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Test Anxiety: A Test of Attentional Bias

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TEST ANXIETY: A TEST OF ATTENTIONAL BIAS

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An Abstract of the Thesis Presented
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Test anxiety is characterized by apprehension, panic, and ruminating thoughts of potential failure that are experienced during an exam situation. In a test conscious society, students' lives are significantly affected by their test performance. Tests are used to measure and determine thresholds in education, career placement and advancement. Possibly due to pressure to perform well, students often experience heightened stress and anxiety during tests, and thus test anxiety has become a pervasive problem. This study investigated attentional bias among a test-anxious sample. It is suggested that test-anxious individuals have a tendency to use a disproportionate amount of their cognitive resources scanning the test environment for possible signs of threat. That is, high test-anxious students have an attentional bias for threatening stimuli related to a testing situation. In the present study, attentional bias was investigated using a Stroop color-naming task and an attentional dot probe task among a sample of undergraduate students. The rationale for using these tasks is that attentional bias toward threatening stimuli would be indicated by delayed color-naming responses (Stroop task) and accelerated responses to probes replacing threatening

words (attentional dot-probe task). During these tasks, participants were shown various words that either contained test-threat (e.g., test), test-threat control (e.g., shoe), general threat (e.g., abuse), or general threat control (e.g., elbow). Participants were also assessed for state, trait, and test anxiety. Initially, differences in attentional bias were not found between high test-anxious and low test-anxious participants; however, an elevation in state anxiety (due to an upcoming exam) was shown to activate attentional bias among high test-anxious participants. High test-anxious participants who had an upcoming exam demonstrated an attentional bias for test-threat words compared to low test-anxious participants who did not have an upcoming exam. Furthermore, it was found that high test-anxious participants (compared to low test-anxious participants) demonstrated an attentional bias for test-threatening stimuli compared to neutral stimuli whether or not participants had an upcoming exam. Overall, this study showed that high test-anxious individuals have an increased susceptibility to distraction when receiving an anxiety-provoking stressor (e.g., words containing test threat). Attentional bias among test-anxious individuals has important implications for test anxiety research including classification of test anxiety separate from other anxiety types (e.g., social anxiety disorder, generalized anxiety disorder) and the development of coping strategies and effective treatments for students.

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INTRODUCTION

In a test-conscious society, students' lives are significantly affected by their test performance (Spielberger & Vagg, 1995). Tests are an important part of society in that they are used to measure and determine thresholds in education, career placement, and advancement. As society continues to grow and evolve, test performance will probably become an increasingly greater factor in determining success (e.g., admission to college, admission to graduate school, and professional exams; Zeidner, 1998). Possibly due to pressure to perform well, among other factors, students often experience heightened stress and anxiety during tests; thus, test anxiety has become a pervasive problem over the years (Spielberger & Vagg, 1995).

Anxiety: Fear and Panic

Anxiety is "normal," but it may become a problem if it is distressing or disabling. Anxiety is often viewed as a disorder if it is associated with personal distress; with maladaptive behavior, such as impaired coordination, stereotyped behavior, or avoidance; or with harmless situations. The elements of anxiety include a subjective feeling state (e.g., tension, apprehension), behavioral responses (e.g., impaired performance, avoidance of certain situations), and certain physiological responses (e.g., increased heart rate, respiration; Barlow, 2001).

The distinction between fear, anxiety, and panic can be quite subtle, but they have distinctive and significant differences. Fear is "a reaction to a

specific observable danger" (Barlow, 2001, p. 8); anxiety is a diffuse, objectless apprehension in anticipation of future danger or misfortune that is accompanied by an unpleasant mood or somatic symptoms (Barlow, 2001); and a panic attack is "a sudden onset of intense apprehension, fearfulness, or terror, often associated with feelings of impending doom" (American Psychiatric Association, 2000, p. 429) occurring at an inappropriate time (Barlow, 2001). Anxiety disorders are marked by the presence of anxiety or panic attacks associated with distress or impairment (American Psychiatric Association, 2000).

Phobia

Specific phobia involves "marked and persistent fear of clearly discernible, circumscribed objects or situations" (American Psychiatric Association, 2000, p. 443). Subtypes include *animal* (e.g., mice, spiders, snakes), *natural environment* (e.g., storms, heights, water), *blood-injection-injury* (e.g., medical procedure, injections, blood withdrawals)*, situational* (e.g., public transportation, bridges, enclosed spaces), and *other* phobias (e.g., the number 13, vomiting; American Psychiatric Association, 2000). Typically, treatment of specific phobia includes a systematic program of therapeutic exposure to relevant stimuli. The exposure can be gradual or confrontive, in the imagination or in real life (Barlow, Raffa, & Cohen, 2002).

Social phobia involves "marked and persistent fear of social performance situations in which embarrassment may occur" (American Psychiatric Association, 2000, p. 450). Social phobia may be *generalized*

(e.g., social anxiety disorder) if the anxiety is related to most social situations. It is important to recognize that “general interpersonal shyness, perhaps combined with social skill deficits, may not equate with social phobia” (American Psychiatric Association, 2000, p. 534-535) and is more than inflated shyness. For example, many famous media people, stage performers, and athletes may have social phobia without being “shy” (Barlow, 2001). Treatment of social phobia usually includes behavior rehearsal (e.g., modeling and role playing) in groups, plus cognitive therapy (Heimberg, 1989).

Classification, Descriptive Pathology, and Prevalence of Test Anxiety

There is no formal diagnostic classification of test anxiety, and it is not quite clear whether test anxiety belongs with specific or social phobia (Zeidner, 1998). However, test anxiety probably should be classified as a specific phobia. Although social phobia has components in common with test anxiety such as fear of performance and evaluation, the premise of social phobia reflects social situations and fear of being humiliated or embarrassed. Individuals with test anxiety often report that they are able to socialize and function in social situations without any difficulties. Specific phobia, on the other hand, suggests anxiety or apprehension of a feared object or situation. Thus, individuals can be diagnosed with test-anxiety with out necessarily meeting criteria for social phobia (Zeidner, 1998).

Test anxiety is characterized by uneasiness, apprehension, hopelessness, and expectations of failure (Seiber, 1980; Zeidner, 1998).

Normally, it occurs as an established set of responses to stimuli, based upon the student's past experiences in testing situations (Sieber, 1980). Test anxiety is experienced before, during, or after an examination and is commonly attributed to concern, worry, or fear. Almost everyone has experienced test anxiety at one time or another, however, some students experience anxiety to such an extent that it interferes with test-taking, and as a result, academic performance may be seriously affected (Spielberger & Vagg, 1995). Students with test anxiety often experience ruminating thoughts about potential failure accompanied by emotional distress and physiological arousal that is frequently interpreted as threatening and dangerous. When they sit down for the exam, they experience panic and thoughts of failure, leading them to believe that the testing situation represents a potential catastrophe (Maxfield & Melnyk, 2000; Sieber, 1980). These negative cognitions prevent successful test-taking by distracting the student's attention from the exam itself and interfering with the student's ability to analyze the question and formulate or select the correct answer. Test anxiety not only affects the test-taking experience itself, it may even cause avoidant behavior wherein a student avoids studying and preparation for upcoming exams. The anticipation of expected failure may lead to a self-fulfilling prophecy (Leary & Kowalski, 1995; Maxfield & Melnyk, 2000; Zeidner, 1998).

The prevalence of test anxiety among school and college-age students is widespread. It is estimated that in a typical classroom of 20 children, two or three will be highly anxious in a test-taking situation (e.g., an exam). For

college populations, the prevalence of test anxiety of students in the United States experiencing debilitating stress during evaluative situations is estimated to be between 15% and 20% (Hill, 1984). This means that millions of students regularly experience test anxiety to the extent that it affects their current performance and, perhaps, even their future goals (Hill, 1984; Zeidner, 1998).

Early Studies of Test Anxiety

From the perspective of biology, Darwin (1872) described fear as a characteristic common to both humans and non-human animals (Spielberger & Vagg, 1995). Defining it in terms of physiological arousal, he described the components of fear that include increased heart rate, dry mouth, increased respiration, choking, shaking, numbness in fingers and toes, and feeling flushed, all of which are now attributed to the activation of the autonomic nervous system. In contrast to Darwin's physiological manifestations of fear, Freud (1936) focused on anxiety, which he described as subjective experiences associated with fear reactions. Freud (1936) described anxiety as being either "realistic" (i.e., normal), which is caused by a real danger in the environment, or "neurotic" (i.e., abnormal), which is caused by irrational threats stemming from internal dangers (Spielberger & Vagg, 1995). In a testing situation, many students experience normal anxiety (e.g., nervousness, tension), however, when irrational threats arise from physiological arousal, test anxiety becomes pathological, and should be investigated.

In early studies, test anxiety theory was primarily based upon physiological responses experienced by students. Folin, Demis, and Smillie (1914) examined test anxiety among medical students and it was reported that 20% of students presented with unusually high levels of glucose in their urine (i.e., glycosuria) after a stressful exam. The presence of glycosuria was not evident in the students prior to the exam. Similarly, Cannon (1929), who was investigating homeostasis and the autonomic nervous system, found evidence of glycosuria following a stressful exam.

Bloch and Brackenridge (1972) obtained blood samples from medical students after an important exam. They found a strong negative correlation between self-rated exam performances and high plasma cholesterol levels, a physiological indicator of stress. Students who reported themselves as performing poorly had unusually high plasma cholesterol levels in their blood compared to students who rated themselves as performing well on the exam.

These earlier studies demonstrated the existence of physiological responses and biological changes in the body, presumably due to anxiety. This led to more studies that focused on physiological properties of test anxiety. However, these studies did not identify emotional states that are typically experienced during the exams (Spielberger & Vagg, 1995). In the late 1930s, Brown (1938) and other researchers became quite concerned about the effects of test anxiety after two suicides at the University of Chicago. The researchers' goals were to study test anxiety in depth and to develop a successful approach to treat it (Zeidner, 1998).

Components of Test Anxiety

Worry and emotionality.

According to Liebert and Morris (1967), test anxiety consists of two parts, a worry component and an emotionality component. Worry is conceptualized as cognitive concerns regarding the exam and exam performance. Such concerns focus around negative cognitions (e.g., preoccupation with test performance), potential negative consequences (e.g., failure), and comparison of one's ability to others' (e.g., "I will be the only one who fails"). Worry can be elicited by internal or external cues that arise during an exam. For example, students may perceive that their ability to cope is inadequate, and thus failure is imminent. Students' worries stem primarily from memories of previous evaluative situations and are learned based upon success or failure (Zeidner, 1998).

Research has demonstrated that expectation of successful performance and worry are negatively correlated (Spielberger & Vagg, 1995). Wine (1971) found that highly anxious students who performed poorly on an exam scored high on worry, suggesting poor performance was attributed to worrisome cognitions (e.g., self-blame for potential failure), and this in turn distracted the student from the task at hand (e.g., the exam). Students who scored high on worry often concerned themselves with past exam disasters and berated themselves for not studying properly or for forgetting the answers to simple exam questions (Covington, 1984).

Emotionality is conceptualized as the student's awareness of his or her physiological and autonomic arousal during a testing situation (e.g.,

nervousness, tension, perspiration; Liebert & Morris, 1967). Both high test-anxious and low test-anxious students experience emotionality; however, they differed in the intensity of physiological arousal (e.g., heart rate). For example, Deffenbacher (1986) examined 156 students who were evaluated as high test-anxious and low test-anxious. High test-anxious students had more elevated heartbeats (e.g., *M* = 79 beats/min) compared to the low test-anxious students (e.g., *M* = 70 beats/min) during an evaluative situation. Likewise, other research found that heart rates between high test-anxious and low test-anxious students were significantly different under evaluative conditions (Montgomery, 1977; Zeidner, 1998).

However, when examining emotionality that encompasses physiological arousal as a whole (e.g., perspiration, nervousness, sweating, difficulty breathing) in which heart rate is not singled out, emotionality in general does not correlate with performance. Several studies have demonstrated a low correlation between emotionality and test performance. For example, emotionality and reading test performance were unrelated (i.e., *r* = 0.03), however, worry and performance were significantly negatively correlated (e.g., *r* = -0.29) among their sample of students (Morris & Perez, 1972). Similarly, Morris and Liebert (1970) reported that emotionality was unrelated to test performance, while worry was negatively related to test performance among a college sample (Deffenbacher, 1980).

State-trait test anxiety. According to Spielberger (1972) state anxiety may be conceptualized as a

> transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time. The condition is characterized by subjective, consciously perceived feelings of tension and apprehension, and activation of the autonomic nervous system (Spielberger, 1972, p. 39).

