before the experimental manipulation, reaction time for unrelated word pairs before the experimental manipulation, SPQ-B total scores, BAI total scores, PNSS total scores, and each of the five subsections of the Big Five Personality Inventory before the experimental manipulation to determine if there were any relationships between the remaining variables. These measures were thought to have been related to the effect that we proposed initially, but with the effect not being able to be found, correlations were all that was fit to be done. The results of these correlations are shown in Table 4.

As for the Spearman's Rho correlations, participant's accuracy for unrelated word pairs were, naturally, significantly positively correlated with accuracy for related word pairs, $r = .54$. Reaction time for related and unrelated word pairs were significantly positively correlated as well, $r = .80$. Reaction time for unrelated word pairs before the experimental manipulation were significantly negatively correlated with accuracy for unrelated word pairs before the manipulation, $r = -.47$, so as accuracy for unrelated word pairs went up, reaction time for unrelated word pairs went down. Participant's total scores on the Schizotypy Personality Questionnaire-Brief were significantly positively correlated with total scores on the Beck Anxiety Inventory, $r = .47$, and total scores on the Beck Anxiety Inventory were significantly positively correlated with scores on the Personal Need for Structure Scale before the manipulation, $r = .57$. People who scored higher in schizotypy reported more symptoms of anxiety within the past month, and as more symptoms of anxiety were reported, the more participants reported a personal need for structure. Scores on Extroversion were significantly negatively correlated with total scores on the Schizotypy Personality Questionnaire-Brief, $r = -.58$. Scores on Agreeableness were significantly negatively correlated with total scores for Personal Need for Structure, $r = -.49$. Scores for Neuroticism were significantly negatively correlated with reaction time for unrelated word pairs, $r = -.41$, significantly positively correlated with total scores on the Schizotypy Personality Questionnaire-Brief, $r = .63$, and significantly positively correlated with total scores on the Beck Anxiety Inventory, $r = .69$. Scores on Openness were significantly negatively correlated with reaction time for related word pairs, $r = -.48$, and significantly negatively correlated with reaction time for unrelated word pairs, $r = .45$.

Table 4.

Spearman's Rho Correlations Between Behavioral and Personality Data

Measure		1	2	3	4	5	6	7	8	9	10	11
1 ACC_Rel.	Corr.	-										
	N	24										
2 ACC_Un.	Corr.	.54*	-									
	N	24	24									
3 RT_Rel.	Corr.	-.35	-.40	-								
	N	24	24	24								
4 RT_Un.	Corr.	-.26	-.47*	.80*	-							
	N	24	24	24	24							
5 SPQ	Corr.	.07	-.09	-.06	-.33	-						
	N	24	24	24	24	24						
6 BAI	Corr.	.19	.30	-.08	-.28	.47*	-					
	N	24	24	24	24	24	24					
7 PNSS	Corr.	-.06	-.10	.07	-.03	.20	.57*	-				
	N	23	23	23	23	23	23	23				
8 Extro.	Corr.	.06	.10	.39	.34	-.58*	-.16	-.19	-			
	N	24	24	24	24	24	24	23	24			
9 Agree.	Corr.	-.01	.26	.21	.11	-.10	-.02	-.49*	.28	-		
	N	24	24	24	24	24	24	23	24	24		
10 Consc.	Corr.	-.16	-.04	.02	.12	-.29	-.09	-.14	.28	.53*	-	
	N	24	24	24	24	24	24	23	24	24	24	
11 Neuro.	Corr.	.14	.26	-.21	-.41*	.63*	.69*	.17	-.35	.07	.10	-
	N	24	24	24	24	24	24	23	24	24	24	24
12 Open.	Corr.	.27	.39	-.48*	-.45*	-.08	.01	-.35	.00	.35	.13	.30
	N	23	23	23	23	23	23	22	23	23	23	23

*. Correlation is significant at the 0.05 level or greater (2-tailed).

4. DISCUSSION

If one takes the Meaning Maintenance Model literature at face value, one might think generating meaning threat should be as easy as violating people's expectations, but it has proven far more difficult for that to show any kind of behavioral change. The Country Dentist by Franz Kafka has been used in the literature before to generate meaning threat, but there is little evidence that it did so for this experiment. Participants certainly reported feeling unsettled by Kafka's story, but even so, their decisions about the relatedness of word pairs were not affected by the meaning threat condition.

For both hypotheses, the null hypothesis failed to be rejected. Participants in the meaning threat condition were just as accurate as their control group counterparts for both unrelated and related word pairs and their reaction time was no different for related and unrelated word pairs. Additionally, scores on the Personal Need for Structure Scale indicated that there was no change in need for structure through the course of the experiment. This finding is dissimilar to the finding of Proulx et. al., 2010, but differences between this experiment and theirs might explain such results. Results did indicate that there was a small increase in accuracy and a small decrease in reaction time, but that is expected as an effect of training. Significant main effects of related/unrelated and the increase in accuracy and decrease in reaction time would seem to suggest participants responded as they should have to the word pairs.

4.1 Limitations

The basic problem is, we don't seem to have introduced meaning threat into the experiment. A number of possible reasons for this exist, including that it might not have

been present. Low sample size may have hindered power for the experiment and it tends to make it difficult to generalize findings into real knowledge because there is just not enough information. Even the Spearman's rho correlations in this experiment should be taken with a grain of salt due to lacking the kind of sample size needed to make them powerful enough to be relevant. It could also be a matter of participants being heterogenous at the beginning of the experiment, but this became less of a possibility once outliers were removed. The correlations found, even weak as they were, reflected the kind of correlations that we should be seeing between reaction time, accuracy, schizotypy, anxiety, and need for structure, however. So, it could be the case that power might not be the problem, but that meaning threat simply failed to be generated by the story.

Another possible confound for the behavioral data is that errors were found in the script for the experiment. Late in the experiment, the realization hit that a second practice session of word pairs before the second set of word pairs could be negating the effect of meaning threat. If there were people who had meaning threat generated via the story, the practice session could have corrected it by immediately giving them feedback on what was related and unrelated in the world. That little correction would give them a sense of meaning to the world again and eliminate the meaning threat before the second set of word pairs even began. Additionally, in experiments where participants were exposed to absurdist literature for the purposes of generating meaning threat, participants were given a distractor task after reading the absurd story, (Proulx et. al., 2010.) Lack of a distractor task in our experiment after the absurd story could possibly account for differences found, as it is possible that meaning threat needs time or a delay to be established.

4.2 Conclusions

The big issue here is that in describing meaning threat, Heine, et. al., (2006) fail to give any guidance as to what results like this may mean. Meaning threat is sort of so vaguely described that it leaves any number of viable excuses intact when effects aren't found. Individual differences in what is considered "normal" can account for variations in results just as well as one could with tearing apart methodology.

The literature lacks manipulation checks, which leads an experimenter to wonder whether the experiment was a failure, or if the results found stand. This experiment looked at several possible manipulation checks, as one of the goals was to see if some could be found for meaning threat. Although the experiment would suggest that meaning threat was not generated, with a more effective manipulation of meaning threat, the potential checks that we included could be extremely helpful in future research. An experiment with the successful generation of meaning threat and these measures would help create independent checks, which the meaning threat literature sorely needs.

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APPENDICES

APPENDIX A: Consent Form

Principal Investigator: Micah D'Archangel
Study Title: A neurophysiological investigation of short stories and words
Institution: Middle Tennessee State University

Name of participant: _____ Age: _____

The following information is provided to inform you about the research project and your participation in it. Please read this form carefully and feel free to ask any questions you may have about this study and the information given below. You will be given an opportunity to ask questions, and your questions will be answered. Also, you will be given a copy of this consent form.

Your participation in this research study is voluntary. You are also free to withdraw from this study at any time. In the event new information becomes available that may affect the risks or benefits associated with this research study or your willingness to participate in it, you will be notified so that you can make an informed decision whether or not to continue your participation in this study.

For additional information about giving consent or your rights as a participant in this study, please feel free to contact the MTSU Office of Compliance at (615) 494-8918.

1. Purpose of the study:

You are being asked to participate in a research study because we are interested in how the brain processes short stories and words.

2. Description of procedures to be followed and approximate duration of the study:

You will be asked to complete three tasks. First, you will be asked to answer a short questionnaire (99 questions) and then you will read word pairs and judge whether they are related or unrelated. Next you will read a short story (8 pages). Next, you will read word pairs and judge whether they are related or unrelated again. Your brain's electrical activity will be measured during this study. A cap containing electrodes will be placed on your head while you read the stories and judge the words, so your total time commitment will be about two hours. The actual story, questionnaire, and word portion of the study should take about one hour.

3. Expected costs:

There are no expected costs associated with this study.

4. Description of the discomforts, inconveniences, and/or risks that can be reasonably expected as a result of participation in this study:

You will have to sit still for 10 to 20 minutes at a time, which may be tiring or annoying. Your hair may be a little wet at the end of the session from the EEG cap. We will provide you a hair dryer and towel for your convenience.