In a testing situation, state anxiety is conceptualized as a situation-specific form of test anxiety that encompasses both worry and emotionality. It is characterized as an emotional state that a student may experience during an evaluative situation (e.g., the anxious effect provoked by an exam; Hong & Karstensson, 2002). A student may consciously experience nervousness, tension, worry, disorganization, apprehension, fear, or even feel a sense of danger in response to physiological arousal from the autonomic nervous system (e.g., increased heart rate, perspiration, dry mouth). The emotional states are often accompanied by ruminating thoughts of failure and hopelessness. State anxiety often fluctuates depending upon the extent of the student's perceived threat created by factors such as how well prepared the student was for the exam (e.g., amount of time studying, studying the correct topics), the type of test questions (e.g., multiple choice, essay), difficulty level of the test question (superficial versus deep knowledge), and individual differences in personality characteristics (Spielberger, 1972; Spielberger & Vagg, 1995; Zeidner 1998).

Trait anxiety can be difficult to isolate and measure directly because it is not typically manifested in behavior. Spielberger defines trait anxiety as

> relatively stable individual differences in anxiety proneness, that is, to differences in the disposition to perceive a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with state [anxiety] reactions. Trait [anxiety] may also be regarded as reflecting individual differences in the frequency and the intensity with which state [anxiety] have been manifested in the past, and in the possibility that such states will be experienced in the future (Spielberger, 1972, p. 39).

In a testing situation, a student has the ability to perceive and interpret an exam situation as being more or less threatening or dangerous. Thus, trait anxiety is characterized as the ability to perceive or interpret a testing situation to which the student responds with more or less intensity of state anxiety (e.g., apprehension, worry; Spielberger 1972; Spielberger & Vagg, 1995). For example, students who score high on trait anxiety are likely to interpret the exam situation as being more threatening compared to students who scored lower on trait anxiety. Thus, high trait anxious students are more likely to experience state anxiety of greater intensity and frequency (Zeidner, 1998), greater physiological arousal, more worry cognitions, and increased task-irrelevant thoughts that distract the student's attention away from test performance compared to low trait anxious students (Spielberger, 1978).

Four-factor theory of test anxiety. Sarason (1984) expanded the test anxiety construct that went beyond worry and emotionality. He described the construct of test anxiety as encompassing four factors: tension, worry, bodily symptoms, and test irrelevant thoughts. Tension is described as the emotional feelings that one experiences prior to or during an exam (e.g., distress, uneasiness, anxiety, feeling jittery). Worry is described as thoughts relative to exam performance (e.g., potential failure, performance of others, consequences). Test-irrelevant thinking is described as thoughts and concerns that divert the student's attention away from the exam itself (e.g., irrelevant bits of information that "pop up", thoughts unrelated to the exam, thoughts about past events). Bodily reactions are described as physiological symptoms just prior to or during an exam (e.g., headache, upset stomach, increased heart rate). Tension and bodily symptoms are considered as part of emotionality, whereas worry and test-irrelevant thoughts are considered to be cognitive processes.

To measure these four components, Sarason (1984) developed the 40-item Reactions to Tests Scale (RTT). The RTT has four 10-item subscales, each of which measures one of the components. The RTT has demonstrated zero order correlations among the subscales that ranged from $r = 0.24$ to $r = 0.69$. Examination of the correlation between the RTT and the Test Anxiety Scale (another validated measure of test anxiety; Sarason, 1978) shows that coefficients for each of the 10-item scales ranged from $r = 0.68$ to $r = 0.81$. For all 40 items, total scale reliability equaled $r = 0.78$.

Benson and Bandalos (1992) have demonstrated coefficient alphas for each of the subscales of the RTT even higher than Sarason's (1984) sample, with coefficient alphas for each of the four subscales ranging from $r = 0.85$ to $r = 0.92$. The total scale reliability was reported as $r = 0.95$. Benson and Bandalos (1992) went on to develop a shorter 20-item scale revision of the RTT that demonstrated proven alpha coefficients that ranged from $r = 0.64$ to $r = 0.92$. Validity and reliability are very similar between the 40- and 20-item measures and are comparable in their effectiveness in measuring the four components of test anxiety; however, the shorter form has the advantage of being quicker to administer and score.

Etiological Models of Test Anxiety

Transactional process model of test anxiety.

Spielberger and Vagg (1995) describe the transactional process of test anxiety as being situation specific and involving a temporal sequence of events. The transactional process model distinguishes between a series of events that takes place during an evaluative situation. These events include the examination itself (e.g., stressor), the student's subjective interpretation about the stressor as more or less intense (e.g., threat), the emotional states that are experienced during an exam (e.g., anxiety), cognitive appraisals (e.g., irrational thinking), coping strategies (e.g., avoidance), and consequences (e.g., exam performance).

When a student begins the exam process, according to Spielberger and Vagg (1995), the exam itself will be interpreted as being more threatening

or less threatening according to the student. This interpretation depends upon the extent of the student's trait anxiety (e.g., personality characteristics, individual differences). The student will then appraise the exam condition. If the student interprets the exam as more threatening, then the student is likely to experience an elevation in state anxiety (e.g., worry, apprehension, ruminating thoughts of failure, test irrelevant thoughts). The emotional responses provide feedback that can alter or reinforce the appraisal of the exam as being more threatening or less threatening. For example, if a student is considered to be test-wise (e.g., demonstrate proficient test-taking skills), they may think the exam situation is less threatening compared to a student who is considered to be less test-wise.

Appraisals of the exam correspond to the student's knowledge of the exam material. If the student is able to answer a question correctly, especially at the beginning of the exam, then state anxiety is likely to lower along with increased positive cognitive appraisals (e.g., "I am confident that I will pass this exam"). On the other hand, if a student's knowledge of the exam material is weak and they are not able to respond to questions correctly, they are likely to experience a negative emotional response including tension, worry, and physiological arousal. The rise in state anxiety may lead to the student appraising the exam situation as more threatening which, in turn, will likely reinforce negative cognitive appraisals and self blame (e.g., "I should have studied longer").

The final stage of the transactional process model is the formulation of answers to the exam questions (e.g., retrieving information from memory). Poor performance is likely to cause emotional responses and cognitive appraisals that may ultimately interfere with information retrieval, attention, and concentration that will contribute to poor performance.

According to Vagg and Spielberger (1995), students who are high test-anxious consider examinations as a significant threat to which they respond with more intense emotionality and negative worry cognitions compared to students who are low test-anxious. Emotional responses interfere with concentration and attention due to task irrelevant thoughts, and worry cognitions interfere with information processing and the ability to retrieve information from memory. Treatments that are primarily focused on addressing emotional responses (e.g., alleviating anxiety) and cognitive worry (e.g., modifying irrational beliefs) during examinations have been beneficial by reducing test anxiety (e.g., cognitive-behavioral therapies). Hembree (1998) suggested, through a meta-analysis of test anxiety treatments, that cognitive-behavioral therapies of test anxiety are successful in reducing worry and emotionality. In general, cognitive-behavioral therapies have demonstrated a rise in performance (e.g., course grade) among school-aged students by approximately one-half of a standard deviation and in post-secondary students by approximately three-quarters of a standard deviation (Zeidner, 1998).

Empirical research investigating treatment of test anxiety by targeting emotional reactions and cognitive appraisals has demonstrated promising results (Hembree, 1998; Zeidner, 1998). Although relatively little is known about the development of antecedents of test anxiety, more research is needed to investigate a student's strengths and weaknesses when taking an exam in order to develop effective treatments that will meet that student's particular needs. The majority of the studies were limited to only specific segments of the transactional process model (e.g., emotionality, worry; Vagg & Spielberger, 1995; Zeidner, 1998), but very little was investigated with respect to a student's dynamic relationship between worry and emotionality. Schutz, Davis, and Schwanenflugel (2002) suggest that the relationship between students' perceived ability and the way in which they organize specific concepts during exams is also important (e.g., perception of ability to cope with exam stress).

Concept organization model of test anxiety. Understanding the way students organize their personal concepts during an exam is likely to shed some light on important aspects of the test-taking experience (e.g., what environmental cues are students likely to attend to, strategies students use to regulate their behavior; Clark, 1987; Saarni, 1998). The way an individual organizes personal emotional concepts regarding a specific event depends upon personal experiences and how they regulate appraisal processes. Students who are considered to be high test-anxious (versus low test-

anxious) are likely to have varying concepts about the testing situation (Schutz, Davis, & Schwanenflugel, 2002).

Schutz et al. (2002) discuss theories of emotion and emotion regulation that influence the way students experience thoughts and feelings during an exam. They discuss four conceptual sub-domains: cognitive appraisals, task-focusing, emotion-focusing, and emotion-experiences.

According to Schutz et al. (2002) *cognitive appraisals* occur when a student assesses the testing situation in relation to his or her goals. In order for anxiety to emerge, a student must consider the exam to be important. As the student's perception of the importance of the exam lessens, so also does the emergence of anxiety. Thus, the thoughts relevant to the importance of the examination are the primary component regulating an emotional response. The perception of what is actually happening in relation to the student's goals of the test-taking experience is the second component of cognitive appraisals (Schutz et al. 2002). That is, in order to achieve the student's goals, specific events must take place (e.g., ability to recall certain information, responding correctly to a certain percentage of questions) in order to achieve the expected grade. The third component of cognitive appraisal is the perception of the student's ability to cope and handle the test (e.g., having the confidence to deal with challenging questions, strategies to guess at multiple choice options).

Task-focusing as described by Schutz et al. (2002) is the student's ability to focus and manage the task at hand (e.g., the exam itself). Task-

focusing consists of processes such as reading directions, analyzing important concepts of an exam question, strategically keeping track of and managing time, selecting the best multiple-choice options, and checking answers. The processes are designed to help maintain focus on the exam and away from task-irrelevant and unpleasant thoughts.

Emotion-focusing is described as occurring when the student's attention drifts away from the exam to their own emotions about the exam (Schutz et al. 2002). That is, the student's focus is disengaged from the exam itself and is instead on the student's thoughts and feelings about their performance. For example, the student may emphasize the test's importance, blame one's self for not studying enough, or wonder how others are doing. The emotion-focusing process may actually reduce or elevate a student's anxiety. For instance, a student may engage in self-talk that deemphasizes the test importance, thus reducing anxiety. However, a student may engage in self-blame and list things that should have studied or done to better prepare for the test, resulting in an elevation of anxiety (Schutz et al., 2002).

Emotion-experiences are described by Schutz et al. (2002) as the types of emotions that the student is experiencing. These emotions can be pleasant (e.g., pride, satisfaction) or unpleasant (e.g., anger, hopelessness). The distinction is based upon cognitive appraisals. If the student's goals are being met and the exam is going as expected, then pleasant emotions are likely to emerge such as feeling pride and contentment. However, if the exam

is not going as expected, then unpleasant emotions are likely to emerge such as feeling disappointed or angry. Furthermore, if a student believes that he or she cannot effectively cope with the exam, the experience of anxiety is more likely.

In order to test concept organization and the relationship that exists between them, Schutz et al. (2002) instructed participants to rate the degree of relationship between the above concepts with respect to test anxiety during an exam. They found that among the low to moderate test-anxious students, the students distinguished concepts based upon their ability to regulate task-focusing and emotion-focusing processes. That is, low to moderate test-anxious students had a tendency to rate their ability to focus on the task at hand as successful and typically experienced emotions that were described as being pleasant. Among the high test-anxious students, however, emotional regulation was significantly correlated with feelings of anxiety, hopelessness, shame, and anger, and ability to focus at the task at hand was less successful. With respect to cognitive appraisals, when the low to moderate test-anxious students endorsed feeling confident, certain, or in control during the exam, these were significantly correlated with the endorsement of pleasant emotions (e.g., pride, enjoyment, satisfaction). However, high test-anxious students viewed task-focusing strategies as being correlated to unpleasant emotions (e.g., anxiety, anger). The use of strategies (e.g., task-focusing) was higher among the high test-anxious students compared to the low test-anxious students. They reported spending

more time reading directions, checking answers as well as a reporting high anxiety.

Schutz et al. (2002) suggest that the results demonstrated evidence of attentional bias among students who were highly anxious (e.g., scanning the test environment for possible signs of threat; Eysenck, 1992). Attentional bias is speculated to be caused by their ability to find unpleasant emotions intertwined with the test-taking process and greater use of test-taking strategies. Although the researchers did not investigate attentional bias directly, it is noteworthy that the way in which high test-anxious students organize their concepts during test-taking is significantly different compared to low test-anxious students. Specifically, high test-anxious students organize their concepts based on their feelings of anxiety compared to low test-anxious students who organize concepts based on their ability focus on the task at hand. A reasonable approach to investigate why high test-anxious individuals organize their concepts differently compared to low test-anxious individuals can be explained in terms of cognitive schemas and attentional bias theories.

Cognitive Schemas

According to Williams, Watts, MacLeod, and Matthews (1997), it would be highly inefficient to understand each new situation without the ability to reference previous similar situations. A schema is basically a memory structure used to store a body of knowledge regarding a specific event or situation. Thus, a schema can be used as a template to organize new information. The schema itself is generic with abstract prototypical

representations of specific events or situations. For instance, in the most general sense, each individual has a specific schema related to taking a college exam. One might enter the classroom and do a last-minute review of his or her notes. The instructor then announces for everyone to put their books and notes away and proceeds to pass out the exam. The individual then reads and answers each question to the best of his or her ability. This schema can be activated with future exam situations, even if the situation is different (e.g., SAT, college exams, written drivers license exam).