5. Anticipated benefits from this study:

- a) The potential benefits to science and humankind that may result from this study are a better understanding of how the brain processes short stories and words.
- b) The potential benefits to you from this study are a better understanding of what psychological research entails. You will not receive a direct benefit from participating in this study.

6. Alternative treatments available:

You may choose not to participate in this study.

7. Compensation for participation:

You may be eligible to receive extra credit for participating in this study.

8. Circumstances under which the Principal Investigator may withdraw you from study participation:

You may be withdrawn from the study if you do not wish to continue.

9. What happens if you choose to withdraw from study participation:

You may choose to withdraw at anytime without penalty.

10. Contact Information.

If you should have any questions about this research study or possible injury, please feel free to contact **Dr. William Langston** at **615-898-5489** or **Micah D'Archangel** at **931-209-3659**.

11. Confidentiality.

All efforts, within reason, will be made to keep the personal information in your research record private but total privacy cannot be promised. Your information may be shared with MTSU or the government, such as the Middle Tennessee State University Institutional Review Board, Federal Government Office for Human Research Protections or if you or someone else is in danger or if we are required to do so by law.

12. ACT Scores Request.

By agreeing to participate in this study, you are also agreeing to allow researchers access to your Reading ACT and English ACT scores. Your name will be used to access your scores, but your name will not be associated with them once they are acquired. If you agree to allow access to these scores, please initial here _____.

13. STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS STUDY

I have read this informed consent document and the material contained in it has been explained to me verbally. I understand each part of the document, all my questions have been answered, and I freely and voluntarily choose to participate in this study.

Date

Signature of patient/volunteer

Email

MTSU ID (M#)

Consent obtained by:

Date

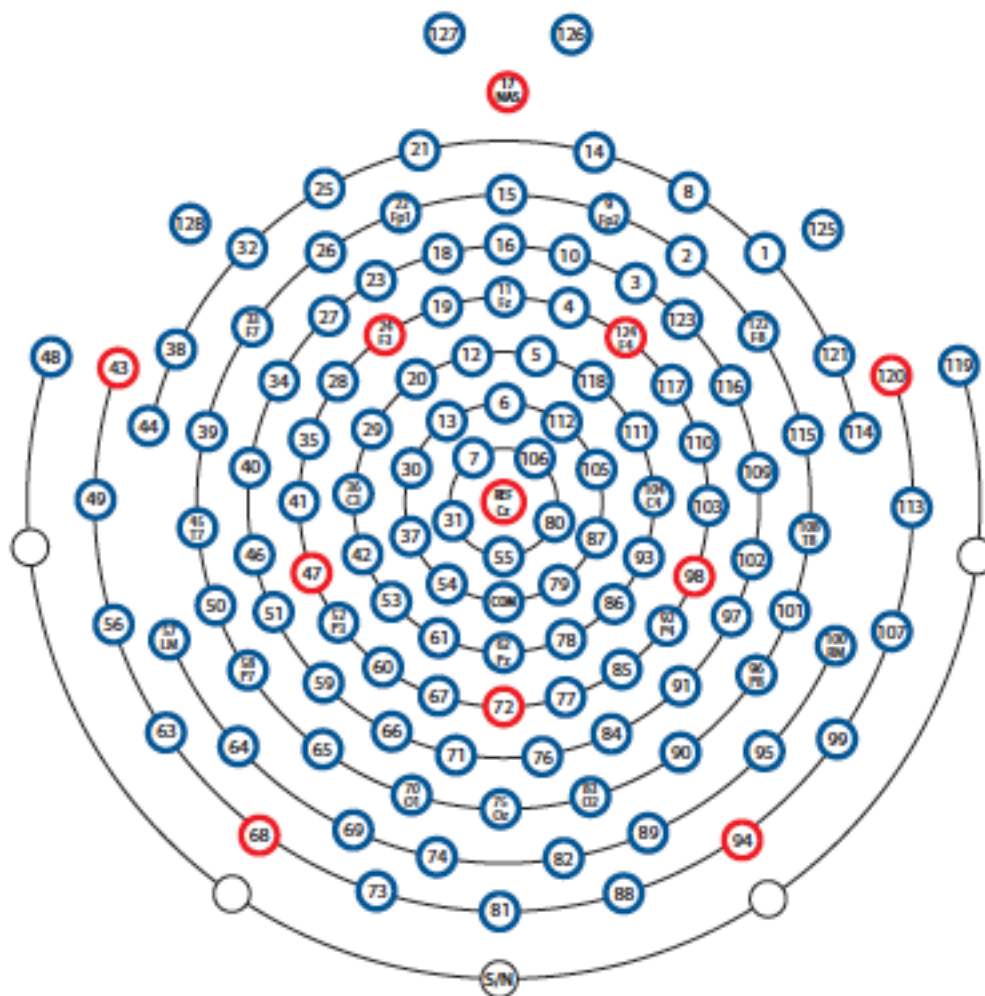
Signature

Printed Name and Title

APPENDIX B: Word List

RELATED					UNRELATED							
WORD1	WORD2	LSA VALUE			WORD1	WORD2	LSA VALUE				Related	Unrelated
BULL	COW	0.21	31.68	SUM	WITCH	EGG	0.02	4.9	SUM		0.06	0
GOOSE	DUCK	0.49	0.46588235	AVG	ROSE	BRAIN	0.05	0.07205882	AVG		0.15	0
OWL	HAWK	0.35	0.18	SD	CROW	TRAY	0.02	0.0612	SD		0.18	0
MOUSE	RAT	0.54			WATER	JUDGE	0.03				0.19	0
LAMB	SHEEP	0.53			PRINCE	LIMB	0.03				0.19	0
CRAB	SHRIMP	0.4			HORN	CREAM	0.11				0.19	0
TOAD	FROG	0.87			HERB	JET	0.02				0.2	0
COD	TROUT	0.37			MOTH	LOCK	0.03				0.21	0.01
PEA	BEAN	0.36			GRASS	PRIEST	0.06				0.24	0.01
LEMON	LIME	0.33			PIG	BRASS	0.14				0.25	0.02
BARN	SHED	0.63			NUN	FLUTE	0.1				0.27	0.02
TIE	BELT	0.43			NEST	DRUM	0.04				0.28	0.02
PLATE	BOWL	0.39			WOOD	CALF	0.04				0.3	0.02
BROOM	BRUSH	0.3			STORM	GOAT	0.07				0.3	0.02
GOWN	DRESS	0.59			ANT	INN	0.03				0.31	0.03
DOOR	GATE	0.47			ELK	VEIL	0.06				0.32	0.03
CUP	MUG	0.48			ROOM	SNAIL	0.05				0.33	0.03
POT	PAN	0.61			OAK	DOLL	0.1				0.35	0.03
BOLT	SCREW	0.71			TAXI	SNAKE	0.01				0.36	0.03
YACHT	SHIP	0.31			WHEEL	BAND	0.16				0.36	0.03
BLOUSE	SKIRT	0.7			HARP	SHACK	0.1				0.37	0.03
BOOT	SHOE	0.3			SKIS	PEACH	0.04				0.37	0.03
SPEAR	SWORD	0.54			ANCHOR	FILM	0.03				0.38	0.03
FORK	SPOON	0.48			BASE	CAGE	0.06				0.39	0.03
SPRING	FALL	0.58			DIRT	SCARF	0.17				0.4	0.04
ROCK	STONE	0.15			SMOKE	TOY	0.08				0.42	0.04
PIN	TACK	0.19			JOKE	HAND	0.24				0.42	0.04
BUS	TRAIN	0.32			SKUNK	TAPE	0.04				0.42	0.04
TRUCK	VAN	0.25			CHISEL	EEL	0.02				0.43	0.04
DOLPHIN	WHALE	0.64			SOCK	STICK	0.27				0.43	0.05
WALRUS	SEAL	0.37			KEY	FAN	0.09				0.44	0.05
CHERRY	GRAPE	0.19			PINK	FLEA	0.17				0.45	0.05
SOFA	COUCH	0.71			FOX	RAKE	0.11				0.46	0.05
CANOE	RAFT	0.56			FENCE	TANK	0.07				0.47	0.05
WAGON	CART	0.46			DRAIN	BOARD	0.05				0.48	0.06
OVEN	STOVE	0.57			SWAN	WALL	0.01				0.48	0.06
SHOVEL	HOE	0.36			RADIO	SHELL	0.03				0.48	0.06
RED	BLUE	0.69			TABLE	GEL	0.03				0.48	0.06
GRAY	BLACK	0.48			JEANS	SKY	0.1				0.48	0.07
FOOD	DRINK	0.19			OLIVE	DOCK	0.1				0.49	0.07
CHAPEL	CHURCH	0.42			DESK	HOOK	0.16				0.5	0.08
JACKET	COAT	0.6			GLUE	ROBE	0.1				0.53	0.08
RUBY	GEM	0.2			EAGLE	GLASS	0				0.53	0.08
PENCIL	PEN	0.42			DOME	LEAF	0 * = -.01				0.53	0.09
COVER	QUILT	0.18			PEPPER	SIGN	0.09				0.54	0.09
METAL	STEEL	0.48			ZEBRA	HOUR	0.08				0.54	0.09
UNCLE	AUNT	0.82			MATH	RUG	0.11				0.54	0.1
HEEL	TOE	0.67			WASP	GYM	0.05				0.56	0.1
CORD	PLUG	0.06			DONKEY	PURSE	0.09				0.57	0.1
WHEAT	GRAIN	0.72			WIFE	FIELD	0.08				0.57	0.1
HOT	COLD	0.48			LUNCH	SAND	0.12				0.58	0.1
JELLY	JAM	0.44			RAM	COIN	0.05				0.59	0.1
BOY	GIRL	0.53			TIRE	STAGE	0 * = -.02				0.6	0.1
JUICE	MILK	0.42			FLAME	MOUTH	0.2				0.61	0.11
OCEAN	SHORE	0.43			DAWN	GAS	0.03				0.62	0.11
HINT	CLUE	0.24			BRIDGE	TOAST	0.02				0.63	0.11
DAY	NIGHT	0.54			ELBOW	CAMP	0.11				0.64	0.11
DARK	LIGHT	0.57			ATTIC	MAIL	0 * = -.01				0.64	0.12
MOON	SUN	0.28			NOTE	SAW	0.14				0.67	0.14
STAR	SPACE	0.27			HEAD	TEA	0.23				0.69	0.14
PIE	CAKE	0.62			NOON	PILL	0.04				0.7	0.16
HAMMER	NAIL	0.5			LAKE	JAIL	0.03				0.71	0.16
KITE	STRING	0.45			VASE	POND	0 * = -.01				0.71	0.17
WINE	BEER	0.85			ICE	CLOCK	0.06				0.72	0.17
BAT	BALL	0.84			LID	MAP	0 * = -.03				0.82	0.2
FROST	SNOW	0.64			EYE	SONG	0.1				0.84	0.23
CLOUD	RAIN	0.53			ENGINE	HAIR	0				0.85	0.24
RIVER	STREAM	0.38			SCIENCE	YARD	0.03				0.87	0.27