The function of a schema, according to Williams et al. (1997) involves identifying the appropriate memory structure and then applying it to manage a specific event. If specific elements deviate from the schematic representation, then more attention is allocated to these elements. The hypothesis of filtering and attention elaboration explains this phenomenon.

Filtering. Information typical of the schema becomes cohesively organized, but atypical material is only weakly associated in the final representation. Filtering predicts an advantageous recall for typical information compared to atypical material. In other words, typical material is incorporated into a generic schema related to a specific event or situation. For instance, a student may have a schema for typical events during the exam situation such as paper and pencil format, no book or notes allowed, no talking, specific time limit, or the exam being related to the material discussed during previous lectures. However, atypical events such as the instructor

providing everyone with pizza may not qualify in the exam-related schema. Thus, in future exam situations, a student is not likely to expect pizza.

Attention elaboration. There is a memory advantage with atypical material. This is due to the fact that schemas of atypical material attract disproportionate processing resources during encoding. In other words, events or material that are atypical of the event or situation, stand apart and individuals have a greater ability to recall such material. For instance, during an exam situation, the professor provides students with pizza. Although being provided pizza during the exam is not typical of what one might expect during an exam, it is likely to be remembered.

Theoretical constructs of frames and scripts are a useful method of developing formulations of schemas. Both frames and scripts represent modules of generic information. “Processing an input involves assigning elements to appropriate slots in the relevant frame or script” (Williams et al., 1997, p. 216). Frames represent organized relationships from simple to complex rule defined systems (e.g., a car in the United States has the driving controls on the left side of the vehicle) and scripts represent a subset of frames involving temporal sequence of events (e.g., the process of starting a vehicle and driving; Williams et al., 1997).

Understanding cognitive schemas has clinical relevance to anxiety disorders. Emotional information is processed in a biased fashion among individuals with anxiety disorders (Williams et al., 1997). Past negative events can lead one to develop maladaptive schemas that can lead an

individual to become anxious when confronted with specific situations. Anxious individuals are especially attentive to environmental stimuli that are related to threat or perceived threat. Thus, anxious individuals are likely to perceive threatening meaning in ambiguous situations (Mathews & MacLeod, 1994) and develop biased schemas (Williams et al., 1997).

Take the example of a woman who is prone to anxiety and had a negative testing experience. Perhaps she forgot about an important exam and consequently did not adequately prepare. Initially, she would have the unexpected sensation of physiological distress and emotional concerns regarding failure. During the course of the exam, she becomes increasingly worrisome, self-critical, and hopeless. Accompanying these emotional experiences, the individual may also experience increased somatic symptoms including sweating, heart palpitations, and shortness of breath. Despite the fact that she did not adequately prepare for the exam, she incorporates these negative experiences into her schema. With the anticipation of future exams, she recalls this biased material that includes negative emotional experiences and physiological arousal rather than a typical schema experienced when she studied for her exam and was successful.

Schemas are automatic and related to biased information. According to Williams et al. (1997), anxious individuals develop schemas that arise from automatic processes, which “operate without awareness, are rapid, unconstrained by capacity and occur in parallel” (p. 277). In an investigation of how anxiety affects resource allocation, Williams and Dritschel (1988)

demonstrated that cognitive resources are oriented either away or toward a threatening stimulus. Non-anxious individuals shift their cognitive resources away from threat while anxious individuals shift their cognitive resources towards the threat.

Attentional Bias

According to Eysenck (1992), the visual environment is full of attributes that vary in color, shape, size, movement, and have specific emotional significance. Thus, specific attentional resources are necessary for selecting important sensory information in one's environment in an efficient manner. Environmental stimuli with threat significance (e.g., sudden loud noises, sudden movement) would quickly grab the attention of an individual. From an evolutionary adaptive perspective, being sensitive to threats is necessary for survival in that one needs to avoid danger whenever possible. It is suggested that individuals with anxiety disorders demonstrate a disproportional amount of their attentional resources toward threatening stimuli within their environment (Eysenck, 1992). Attentional bias is described as the process of selectively attending to threatening stimuli over neutral stimuli (Eysenck, 1992; Schutz et al., 2002). Individuals with anxiety disorders are likely to misinterpret even harmless environmental stimuli or neutral situations as being potentially dangerous. As a result, they may demonstrate an emotional response characterized by physiological arousal that leads to behavioral avoidance. Thus, individuals with anxiety disorders may be constantly scanning the environment for possible signs of danger and are more likely to

interpret ambiguous information as being more threatening or dangerous compared to non-anxious individuals (Eysenck, 1992). What may be interpreted by anxious individuals as potentially threatening easily and quickly grabs their attention compared to non-anxious individuals. Eysenck (1992) hypothesized that anxious individuals have a hypervigilant fear detection mechanism. That is to say, these individuals have an internal alarm system that is hypersensitive to stimuli that, in turn, are then interpreted (or misinterpreted) as being potentially harmful. Researchers have tested attentional bias using attentional dot-probe tasks, modified attentional dot-probe tasks with fear relevant pictures, and Stroop color-naming tasks.

Attentional dot-probe task. A number of studies have investigated attentional bias among anxiety disorders. Many studies focused on the investigation of task performance that is relevant to the presentation of threatening versus non-threatening stimuli (MacLeod, Mathews, & Tata, 1986). Among anxious individuals, a “shifting” of attention might occur toward threatening stimuli, thus facilitating task performance when threatening stimuli are presented (e.g., shorter response time when threatening words are presented). This idea was tested using a dot-probe task. Typically, a dot-probe task involves participants’ responding (e.g., pressing a button) to the appearance of a dot on a computer screen after viewing words presented to them. The words themselves are characteristically either neutral (e.g., “flower”, “grass”) or potentially threatening (e.g., “snake”, “spider”; Barlow, 2001).

In the attentional dot-probe task (or attentional deployment task; Macleod, Mathews, & Tata, 1986), a word pair appears on a computer screen in a series of trials. One word is above and the other is below the center of the screen. The words are presented for brief intervals (e.g., 500 ms). In the experimental trials, one word is threatening and the other word is neutral. In other trials, both words are neutral. Participants are asked to read the top word out loud on each trial. On key trials, a "dot probe" replaces one of the two words, and participants press a button as soon as they see a probe. The reaction time to the dot probe is a measure of visual attention to the word that the dot replaced. Anxious participants respond faster to probes that replace threat words; that is, they have an attentional bias for threat (Taghavi, Neshat-Doost, Moradi, Yule, Dalgleish, 1999).

Asmundson and Stein (1994) investigated participants diagnosed with social phobia and compared them to a control group of individuals not meeting criteria for social phobia. Participants with social phobia had significantly quicker response times to probes (e.g., dots) following social threat words compared to probes following either neutral or physical threat words. Control participants did not exhibit this effect. The researchers suggested that participants with social phobia selectively process threat cues that are specifically related to social evaluation.

Navon and Margalit (1983) found that anxious participants were no more sensitive to threatening material than control participants. However, they did find a different pattern of response depending upon whether the

threatening word was shown at the top of the screen or at the bottom of the screen, and if the probe replaced the top word or the bottom word. For example, if the word was threatening and replaced by a probe at the top of the screen, then anxious participants were quicker to respond than controls. Anxious participants were slower to respond if the word was neutral and replaced by a probe at the top compared to controls. They were also slower to respond if the word at the bottom of the screen was threatening and replaced by a probe at the top compared to controls. Furthermore, anxious participants demonstrated a slower response time if a threat word was at the top of the screen and was replaced by a probe at the bottom of the screen. These results suggest that anxious individuals orient their attention toward the location where the threat occurred. The controls had a tendency to demonstrate just the opposite, suggesting that they orient their attention away from the location where the threat occurred (Williams, Watts, MacLeod, & Mathews, 1997).

Using an attentional dot-probe task, MacLeod and Matthews (1988) investigated the vulnerability factor of trait anxiety when state anxiety is high. They examined medical students prior to an important exam. The students were administered the State-Trait Anxiety Inventory (Spielberger, 1983) 12 weeks prior to an exam and one week prior to an exam. The students were assessed and classified as being high or low trait-anxious and high or low state-anxious. The participants completed a dot-probe task 12 weeks prior to an exam and then again one week prior to an exam. There were no

significant differences between high trait-anxious and low trait-anxious participants when the attentional dot-probe task that was administered 12 weeks prior to the exam. However, one week prior to the exam participants high in trait anxiety showed bias towards words that were related to exams. That is, they responded quicker when the probe replaced an exam word in the same location. This was the opposite for participants low in trait anxiety in that they responded slower to exam words when a probe in the same location replaced it. These results suggest that trait anxiety is a vulnerability factor, although it is apparent in individual differences in attentional bias only when state anxiety is high such as prior to an important exam (Williams et al., 1997).

Modified use of attentional dot-probe tasks with pictures of feared stimuli. The words themselves may not create a significant amount of stress when a dot-probe task is used. Hansen and Hansen (1988) therefore used a modification of the attentional dot-probe task containing depictions of facial expressions (e.g., neutral, happy, angry) rather than words. Although control group individuals detected angry facial expressions among a crowd more readily than happy faces among the same crowd, the anxious individuals detected angry facial expressions significantly faster. The researchers suggest that threatening faces tend to “pop out” of a crowd, supporting the attentional bias hypothesis. Ohman, Flykt, and Esteves (2001) suggested small animal stimuli could capture the attention of anxious individuals faster than non-anxious individuals, similar to the methods of detecting faces. They

exposed participants to fear relevant stimuli (e.g., spiders, snakes) and neutral stimuli (e.g., flowers, mushrooms). In a series of experiments, participants detected the snakes and spiders significantly faster than the flowers and mushrooms. The ability to detect the location of the spider or snake quickly was shown regardless of the location within an array of distracting stimuli (e.g., bushes, birds), suggesting that they "popped out" rather than requiring the participants to actively search for them. Furthermore, participants who indicated that they had a phobia of snakes or spiders detected these stimuli faster than the participants who did not. The findings suggest that individuals in general have the ability to direct their attention toward potentially threatening or dangerous stimuli (e.g., spiders, snakes). The detection process was accomplished in an efficient and effortless manner. The individuals who are anxious (e.g., phobic) appear to have a heightened ability to focus attention on feared stimuli. The researchers suggest this selective attention is what has helped individuals to survive by avoiding danger.

Stroop color-naming task. A popular approach to investigating attentional bias uses an interference paradigm, namely the Stroop color-naming task (Stroop, 1935). Stroop tasks have been used quite frequently to investigate attentional processes. In the original Stroop task, participants were shown a series of words naming actual colors (e.g., green, red, brown) or ambiguous stimuli (e.g., rows of Xs) each of which were printed in different colors. The words themselves did not always match the color in which they

were printed (e.g., the word “red” might appear in green ink). The participant was required to identify the color printed while ignoring the meaning of the word. Participants had longer response times to identify the colors of words when the words were antagonistic to the color (e.g., the word “red” printed in green ink) as opposed to rows of meaningless stimuli (e.g., rows of Xs printed in various colors), or to words printed with its corresponding color (e.g., the word “green” printed in green ink; Williams, Mathews, & MacLeod, 1996). The interference of one attention-requiring stimulus with another in a selective attention task may be measured as a function of reaction time. People are slower to respond in the Stroop color-naming task when the color name is different from the ink color, suggesting that attentional resources have been devoted to the meaning of the word, interfering with ability to name the ink color (Posner & Snyder, 1975). Generally, reaction time will be shorter when the participant is not paying attention to the task-irrelevant dimensions of the stimuli on interference tasks.

Modified versions of the Stroop color-naming task were used with increased interest in cognitive processes associated with emotional disturbance. Anxious participants also show an attentional bias for threat on the modified Stroop color-naming task. The Stroop color-naming task can be used to measure the significance on emotional salience of words (Williams et al., 1986). For instance, Gotlib and McCann (1984) used the Stroop color-naming task to examine the latency effect of naming colors among students with mild depression. The students were required to identify the colors of

words that were classified as neutral (e.g., lighted, cake, beads), negative/depressive (e.g., hopeless, tormented, grief), or positive in nature (e.g., applause, happy, smile). Students who were not depressed showed very little variation in response time between each of the categories of words. However, the students who were depressed had significantly slower reaction times when identifying the colors of the negative words compared to the neutral or positive words.

Mathews and MacLeod (1985) found similar results among participants diagnosed with anxiety. Participants were divided into two groups that were based upon their anxiety being either social in nature (e.g., uncomfortable in evaluative situations) or physical in nature (e.g., having a panic attack that would lead to a heart attack). Participants were asked to identify the color of words that were classified as neutral (e.g., holiday), socially threatening (e.g., failure), or physically threatening (e.g., disease). Participants with anxiety had slower response times for identifying threatening words compared to neutral words. All participants with anxiety had slower response times for words containing a social threat. However, only those participants with anxiety that was physical in nature had slower response times for identifying words that were physically threatening. The control participants had non-significant differences in response times between the categories of words that were neutral, socially threatening, and physically threatening. The results suggested that individuals with anxiety disorders tend to exhibit attentional bias for threatening stimuli and would thus have longer response times when

asked to identify threatening words compared to when asked to identify neutral words.

Watts, McKenna, Sharrock, and Trezise (1986) investigated participants that were classified as spider-avoidant. The researchers used the Stroop color-naming task containing words classified as threatening (e.g., death, fear) and also words specific to spider-related pathology (e.g., crawl, hairy). The results demonstrated that the spider-avoidant participants did not significantly differ in their response times when asked to identify the color of general-threatening words compared to non-spider-avoidant participants. However, the spider-avoidant participants did demonstrate significantly slower response times when asked to identify the color of words containing a spider related threat. The results suggest that among the spider-avoidant participants, attention is drawn to the actual meaning of the word that distracted them from the task at hand (e.g., identifying the color), resulting in slowed reaction times.

Attentional Bias Relevant to Test Anxiety

Test-irrelevant cognitive processing accounts for the relationship between elevated anxiety and performance deficits among students (Muller, 1992). Elevated anxiety induces attentional deficits that lead high test-anxious students to direct their attention toward task-irrelevant concerns (e.g., “I wonder how everyone else is doing”) and away from task-relevant concerns (e.g., the exam; Muller, 1992; Zeidner, 1980). Cognitive interference has two distinct components. The first consists of self-interference and preoccupation

that involve cognitive appraisals and worry about one's performance (e.g., "the stress is too much!"). The second component is distractibility (e.g., difficulty focusing on the task at hand). In an exam situation, intrusive thoughts and distractibility often lead to self-defeat and may impair performance if the student does not believe that she or he can cope effectively (Sarason & Sarason, 1990).

Early research investigating attentional processing focused primarily on the mechanisms involving distractibility. Highly anxious children direct their attention more toward task-irrelevant and less toward task-relevant information (Dusek, 1980). For instance, Nottelmann and Hill (1977) investigated task-irrelevant behavior among fourth and fifth grade children. The children were assessed and classified as low-anxious, moderately-anxious, or highly-anxious. The children were instructed to perform anagram tasks (e.g., writing as many words possible from the word "generation"). While the children were performing the anagram tasks, an experimenter performed a different anagram task (e.g., generating words from the word "inoperable") as a method to assess the frequency and direction of task-irrelevant behaviors. Task-irrelevant behaviors were recorded as glances at the experimenter and what they were doing, glances directly at the experimenter's task, and other off-task glances. High-anxious children created fewer words and glanced away more frequently compared to the low-anxious children.

Hypotheses of distractibility suggest that cognitive interference plays a key role showing a tendency to experience thoughts that intrude or “pop into” a student’s mind while taking a test. When students are confronted with a challenging task, they are prone to cognitive interference that divides their attention between self and the exam (Sarason, 1987). In general, test-anxious students spend approximately 40% of their available time on task-irrelevant cognitive activities (e.g., worry, wandering of thoughts), and only 60% on task-relevant activities (e.g., analyzing questions; Deffenbacher, 1978). It is postulated that when conceptualizing cognitive interference, divergence of attention is prompted by environmental stimuli that are considered to be potential threats (Eysenck, 1992).

Alting and Markham (1993) examined the distractibility of children under the hypothesis that participants might be searching the environment for stimuli indicating threat, thus would be selectively biased toward threatening cues. Participants were administered Sarason’s (1984) Reactions to Tests and evaluated as either low test-anxious or high test-anxious. They were then instructed to perform 20 difficult anagram tasks (target task). The participants were then divided into two groups. One group was given specific instructions stating that their performance would be related to their intelligence (i.e., the experimental group). The other group was given no such instruction (i.e., the control group). The distracters consisted of nonverbal visual images that were rated as emotionally neutral.

Alting and Markham (1993) observed that high test-anxious participants demonstrated significantly longer duration times glancing away from the target task, compared to low test-anxious participants. However, the frequency of glancing away from the target task was not significantly different between low and high test-anxious participants. In general, when comparing all participants, it was found that among the participants who were given the indication of the relationship between performance and intelligence, the high test-anxious group demonstrated longer duration of glancing away from the target task compared to the low test-anxious participants. However, no significant differences were found between the high test-anxious experimental and the high test-anxious control groups.

These results support the hypothesis that distractibility to task-irrelevant non-threatening cues provides evidence of cognitive interference with high test-anxious students. However, the lack of significance between the control and experimental high test-anxious groups could be due to the neutral nature of the stimuli. Therefore, examining high test-anxious students with threat stimuli may support the hypothesis of these students being selectively biased toward threatening cues.

Similar to individuals with depression and anxiety disorders, test-anxious students may have a tendency to use a disproportionate amount of their cognitive resources scanning the test environment for possible signs of threat due to the way in which they process information that will prepare them for potential failure (Eysenck, 1992). In other words, they may frequently

interpret ambiguous stimuli in a threatening fashion. Thus, high test-anxious students might have an attentional bias for threatening stimuli in the test-related environment. As a result, students with test anxiety interpret the test-related environment differently from students who do not experience test anxiety. Students with test anxiety may recognize environmental stimuli and deem them important, while these stimuli may remain unrecognized by students without test anxiety (Schutz et al., 2002).

Keogh and French (2001) investigated the susceptibility to distraction among high test-anxious participants. Participants were administered the State Trait Anxiety Inventory (Spielberger, 1983) and were classified as low test-anxious or high test-anxious according to their scores on the Test Anxiety Scale (Sarason, 1978). Participants were administered a computerized task and instructed to identify whether a word appearing on a screen was either "left" or "right". In the control condition, a target word replaced a "cross" symbol on the computer screen. In the experimental condition, a distractor word was replaced by the target word. The distractors present were classified as exam threatening words (e.g., examination); general-threatening words (e.g., dangerous); exam non-threatening words (e.g., intelligent); general non-threatening words (e.g., lettuce); uncategorized neutral words (e.g., advertise); and non-word controls (e.g., XXX). Participants were randomly allocated to a stress or non-stress conditions. Participants in the stress condition were asked to count backwards from 1000 out loud in threes for two minutes (e.g., 1000, 997, 994, etc). These participants were informed

that the ability to successfully complete this task was related to intelligence. Participants in the non-stress condition only completed the computer task.

High test-anxious participants (compared to low test-anxious participants) exhibited increased susceptibility to distraction only when receiving an anxiety-provoking stressor. When high test-anxious participants were placed in low stress conditions, there were no significant differences in distractibility. There were no significant differences between high and low test-anxious participants when exam non-threatening words (e.g., intelligence) were presented. Keogh and French (2001) believed that susceptibility to distraction exhibited by high test-anxious participants would be most pronounced with exam threatening words. That is, high test-anxious participants would be most distracted by examination-relevant threatening stimuli (e.g., examination). However, among high test-anxious participants, susceptibility was significantly different compared to low test-anxious participants when shown general-threatening words, not exam threatening words. According to Keogh and French (2001) these findings suggest that test-anxious students are more affected by the emotional valence of the words rather than the relevance of material. This study indicates that high test-anxious students who are susceptible to examination stress are more likely to be distracted by threat stimuli and are likely to attend selectively to worrisome thoughts and negative cognitive appraisals; however, relevance of examination threat may not be as important as stimuli containing emotional threat (Keogh & French, 2001).

These results indicate that susceptibility to distraction was directly related to examination relevant stimuli (e.g., exam threat words), and could be due in part to the interpretation of the words themselves. It is possible that the threat-relevant stimulus words failed to provoke the desired effect due to an inadequate repertoire of words. Thus, threat-relevant words may be directly related to the schema of examination stress. For example, the threat-relevant words consisted of “examination,” “grade,” and “multiple-choice.” Perhaps words that are more threat-relevant, such as “quiz,” “fail,” and “algebra” may be more related to test-anxious students’ schema. An investigation with respect to emotional valence of these words would help to shed some light on this matter.

The finding that susceptibility to distraction was not directly related to threat-relevant stimuli is also inconsistent with many studies that have demonstrated that the relevance of distracting stimuli is important among anxious participants. For instance, Mathews and Klug (1993) found that high-anxious participants showed a greater interference to cognitive concern for threat-relevant words compared to threat words that were irrelevant using a Stroop color-naming task (Keogh & French, 2001). Perhaps a follow-up study using the Stroop color-naming task should be used to investigate test-anxious students to support the attentional bias hypothesis and the relationship between threat-relevant stimuli that is specific to test-anxious participants’ schema.

The Stroop color-naming task has yielded promising results and has been used to investigate depression, general anxiety, specific phobia, and social phobia. With respect to social phobia, Hope, Rapee, Heimberg, and Dombeck (1990) used a Stroop color-naming task to investigate cognitive processing of participants with social phobia. They investigated color-naming latencies for words that contained social threat. The researchers selected participants who were diagnosed with social phobia and panic disorder according to Anxiety Disorders Interview Scale – Revised (ADIS-R; DiNardo & Barlow, 1988). The participants were presented with words that represented social threat (e.g., embarrassment) or physical threat (e.g., illness). Both the social threat and physical threat words were matched with a control list of words containing neutral words (e.g., upward) according to number of letters, syllables, and frequency of occurrence. Participants were presented with the words and then asked to identify the color of the words, while specifically instructed to ignore the meaning of those words.

The results demonstrated that individuals with social phobia had a longer response time for color-naming the words representing social threat compared to neutral words. Individuals with panic disorder had a longer response time for color-naming the words representing physical threat compared to neutral words. This study demonstrated that both individuals with social phobia and those with panic disorder demonstrated greater cognitive processing of words related to their cognitive schemas (e.g., their mental representations of experience that include a particular way of

perceiving cognitively and responding to a complex situation or set of stimuli; Abramson, Seligman, & Teasdale, 1978). Both individuals with social phobia and those with anxiety disorders had specific schemas facilitating cognitive processing and concerns. In other words, individuals with social phobia are concerned with social-evaluative threats, and individuals with panic disorder are concerned with physical threats (Hope et al., 1990).

The theory of attentional bias as it relates to hypervigilance suggests that test anxiety is associated with distractibility due to the divergence of attention from the examination itself to threatening stimuli within the environment (Eysenck, 1992; Hope et al., 1990). Because test-anxious students are thought to be constantly scanning the test environment to detect stimuli of potential threat, a disproportionate allocation of cognitive resources by abandoning test-taking cognitive resources that ultimately leads to a disruption in performance. Since high test-anxious students demonstrate attentional bias and are preoccupied with intrusive thoughts (as demonstrated with the transactional processing model, Spielberger & Vagg, 1995) it is not surprising that they may have difficulty focusing on test-taking (Zeidner, 1998).

Although the literature supports the hypothesis of attentional bias and cognitive interference among highly anxious individuals (e.g., social phobia, specific phobia), thus far there have been no studies that have used the Stroop color-naming task to examine the hypervigilance among test-anxious students. Even though Keogh and French (2001) did not find hypervigilance

among test-anxious students, it might be possible to investigate test anxiety as it relates to a stressful environment (e.g., during or prior to an examination). It may not be enough to elicit a hypervigilant response with test-threat stimuli alone; therefore, attentional bias should be investigated among test-anxious students during a stressful situation. For example, Alting and Markhan (1998) told participants that successful completion of an anagram task was related to their IQ. They hypothesized that this method of stress induction would result in high test-anxious participants being more distracted (see above).

Although no significant results were found between the stress induced and non-stress induced groups, according to Alting and Markhan (1998), high test-anxious participants demonstrated more distractibility (e.g., looking away at task, looking at what experimenter was doing) compared to low test-anxious participants. The lack of significance between the stress induction groups may be due to the actual method of the stress induction. It is likely that informing participants that their performance was related to their IQ did not induce enough stress to cause an effect. Since the stress itself was not directly measured as to its effectiveness, it is not actually known if stress induction was successful or not. A more overt method could be used to induce stress among participants. An example could be to inform the participants that they would be given a test or are to perform a difficult task at the end of the experiment. The success of the stress induction could then be evaluated using the State Trait Anxiety Inventory, State scale (Spielberger,

1983; similar to Amir, McNally, Riemann, Burns, Lorenz, & Mullen, 1996) and the Multiple Affect Adjective Check List (Zuckerman, & Lubin, 1985).

An elevation in state anxiety was necessary to reveal significant differences on the dot-probe task (MacLeod & Mathews, 1988). It would appear that similar stress induction that is relevant to the testing situation would be necessary to activate a high test-anxious individual's test-related schema. The schema of high test-anxious individuals is not activated unless they are in a testing situation. Therefore, it would seem that merely presenting test-threat words would not prompt significant elevations in state anxiety to demonstrate a biased effect (e.g., slower response times on the Stroop color-naming task). Thus, an appropriate amount of stress is necessary to capture the testing situation, for instance, assessing the participants just prior to an important exam.