APPENDIX C: EEG Map



APPENDIX D: IRB Approval Letter

IRB
INSTITUTIONAL REVIEW BOARD
 Office of Research Compliance,
 010A Sam Ingram Building,
 2269 Middle Tennessee Blvd
 Murfreesboro, TN 37129

**IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE**

Friday, January 13, 2017

Investigator(s): Micah D'Archangel (Student PI), William Langston (FA) and Christof Fehrman

Investigator(s) Email(s): mad5s@mtmail.mtsu.edu; william.langston@mtsu.edu

Department: Psychology

Study Title: A neurophysiological investigation of meaning threat

Protocol ID: **17-2109**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category (7) *Research on individual or group characteristics or behavior*. A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	APPROVED for one year from the date of this notification
Date of expiration	1/31/2018

Participant Size	70 (SEVENTY)	
Participant Pool	Adult MTSU students	
Exceptions	NONE	
Restrictions	Mandatory informed consent	
Comments	NONE	
Amendments	Date xx/xx/xxxx	Post-approval Amendments NONE

This protocol can be continued for up to THREE years (**1/31/2020**) by obtaining a continuation approval prior to **1/31/2018**. Refer to the following schedule to plan your annual project reports and be aware that you may not receive a separate reminder to complete your continuing reviews. Failure in obtaining an approval for continuation will automatically result in cancellation of this protocol. Moreover, the completion of this study MUST be notified to the Office of Compliance by filing a final report in order to close-out the protocol.

Continuing Review Schedule:

Reporting Period	Requisition Deadline	IRB Comments
First year report	12/31/2017	INCOMPLETE
Second year report	12/31/2018	INCOMPLETE
Final report	12/31/2019	INCOMPLETE

IRBN001 Version 1.3
Office of Compliance

Revision Date 03.06.2016 Institutional Review Board
Middle Tennessee State University

The investigator(s) indicated in this notification should read and abide by all of the post-approval conditions imposed with this approval. [Refer to the post-approval guidelines posted in the MTSU IRB's website](#). Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident. Amendments to this protocol must be approved by the IRB. Inclusion of new researchers must also be approved by the Office of Compliance before they begin to work on the project.

All of the research-related records, which include signed consent forms, investigator information and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity.

IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

[Click here](#) for a detailed list of the post-approval responsibilities.
More information on expedited procedures can be found [here](#).