In support of attentional bias for test anxiety, other cognitive tests investigating test anxiety would be appropriate such as the attentional dot probe task. With the attentional dot probe task, the focus will not necessarily be on response time differences between threat and non-threat stimuli, but rather the allocation of attentional resources that orient toward the location of threat words. Anxious individuals, however, may respond to probes that replace threat words more quickly than neutral words, suggesting that they have an attentional bias for threat (Taghavi et al., 1999). Of particular interest, however, is the finding that high trait-anxious individuals are more likely to respond to stress with attentional changes around the subject of their

predominant worry (Williams et al., 1997). As of now, there has been no examination of test anxiety using the attentional dot probe task. Although MacLeod and Mathews (1988) investigated a testing situation using medical students (see above), the participants were not assessed for test anxiety.

Overview and Hypotheses

The present study examined attentional bias among students with test anxiety. It is suggested that individuals who are highly test-anxious have a tendency to focus on environmental cues or threat stimuli relevant to their test-related schema (Williams et al., 1997). This idea was formally tested by implementing a modified Stroop color-naming task and an attentional dot-probe task. The rationale for using these tasks is that attentional bias toward threatening stimuli would be indicated by delayed color-naming responses (Stroop task) and accelerated responses to probes replacing threatening words (attentional dot-probe task). However, since the literature is inconsistent regarding hypervigilance to test-threat stimuli among test-anxious participants when using a Stroop color-naming task, some participants were assessed just prior to an exam in order to effectively capture and assess test anxiety during elevations of state anxiety. All participants were identified as either high or low in test anxiety and assessed for state and trait anxiety and test anxiety. They were randomly allocated to test (exam stress) or no test (no exam stress) conditions.

Hypothesis one. Test-anxious students are thought to scan the environment for potential threat and use a disproportionate amount of their

cognitive resources searching for threatening stimuli. Thus, on the modified Stroop color-naming task, high test-anxious participants (compared to low test-anxious participants) were hypothesized to demonstrate significantly slower response times for test-threat words, using a between groups comparison. For example, the word “test”, a test-threat word, should yield a slower response time among high test-anxious participants compared to low test-anxious participants.

Hypothesis two, On the modified Stroop color-naming task, using a two-way interaction in a between- and within-subjects design, high test-anxious participants responding to test-threat words (1) will show slower response times than when they are presented with test-threat control words, and (2) will show slower response times than low test-anxious participants responding to test-threat and test-threat control words. For instance, among high test-anxious participants only, the word “exam”, a test-threat word, should yield a slower response time compared to the word “water”, a test-threat control word.

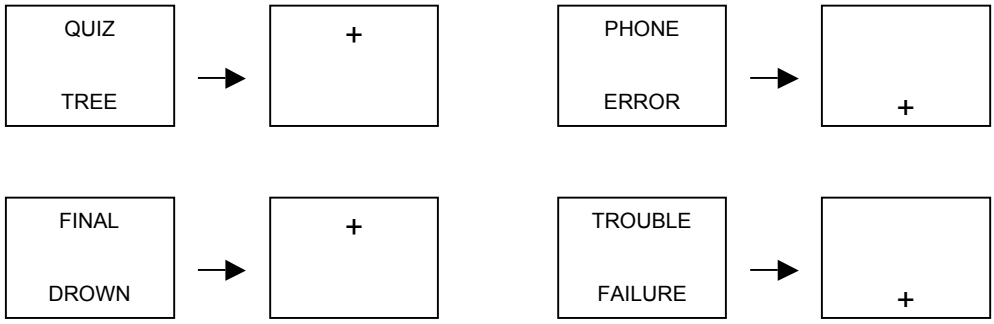
Hypothesis three. According to attentional bias theory, test-anxious individuals are sensitive to environmental stimuli that are relevant to their specific anxiety-related schemas. Therefore, it was predicted that high test-anxious participants will have significantly slower response times on the Stroop task for threat words that are relevant to their specific anxiety-related schemas. That is, high test-anxious participants should have slower

response times for test-threat words (e.g., “time”) compared to general-threat words (e.g., “rape”).

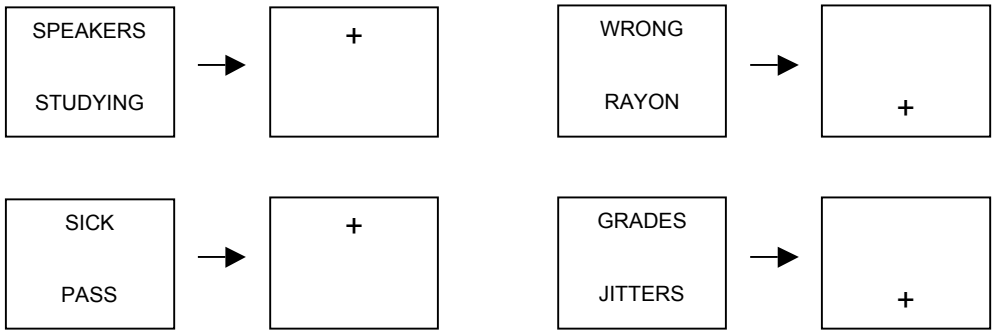
Hypothesis four. Using the attentional dot-probe task, response times were hypothesized to be faster or slower with respect to the location of the word and the probe. High test-anxious participants’ attention should be oriented towards the location and direction of threat words that are relevant to the participants’ particular schema. For example, response time will be faster for high test-anxious participants (compared to low test-anxious participants) if the probe replaces a test-threat word (e.g., “quiz”) when paired with a test-threat control word (e.g., “tree”) or a general-threat word (e.g., “drown”). Similarly, high test-anxious participants (compared to low test-anxious participants) were predicted to have slower response time if the probe replaces a test-threat control word (e.g., “speakers”) when paired with a test-threat word (e.g., “studying”; see Figure 1). The rationale behind the dot-probe task is that high test-anxious participants will focus their attention on test-threatening words. Thus if the probe occurs elsewhere (e.g., replacing a neutral word), there will be a lag in response time because they have to shift their focus away from the area of the test-threatening word.

Figure 1. Attentional Dot-Probe Presentation

Faster response times among high test-anxious participants compared To low test-anxious participants on these examples



Slower response times among high test-anxious participants compared To low test-anxious participants on these examples



Hypothesis five, exploratory hypothesis. An elevation in state anxiety was predicted to be necessary to activate test-related schemas. Hypotheses one through four predicted differences between high test-anxious and low test-anxious participants, without specifically examining elevations in state anxiety. If an elevation in state anxiety is necessary to activate test-related differences, it is unlikely that hypotheses one through four will reveal significant differences in response latencies on both the modified Stroop

color-naming task and the attentional dot-probe task. If one is about to take an exam, state anxiety should be elevated. Thus, on the modified Stroop color-naming task, high test-anxious participants who are under exam stress should yield significantly slower response times compared to high test-anxious participants who are not under exam stress (as described in hypothesis one, two, and three). On the attentional dot-probe task, high test-anxious participants who are under exam stress should yield significantly faster response times (as described in hypothesis four) compared to high test-anxious participants who are not under exam stress.

Chapter 2.

METHOD

Participants

Participants were undergraduate psychology students attending the University of Maine. All qualified participants were not colorblind and not taking psychotropic medications. Participants were screened for test anxiety and recruited voluntarily. In exchange for their participation, they were given extra credit in their enrolled psychology course. Those meeting initial criteria were asked to participate in the experimental portion of the study later in the semester.

Based on an average effect size of d = 1.10 (derived from Alting & Markham, 1993; Hope et al., 1990; Keogh & French, 2000; MacLeod & Mathews, 1998) a sample size analysis with a statistical power of 0.80 demonstrated that a minimum of 56 participants (four groups of 14) would be required to detect existing significant differences. The analysis assumed a two-tailed hypothesis test (α = 0.05).

Assessment

Demographic information. Participants were asked general demographic information (e.g., age, gender) and current GPA. In addition, they were asked if they had been diagnosed with colorblindness, and whether they were currently taking any psychotropic medication (i.e., the exclusionary criteria). Participants were also instructed to complete a contact sheet with their name and email address for the purpose of recruitment in the

experimental portion of the study. This form was kept separate from all other assessment materials and was treated as confidential (see Appendix A).

Reactions to Tests 20-item Scale (RTT 20-item Scale; Benson & Bandalos, 1992). The RTT is representative of test anxiety due to its multidimensional features that extend beyond the original worry and emotionality components of test anxiety. The RTT was originally developed as a 40-item self-report measure of test anxiety consisting of four subscales: tension, worry, test-irrelevant thinking, and bodily symptoms (Sarason, 1984). Benson and Bandalos (1992) developed a shorter 20-item scale revision of the RTT consisting of the same subscales. Items on the 20-item scale require respondents to evaluate the degree of various self-statements related to the four subscales of test anxiety (e.g., tension: “I feel distressed and worried before a test”; worry: “During a difficult tests, I worry whether I will pass it”; test-irrelevant thinking: “During tests I find myself thinking of things unrelated to the material being tested”; bodily symptoms: “I get a headache before a test”). Items are rated based upon a 4-point Likert scale (1 = “Not at all typical of me”, 2 = ”Only somewhat typical of me”, 3 = “Quite typical of me”, and 4 = “Very typical of me”). Possible RTT scores range from 20 to 80 with 80 representing most extreme test anxiety.

Sarason (1984) demonstrated adequate correlation coefficients between RTT 40-item scale and other measures, such as the Test Anxiety Scale (r = 0.44 males, r = 0.38 females; Sarason, 1978) and the Cognitive Interference Questionnaire (r = 0.47 males, r = 0.44 females; Yates, Hannell,

& Lippett, 1985). According to Benson and Bandalos (1992), the RTT 20-item scale correlated highly with its original 40-item scale (CFI = *r* = 0.86 – 0.99). The RTT is a reliable measure of test anxiety with internal consistency reliability coefficients ranging from *r* = 0.64 to *r* = 0.92. Present findings show coefficient alpha *r* = 0.97.

The RTT 20-item scale was used in the present study as a measure of participants' indication of the presence of endorsed test anxiety. The RTT 20-item scale was expected to correlate with the interference of test-threat words on the modified Stroop color-naming task and response latency during the attentional dot probe task (see Appendix B).

State-Trait Anxiety Inventory (STAI; Spielberger, 1983). The STAI is a self-report measure of two separate dimensions of anxiety: state anxiety and trait anxiety. State anxiety reflects changing emotional states of an individual characterized by subjective feelings of tension, nervousness, apprehension, and physiological arousal. Also, state anxiety can vary in intensity and is thought to fluctuate over time. Trait anxiety, on the other hand, is representative of stable personality characteristics and individual differences in anxiety proneness. Trait anxiety is hypothesized to be a tendency to respond with anxiety (e.g., state anxiety) based upon perceived threats within the environment. Each subscale requires respondents to rate the degree of various self-statements. State anxiety assesses how a respondent feels at the present moment in time (e.g., "I feel calm", "I feel frightened") based upon a 4-point Likert scale (1 = "Not at all", 2 = "Somewhat", 3 = "Moderately so", 4

= “Very much so”). Trait anxiety assesses how a respondent generally feels (e.g., “I am a steady person”, “I lack self-confidence”) based upon a 4-point Likert scale (1 = “Almost never”, 2 = “Sometimes”, 3 = “Often”, 4 = “Almost always”).

The STAI scale has test-retest reliability with high school and college student samples. For the Trait anxiety scale, the internal consistency reliability coefficients ranged from $r = 0.65$ to $r = 0.86$ (present findings show coefficient alpha $r = 0.84$). However, for the State anxiety scale, the internal consistency reliability coefficients ranged from $r = 0.16$ to $r = 0.62$ (present findings show coefficient alpha $r = 0.51$ for pretest and $r = 0.59$ for posttest). The low level of stability may be due to situational influences existing at the time of testing. Since State anxiety is expected to fluctuate and be reflective of situational factors, the low reliability was expected. The STAI Trait anxiety scale is a valid measure of anxiety and is correlated with other measures of anxiety including the Taylor Manifest Anxiety Scale ($r = 0.80$), the IPAT Anxiety Scale ($r = 0.75$) and the Multiple Affective Check List ($r = 0.52$)

The STAI was used in the present study as a measure of both state and trait anxiety. The STAI Trait was used to investigate its relationship with the RTT. The STAI State scale was used to assess the level of stress that was present prior to an exam and to determine whether anxiety was successfully increased prior to an exam. The STAI State was expected to correlate with interference of test-threat words on the modified Stroop color-

naming task, with high scores on the State scale demonstrating greater interference as measured by longer reaction times (see Appendix B).

The Multiple Affect Adjective Check List - Revised (MAACL – R; Zuckerman & Lubin, 1985). The MAACL-R is a self-report measure consisting of 132 adjectives that are listed alphabetically. The MAACL-R is designed to measure primary dimensions of affect. There are two forms of the MAACL-R; a Trait form, which asks participants to check words to describe how they "generally" feel, and a State form that requests participants to check words to describe how they feel "now-today". Both State and Trait forms use the same 132 adjectives. The MAACL-R consists of five subscales: anxiety (e.g., "afraid", "fearful"), depression (e.g., "alone", "destroyed"), hostility (e.g., "annoyed", "complaining"), positive affect (e.g., "free", "friendly"), and sensation seeking (e.g., "active", aggressive"). The MAACL-R also has two summary scales. The dysphoria summary scale includes anxiety, depression, and hostility subscales. The positive affect and sensation seeking summary scale includes positive affect and sensation seeking subscales. The dysphoria summary scale was used in the present study.

The MAACL-R has discriminant validity in which the measure is shown to differentiate patients with mood disorders from those with other types of disorders (Zuckerman & Lubin, 1985). Additionally, the MAACL-R has demonstrated divergent validity between patients with mood disorders and non-clinical samples. The MAACL-R correlates with other similar measures

of anxiety, including the STAI (r = 0.52). Test-retest reliabilities ranged from r = 0.61 to r = 0.87 and internal consistency reliability coefficients ranged from r = 0.84 to r = 0.94 (Zuckerman & Lubin, 1985). Present findings show coefficient alpha r = 0.83 at pretest and r = 0.91 at posttest.

The MAACL-R was used in the present study as a measure of state anxiety. The MAACL-R State scale was used to assess the level of stress induced and to determine whether anxiety was increased just prior to an exam. The MAACL-R was expected to correlate with interference of test-threat words on the modified Stroop color-naming task, with high scores on the State scale demonstrating greater interference (see Appendix B).

Fear of Negative Evaluation Scale (FNE; Leary, 1983). The FNE is a self-report measure of respondents' beliefs that are hypothesized to be indicative of social phobia. The original measure was a 30 item true-false questionnaire (Watson & Friend, 1969). However, a new briefer form of the FNE was developed by Leary (1983), which consists of 12 items. Each of the 12 items requires the respondent to rate the degree of various self-statements that are related to social situations (e.g., "I worry about what others think of me even when I know it doesn't make any difference", "I often worry that I will say or do the wrong thing"). Respondents rate each of the 12 statements on a 5-point Likert scale (e.g., 1 = "Not at all characteristic of me", 2 = "Slightly characteristic of me", 3 = "Moderately characteristic of me", 4 = "Very characteristic of me", 5 = "Extremely characteristic of me"). FNE scores

range from 12 to 60 with 60 indicating the most severe social phobia (see Appendix B).

The reliability of the briefer 12-item FNE has demonstrated that it correlates strongly with the original 30-item scale (r = 0.96). Furthermore, test-retest and inter-item reliabilities have demonstrated strong coefficient alphas (r = 0.75, r = 0.96 respectively). Present findings show coefficient alpha r = 0.88. The FNE is a valid measure of social anxiety as it correlates with other assessments of social distress and avoidance (Friend & Gilbert, 1973; Smith & Sarason, 1975).

The FNE was used as a measure of social evaluation in the present study for the purpose of distinguishing participants with social anxiety. Since test-anxiety has a significant evaluative component, the FNE should correlate with threat words that contain social significance (e.g., failure) and with the RTT.

Modified Stroop Color-Naming Task. The Stroop color-naming task was a modified version of the original Stroop task (Stroop, 1935) and adapted from the one used by Hope et al. (1990). The words used included test-threat, general-threat, and control words. The modified Stroop color-naming task was administered using E-Prime software program (Psychology Software Tools, Inc., 2000). The program allows for the presentation of stimulus words and the recording of response latencies.

Sixty different words were selected from a broader list of 250 words presented in a pilot study that requested undergraduate participants to rate

the words on a Likert scale (0 = “Not at all emotional” to 5 = “Extremely emotional”). In addition, participants were asked to classify words. Participants were asked how each word was related to anxiety or test anxiety. Responses were also on a Likert scale (0 = “Not at all related” to 5 = “Extremely related”). This broader list of words was compiled from various anxiety and test anxiety questionnaires, previous modified Stroop color-naming tasks (Hope et al., 1990; Mathews & MacLeod, 1985; Keogh & French, 2001), attentional dot probe tasks (MacLeod & Mathews, 1988), and open-ended participant responses (similar to Maki, 2003; see Appendix C).

For the Stroop task, participants were instructed to name or identify the color of a word (i.e., the word “Network” printed in Red ink) by pressing a corresponding computer keyboard key. The modified Stroop color-naming task was divided into three phases: two warm-up phases and one experimental phase. At the beginning of each phase, the participants were given simple instructions for the task presented visually on the computer screen (e.g., “Your task is to identify the color of each word presented on the screen. If the word is presented in the color RED, then press the RED button. If the word is presented in the color GREEN, then press the GREEN button,” etc.). Note that a keyboard was used as the color identifier instead of the participant verbally identifying the color. Pilot data were examined to determine, if indeed, a Stroop effect (i.e., interference) had appeared. Some color-words corresponded to the actual colors, whereas others did not. Results of the pilot data demonstrated that significantly longer response

latencies occurred when the font color and the color named by the word did not match (i.e., delayed response time identifying the font color blue when the word printed was “RED” compared to more rapid response times identifying font color red when the printed word was “RED”), $F(1, 60) = 82.574$, $p < .001$. For the present study, participants were initially given a list of 20 words to identify. The words in the first phase, ONE, TWO, THREE, and FOUR, were presented individually on the computer screen in the colors red, blue, green, and yellow. The purpose of the first phase was to screen for color blindness and act as a warm-up. The second phase was similarly designed as a warm-up phase, but this time for the purpose of further assessing the Stroop or interference effect. The participants were shown 20 words naming colors (i.e., RED, BLUE, GREEN, and YELLOW), presented in the colors red, blue, green, and yellow (similar to the pilot study words).

The third phase of the modified Stroop color-naming task was the experimental phase that consisted of the 60 words from the first pilot study (see Table 1). The 60 words were divided into 4 categories: test-threat words, test-threat control words (neutral words), general-threat words, and general-threat control words (neutral words). Both test-threat control and general-threat control were classified as neutral and matched with their respective threat words according to the number of letters and frequency of occurrence in the English language (Caroll, Davies, & Rachman, 1971). The test-threat words were hypothesized to be representative of the concerns of test-anxious students during testing situations (e.g., FAILURE, QUIZ).

General-threat words were hypothesized to be representative of the concerns of anxious individuals and how they perceive events in their environment (e.g., AMBULANCE, FATAL). In the experimental phase, the 60 words (15 test-threat words, 15 test-threat control words, 15 general-threat words, and 15 general-threat control words) were presented in random order and presented in the colors red, blue, green, and yellow.

Table 1. Stimuli for the Modified Stroop Color-Naming Task.

Font Color	Test-threat	Test-threat Control	General-threat	General-threat Control
Red	Challenge	Spaghetti	Accident	Calendar
Blue	Mind	Tape	Alone	Coast
Green	Time	Soda	Ambulance	Butterfly
Yellow	Test	Shoe	Coffin	Camera
Red	Panic	Tulip	Crash	Chair
Green	Worry	Table	Deadly	Handle
Blue	Cramming	Cucumbers	Death	Jeans
Yellow	Confusion	Pinecone	Abuse	Elbow
Red	Doubt	Water	Disease	Sticker
Blue	Exam	Sock	Distress	Elephant
Green	Frustration	Specialized	Rape	Glue
Yellow	Hurry	Radio	Fatal	Grass
Red	Incomplete	Taillights	Fright	Coffee
Blue	Incorrect	Firelight	Illness	Dresser
Green	Performance	Associative	Insane	Penny

In all three phases, the presented word remained on the computer screen until the participant identified or named the color of the word by pressing a colored button on the keyboard. The software recorded correct/incorrect responses and response latencies of each word.

Attentional dot-probe task. The attentional-dot probe task was adapted from the one used by MacLeod and Mathews (1988). As with the modified Stroop color-naming task, the attentional dot-probe task was administered

using E-Prime, a computer software program (Psychology Software Tools, Inc., 2000).

The participants were instructed to respond when they saw a probe, which was in the form of a large plus sign (+). The attentional dot probe task was divided into two phases: one warm-up phase and one experimental phase. At the beginning of each phase, the participants were given simple instructions for the task presented visually on the computer screen (e.g., "Your task is to press the SPACE BAR when you see the + on the computer screen". The words in the first phase were ONE, TWO, THREE, and FOUR that were presented in pairs, one displayed at the top of the screen and one at the bottom of the screen. One word of each pair was replaced by a probe (+). For example, at times the word at the top of the screen was replaced by a probe, while at other times the word at the bottom of the screen was replaced by a probe.

The second phase of the attentional dot probe task was the experimental phase consisting of 60 similar, but different words selected from the same pilot study (see Table 2). As with the warm-up phase, the word pairs were presented randomly, one at the top of the screen and the other at the bottom of the screen. The word pairs consisted of (1) one test-threat word paired with one general-threat word, (2) one test-threat word paired with one test-threat control word, or (3) one general-threat word paired with one general-threat control word. One of the paired words was randomly replaced by a probe, either at the top of the screen or at the bottom of the screen.

During both phases of the attentional dot probe task, the presented probe remained on the computer screen until the participant responded indicating that they recognized the presence of the probe by pressing the SPACE BAR on the keyboard. The software recorded correct/incorrect responses and response latencies of each word.

Table 2. Stimuli for the Attentional Dot-Probe Task.

Test-threat	General-threat	General-threat	General-threat Control	Test-Threat	Test-threat Control
Evaluation	Discomfort	Murder	Pencil	Problems	Eggplant
Final	Drown	Pain	Belt	Quiz	Tree
Grades	Jitters	Scared	Finger	Remember	Blankets
Nervous	Seizure	Kill	Map	Studying	Speakers
Pass	Sick	War	Pen	Wrong	Rayon
Tension	Spiders	Cancer	Candle	Memorize	Arkansas
College	Stroke	Slaughter	Triangles	Intelligence	Breadbaskets
Failure	Trouble	Trapped	Network	Stupid	Purely
Essay	Snake	Suffocate	Marketing	Math	Hull
Mistake	Falling	Poison	Tissue	Error	Phone

Procedure

Participant selection. Participants were selected based upon questionnaire responses (see below), contacted by email, and requested to participate in the study. Participants who did not meet the criteria were provided an explanation as to reason they would not be participating in the study (e.g., We are seeking individuals without color blindness). Pre-screening took place close to the beginning of the spring term in psychology courses that were in the university's web-based participant recruitment system, Experimetrix. The experimental portion of the study took place later in the semester.

Each participant was given a brief explanation of the experiment, informed of the anticipated time it would take to complete the experimental tasks, and requested to read the consent form (copies of which were given to the participants). The consent form explained that participants might become anxious during the procedures, but that the procedures should be no more stressful than typical encounters in daily life. However, if the participant wished to terminate or withdraw their participation, they were free to do so at any point during the procedures (see Appendix D).

Questionnaire assessment. Questionnaires were administered during the pre-screening session. Upon reading the consent form, each participant was given a series of questionnaires to complete that consisted of the demographic information form, the RTT 20-item scale, the STAI (Trait and State pretest), the MAACL-R pretest, and the 12-item FNE. The four questionnaires were administered in random order. Participants were asked to read the directions carefully and to take their time when completing each questionnaire. Participants who met the criteria were then requested to participate in the next phase of the study (the experimental portion) that occurred later in the semester. At this time, they were administered the STAI State posttest and MAACL-R posttest (see Appendix B). It should be clarified that the STAI State pretest and MAACL-R pretest were both administered at the beginning of the semester (e.g., the first week), at which time it was assumed that no exams were taking place. These pre-measures were used as a baseline. The STAI State posttest and the MAACL-R posttest were

administered during the experimental portion of the study and administered prior to the computer tasks and prior to any upcoming exams. Participants who were requested to participate in the experimental portion agreed to take part in the experiment at a time and place within two hours prior to the scheduled exam. These post measures were used to examine if an elevation in state anxiety took place for those who had exams immediately following the experiment.

Computer tasks. Participants completed the computer tasks, the modified Stroop color-naming task, and the attentional dot-probe task, presented in counterbalanced order. Half of the participants completed the attentional dot-probe task first and the modified Stroop color-naming task second, and the other half completed the modified Stroop color-naming task first and the attentional dot-probe task second.

Each participant was seated in front of a computer screen with an accessible keyboard. The keyboard was modified to represent color-coded response keys (i.e., the number pad had red, blue, green, and yellow stickers covering the numbers 1, 3, 7, and 9 respectively) and a symbol-coded response key (i.e., + covered the space bar key). The room itself was quiet and dimly lit. Each participant was given brief verbal instructions and shown how to use the color- and symbol-coded keyboard keys. They were then asked to complete the first phase of the modified Stroop color-naming task or the attentional dot-probe task. Upon completion of the first phase, they were asked if they understood the procedure and whether they had any questions

before proceeding to phases two and three of the Stroop color-naming task and attentional dot-probe task.

Debriefing. All participants were thanked for their participation and given written debriefing information following the experiment (similar to Maki, 2003) that contained a brief description of the study, expected results, and contact information in the event they had any questions about the experiment and outcome (see Appendix E).

Design and Analysis

Participants were divided into two independent groups according to their test anxiety rating based upon their responses to the RTT 20-item scale: the high test-anxious group and the low test-anxious group ("Group"). Participants with scores falling at least one standard deviation above the mean were classified as high test-anxious and participants with scores falling at least one standard deviation below the mean were classified as low test-anxious. Participants were also independently factored by "Condition", in which participants either had an upcoming exam immediately following the computer tasks (within two hours), *test* condition, or no exam(s) scheduled for at least four days following the computer tasks, *no test* condition. The participants were pre-selected based upon their willingness to participate prior to an upcoming exam.

Data were analyzed using a general linear model multi-variate analysis (MANOVA) to examine differences between levels of the independent factors of test anxiety (low test-anxious versus high test-anxious) for multiple

dependent variables of response latencies for the Stroop color-naming task and attentional dot-probe task. The analysis also included independent factors for test versus no test conditions, and word-type, a within-subject comparison (e.g., test-threat versus test-threat control and general-threat versus general-threat control). Furthermore, a more specific analysis was performed to examine response latencies among high test-anxious participants in the test condition compared to low test-anxious participants in the no test condition using a analysis of covariance (ANCOVA) holding Group and Condition constant (the covariates). Dependent variables examined included general-threat response latencies, general-threat control response latencies, test-threat response latencies, and test-threat control response latencies.

High test-anxious participants. Analyses compared latencies of test-threat words between low and high test-anxious participants using the data collected from the modified Stroop color-naming task. Second, latencies of test-threat words were compared to latencies of neutral words. Analyses examined response latencies among high test-anxious versus low test-anxious participants using the data collected from the attentional dot-probe task. Response latencies were compared.

Anxiety-related schemas. Using the data collected from the Stroop color-naming task, analyses examined high test-anxious participants and compared latencies of general-threat words with test-threat words to determine if slower response times were relative to the participants' particular

schemas, using an ANOVA with repeated measures. Further analyses examined schemas by holding constant STAI Trait among highly anxious participants.

Test condition. Data from both the modified Stroop color-naming task and the attentional dot-probe task were used to compare response latencies between participants in the test condition and those participants who were in the no test condition. High test-anxious versus low test-anxious response latencies were examined using MANOVA.

Elevation in state anxiety. To test whether state anxiety was elevated prior to an exam, pre- and post-STAI-S and pre- and post-MAACL-R were analyzed using an ANOVA with repeated measures.

Chapter 3.

RESULTS

Participant Characteristics

Four hundred forty-four respondents (287 females, 157 males) were assessed on the RTT as a pre-screening measure. The RTT sample mean was 48.91 (*SD* = 11.43). Sixty-two participants (38 females, 24 males) were recruited for the study proper, 31 with RTT scores equal to or higher than one standard deviation above the mean (*high test-anxious* group), and 31 with scores equal to or lower than one standard deviation below the mean (*low test-anxious* group). Thirty-one participants were asked to take part in the study just prior to an exam, the *test* condition. The remaining 31 participants were asked to participate in the experiment when they had no exam, the *no test* condition. The test and no test conditions each had equal numbers of high and low test-anxious participants. Table 3 reports demographic and summary statistics of the high and low test-anxious groups, and test and no test conditions for age, gender, and GPA. There were no significant differences in GPA for Group or Condition. Table 4 reports a summary of participant total scores on anxiety measures administered. All measures were significantly different between high test- and low test-anxious groups. Between test and no test conditions, no difference was observed on any anxiety measure with the exception of Post-STAI-S, $F(1, 60) = 4.61$, $p = <.036$. There were no significant differences for gender on any of the measures.

Table 3. Participant Demographic Summary Statistics

	Group			
	Low Test-Anxious Condition		High Test-Anxious Condition	
	Test	No Test	Test	No Test
N	15	16	16	15
Gender (M/F)	7/8	9/7	12/4	10/5
	M (SD)		M (SD)	
Age	20.7_a (1.4)	24.3_a (9.7)	20.2_a (2.7)	19.8_a (1.7)
GPA	3.2_a (0.7)	3.0_a (0.5)	2.8_a (0.6)	3.0_a (0.6)

Note. M/F: males/females, GPA: grade point average. Means having the same subscript are not significantly different at the $p < .05$ level.

Table 4. Participant Anxiety Measure Summary Statistics

	Group				
	Low Test-Anxious Condition		High Test-Anxious Condition		
	Test	No Test	Test	No Test	*F* (1, 60)
	M(SD)		M(SD)		
RTT	31.1_a(4.5)	30.4_a(5.6)	68.4_b(6.6)	69.5_b(6.5)	217.6**
STAI-T	40.7_a(8.8)	35.1_a(7.2)	60.2_b(10.2)	57.9_b(11.1)	27.2**
Pre-STAI-S	38.2_a(9.4)	34.2_a(9.7)	49.9_b(12.3)	49.9_b(16.5)	6.8**
Post-STAI-S	37.2_a(8.5)	31.1_a(8.5)	64.0_b(9.7)	45.8_c(16.0)	26.7**
Pre-MAACL-R	2.5_a(3.3)	2.3_a(3.4)	6.9_b(6.1)	8.3_b (7.7)	4.9**
Post-MAACL-R	2.9_a(3.6)	1.3_a(1.8)	11.3_b(5.6)	8.3_b(8.1)	12.3**
FNE	35.5_a(7.5)	31.0_a(6.6)	43.9_b(10.6)	44.9_b(6.5)	11.1**

Note. F represents the comparison between groups (high test-anxious versus low test-anxious). RTT: Reactions to Tests (Benson, & Bandalos, 1992). STAI-T State Trait Anxiety Inventory – Trait/STAI-S: State Trait Anxiety Inventory – State (Speilberger, 1983). MAACL-R: Multiple Affective Adjective Checklist – Revised (Zuckerman, & Lubin, 1985). FNE: Fear of Negative Evaluation Scale (Leary, 1983). ***p* < *.01*. Means with different subscripts differ significantly at the $p < .05$ level.

Elevation of State Anxiety

STAI-S. To test if state anxiety was elevated prior to an exam (due to exam stress), pre- and post-STAI-S were analyzed using an ANOVA with repeated measures. Analyses demonstrated STAI-S scores was significantly elevated at post-test from pre-evaluation for Group, $F(3, 59) = 11.58$, $p < .001$ and Condition, $F(1, 60) = 24.13$, $p < .001$. Furthermore, high test-anxious participants in the test condition had a significant elevation in post-STAI -S scores (compared to pre-STAI-S scores) compared to those low test-anxious participants in the no test condition, $F(1, 30) = 18.48$, $p < .001$.

MAACL-R. Similar to the STAI-S, the MAACL-R was used to measure an elevation in anxiety prior to an exam. Pre- and post-MAACL-R scores were also analyzed using an ANOVA with repeated measures. Analyses demonstrated that the increase of MAACL-R scores was also significantly higher at post-evaluation from pre-evaluation for Group, $F(1, 60) = 12.15$, $p = .001$, and Condition, $F(1, 60) = 16.37$, $p < .001$. Furthermore, high test-anxious participants in the test condition had a significant elevation in post-MAACL-R scores (compared to pre-MAACL-R scores) compared to those low test-anxious participants in the no test condition, $F(1, 30) = 19.54$, $p < .001$.

Stroop Color-Naming Task

Between group analyses. Latencies for the mean color-naming response times are summarized in Table 5. MANOVA was used in this analysis to examine multiple dependent variables. Results showed no significant differences of response times between high and low test-anxious

participants for any dependent variable when examining Group or Condition. However, General-Threat words (StroopGT) and Test-Threat words (StroopTT) showed a trend of slower response latencies among high test-anxious participants compared to low test-anxious participants *(F*(1, 30) = 2.97, *p* = .090 and *F*(1, 30) = 3.06, *p* = .086, respectively). Similarly, StroopTT showed a trend for longer response latencies among participants in the test condition compared to participants in the no test condition (*F*(1, 30) = 3.62, *p* = .062). Thus, these participants took longer to respond when they were presented with threatening word stimuli (see Table 6). No significant differences were shown for gender for any dependent variable.

Table 5. Stroop Color-Naming Task Mean Response Latencies in Milliseconds

	Group			
	Low Test-Anxious Condition		High Test-Anxious Condition	
	Test	No Test	Test	No Test
Word Type	M(SD)		M(SD)	
StroopGT	701.1_a(85.4)	696.6_a(122.2)	790.2_a(115.6)	708.1_a(6.5)
StroopGTC	683.5_a(109.7)	677.5_a(130.8)	693.6_a(129.0)	689.9_a(127.3)
StroopTT	709.9_a(98.1)	695.9_a(116.4)	811.5_a(156.5)	704.0_a(118.4)
StroopTTC	676.7_a(100.9)	675.3_a(110.7)	687.7_a(110.5)	688.5_a(127.7)

Note. StroopGT: Stroop Color-Naming Task general-threat words. StroopGTC: general-threat words control. StroopTT: test-threat words. StroopTTC: test-threat control words. Means having the same subscripts are not significantly different at the $p < .05$ level.

Table 6. Stroop Color-Naming Task Between Groups and Condition Analyses

	Group			Condition			G + C		
Word Type	*F*(1, 60)	*p*	$\square_p^2$	*F*(1, 60)	*P*	$\square_p^2$	*F*(3, 59)	*p*	$\square_p^2$
StroopGT	3.0	ns	0.1	2.2	Ns	0.0	2.6	ns	0.1
StroopGTC	0.1	ns	0.0	0.0	Ns	0.0	0.1	ns	0.0
StroopTT	3.1	ns	0.1	3.6	Ns	0.1	3.4	0.04*	0.1
StroopTTC	0.2	ns	0.0	0.0	Ns	0.0	0.9	ns	0.0

Note. *F* represents the comparison between groups (high test-anxious versus low test-anxious) and conditions (test versus no test). G + C represents both group and condition. StroopGT: Stroop Color-Naming Task general-threat words. StroopGTC: general-threat words control. StroopTT: test-threat words. StroopTTC: test-threat control words. *$p < .05$, **$p < .01$. $\square_p^2$ (effect size): partial eta squared.

An ANCOVA demonstrated that high test-anxious participants in the test condition had significantly longer response latencies on StroopTT (*M* = 811.52, *SD* = 156.45) compared to low test-anxious participants in the no test condition (*M* = 695.92, *SD* = 116.40). Thus, those individuals were significantly slower to name a color when a test-threatening word appeared on the computer screen. Although not significant, there was a trend toward longer response latencies on StroopGT words, meaning that these individuals were slower to color-name general-threat words ($F(3, 59) = 2.64$ $p = .082$). No significant differences were demonstrated for StroopTTC and StroopGTC using ANCOVA (see Table 6). Figures 2-5 show mean response latencies in milliseconds among high test-anxious versus low test-anxious participants and among participants who will have an exam following the computer tasks versus those who have no exams scheduled.

Figure 2. Mean Response Latencies in Milliseconds for General-Threat Words on the Stroop Task

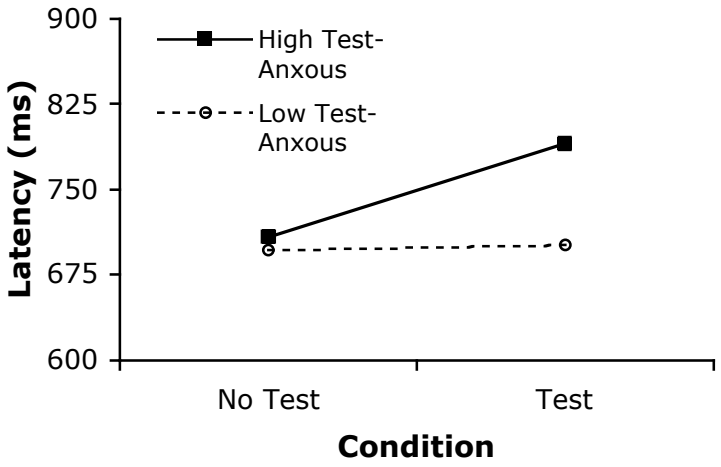


Figure 3. Mean Response Latencies in milliseconds for General-Threat Control Words on the Stroop Task

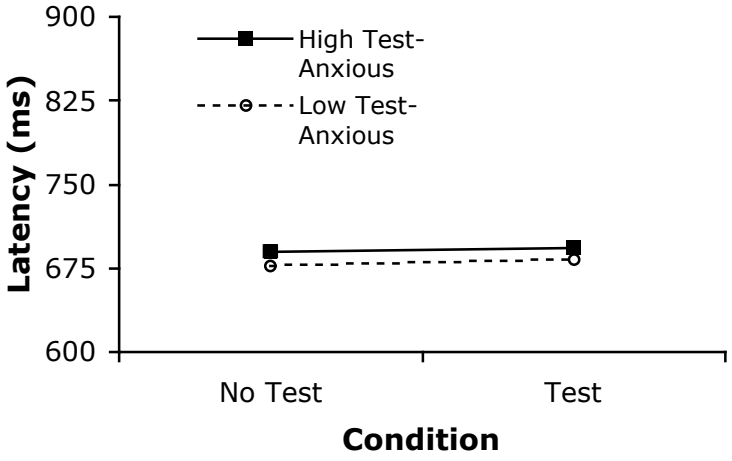


Figure 4. Mean Response Latencies in milliseconds for Test-Threat Words on the Stroop Task

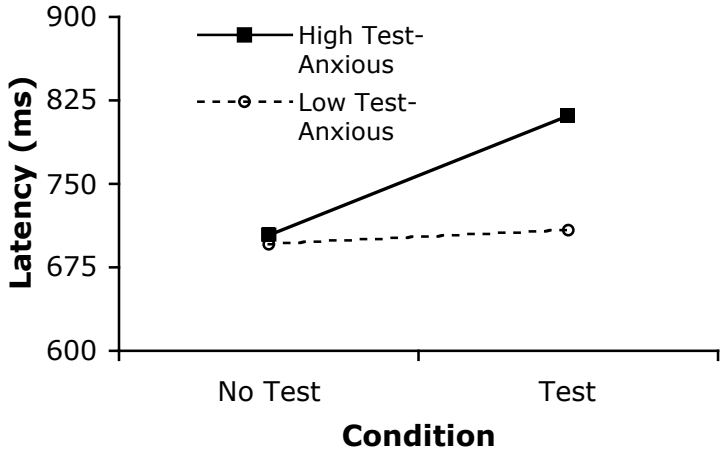
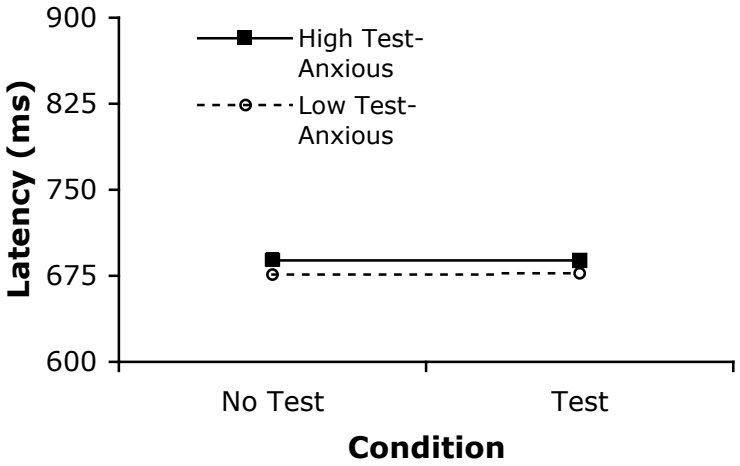


Figure 5. Mean Response Latencies in milliseconds for Test-Threat Control Words on the Stroop Task



Within group analyses. An ANOVA using repeated measures analysis showed significant within group differences, comparing StroopTT words (*M* = 759.52, *SD* = 147.50) and StroopTTC words (*M* = 688.12, *SD* = 117.08) when examining high test-anxious participants only. Thus, high test-anxious participants were significantly slower to respond to test-threat words compared to test-threat control words. Furthermore, high test-anxious

participants in the test condition were significantly slower than those in the no test condition to respond to test-threat words (*M* = 811.52, *SD* = 156.45) compared to test-threat control words (*M* = 687.73, *SD* = 110.47). When comparing StroopGT words and StroopTT words, results demonstrated that no significant differences existed among high test-anxious participants. Similarly, no significant differences occurred when comparing StroopTT words and StroopGT words among participants in the test condition (see Table 7). ANCOVA using repeated measures showed that between test-threat words and general-threat words, holding STAI Trait constant, no significant differences existed for Group $F(1, 60) = 0.22$, $p = 0.36$, Condition $F(1, 60) = 2.365$, $p = 0.13$, or for high test-anxious in the test condition versus low test-anxious in the no test condition, $F(3, 59) = 2.35$, $p = 0.13$.

Table 7. Stroop Color-Naming Task Within Groups and Condition Analyses Among Test-Anxious Participants

	Overall			Condition		
Word Type	*F*(1, 30)	*p*	$\square_p^2$	*F*(1, 30)	*P*	$\square_p^2$
StroopTT – StroopTTC	15.5	0.00**	0.3	12.2	0.00**	0.3
StroopTT – StroopGT	0.7	ns	0.0	1.3	ns	0.0

Note. *F* represents the comparison overall (high test-anxious between word type) and conditions (test versus no test). StroopGT: Stroop Color-Naming Task general-threat words. StroopGTC: general-threat words control. StroopTT: test-threat words. StroopTTC: test-threat control words. *$p < .05$, **$p < .01$. $\square_p^2$ (effect size): partial eta squared.

Attentional Dot-Probe Task

The mean latencies for the dot-probe responses are summarized in Table 8. Initial MANOVAs showed no significant differences between Groups or Conditions for any dependent variable. However, when a test-threat word was paired with a test-threat control word (dpTTTTC) and the probe replaced

the test-threat word, there was a non-significant trend for shorter response latencies among high test-anxious compared to low test-anxious participants ($F(1, 30) = 3.28$, $p = .075$). Similarly, there was a trend for shorter response latencies among participants in the test condition compared to participants in the no test condition for dpTTTTC ($F(1, 30) = 3.11$, $p = .083$). Thus, these participants were quicker to respond when the probe replaced threatening stimuli. There were no significant differences if the probe replaced a threat word at the top versus the bottom of the computer screen.

A similar trend was shown for longer response latencies when a test-threat control word was paired with a test-threat word (dpTTCTT) if the probe replaced the test-threat control word among high test-anxious compared to low test-anxious participants ($F(1, 30) = 2.86$, $p = .096$). In addition, there was a trend for longer response latencies among participants in the test condition compared to participants in the no test condition for dpTTCTT ($F(1, 30) = 3.03$, $p < .087$). Thus, these participants took longer to respond when the probe replaced a test-threatening control word when it was paired with a test-threat word. There were no significant differences if the probe replaced a threat word at the top versus the bottom of the computer screen.

Differences in response latencies when a general-threat word was paired with a general-threat control word, whether the probe replaced a general-threat word (dpGTGTC) or a general-threat control word (dpGTCGT), were non-significant for Groups or Conditions. Again, there were no significant differences if the probe replaced either a general-threat word or a

general-threat control word at the top versus the bottom of the computer screen. There were no significant differences between Groups or Conditions when a general-threat word was paired with a test-threat word, whether the probe replaced a general-threat word (dpGTTT) or a test-threat word (dpTTGT). No significant differences existed if the probe replaced either a general-threat word or a test-threat word at the top versus the bottom of the computer screen.

When a general-threat control word was paired with a test-threat control word, whether the general-threat control word (dpGTCTTC) or the test-threat control word (dpTTCGTC) was replaced by the probe, there were no significant differences between Group or Condition. Again, there were no significant differences if the probe replaced either a general-threat control word or a test-threat control word at the top versus the bottom of the computer screen (see Table 9). No significant differences where shown for gender for any dependent variable.

Table 8. Attentional Dot-Probe Mean Response Latencies in Milliseconds

	Group			
	Low Test-Anxious Condition		High Test-Anxious Condition	
	Test	No Test	Test	No Test
Word Pairs	M(SD)		M(SD)	
dpGTGTC	531.2_a(38.2)	542.7_a(31.1)	511.3_a(60.0)	542.7_a(31.1)
dpGTCGT	546.3_a(31.3)	540.8_a(32.7)	561.8_a(36.9)	546.2_a(30.5)
DpGTTT	539.5_a(59.8)	543.1_a(43.3)	561.5_a(61.2)	537.8_a(35.3)
DpTTGT	537.4_a(62.6)	544.0_a(51.6)	572.9_a(65.3)	531.0_a(58.8)
dpTTTTC	533.7_a(36.4)	543.9_a(41.1)	502.2_a(53.5)	533.1_a(50.6)
dpTTCTT	537.5_a(43.3)	533.2_a(37.4)	583.3_a(69.9)	536.8_a(45.0)
dpTTCGTC	562.2_a(55.2)	565.4_a(73.0)	568.9_a(56.9)	564.7_a(41.7)

Note. dpGTGTC: Attentional Dot-Probe Task general-threat word replaced probe paired with general-threat control word. dpGTCGT: general-threat control word replaced probe paired with general-threat word. dpGTTT: general-threat word replaced probe paired with test-threat word. dpTTGT test-threat word replaced probe paired with general-threat word. dpTTTTC: test-threat word replaced probe paired with test-threat control word. dpTTCTT: test-threat control word replaced probe paired with test-threat word. dpTTCGTC: test-threat control word replaced probe 1/2 of the time paired with general-threat control word replaced probe the other 1/2 of the time. Means having the same subscripts are not significantly different at the $p < .05$ level.

Table 9. Attentional Dot-Probe Task Between Groups and Condition Analyses

	Group			Condition			G + C		
Word Type	$F(1, 60)$	p	η_p^2	$F(1, 60)$	p	η_p^2	$F(3, 59)$	p	η_p^2
dpGTGTC	2.6	ns	0.0	1.7	ns	0.0	2.3	ns	0.1
dpGTCGT	1.5	ns	0.0	1.6	ns	0.0	01.6	ns	0.1
dpGTTT	0.4	ns	0.0	0.6	ns	0.0	0.5	ns	0.0
dpTTGT	0.6	ns	0.0	1.4	ns	0.0	1.0	ns	0.0
dpTTTTC	3.3	ns	0.1	3.1	ns	0.1	3.3	0.04*	0.1
dpTTCTT	2.9	ns	0.1	3.0	ns	0.1	3.0	ns	0.1
dpGTCTTC	0.0	ns	0.0	0.0	ns	0.0	0.0	ns	0.0

Note. F represents the comparison between groups (high test-anxious versus low test-anxious) and conditions (test versus no test). G + C represents predicting group and condition. *Note.* dpGTGTC: Attentional Dot-Probe Task general-threat word replaced probe paired with general-threat control word. dpGTCGT: general-threat control word replaced probe paired with general-threat word. dpGTTT: general-threat word replaced probe paired with test-threat word. dpTTGT test-threat word replaced probe paired with general-threat word. dpTTTTC: test-threat word replaced probe paired with test-threat control word. dpTTCTT: test-threat control word replaced probe paired with test-threat word. dpTTCGTC: test-threat control word replaced probe 1/2 of the time paired with general-threat control word replaced probe the other 1/2 of the time. $*p < .05$, $**p < .01$. η_p^2 (effect size): partial eta squared.

ANCOVA, however, demonstrated that high test-anxious participants in the test condition showed significantly shorter response latencies for dpTTTTC words (*M* = 502.18, *SD* = 53.47) compared to low test-anxious participants in the no test condition (*M* = 543.94, *SD* = 41.14). Although not significant, a strong trend of longer response latencies for dpTTCTT compared to low test-anxious participants in the test condition was also shown $F(3, 59) = 2.99$, $p = .058$). Thus, those individuals were quicker to respond when a test-threat word was paired with a test-threat control word and the probe replaced the test-threat word. Similarly, when the probe replaced the test-threat control word, participants were slower to respond; however, not significantly. No significant differences were demonstrated for dpGTGTC, dpGTCGT, dpGTTT, dpTTGT, dpGTCTTC, and dpTTCGTC using a regression analysis (see Table 9). Figures 6-12 show mean response latencies in milliseconds among high test-anxious versus low test-anxious participants and among participants who will have an exam following the computer tasks versus those who have no exams scheduled.

Figure 6. Dot-Probe Attentional Task Mean Latencies in Milliseconds for General-Threat Words (replaced by probe) Paired with General-Threat Control Words

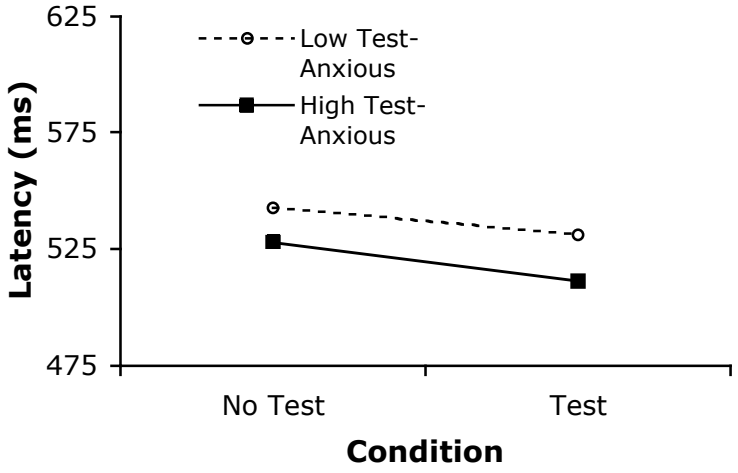


Figure 7. Dot-Probe Attentional Task Mean Latencies in Milliseconds for General-Threat Control Words (replaced by probe) Paired with General-Threat Words

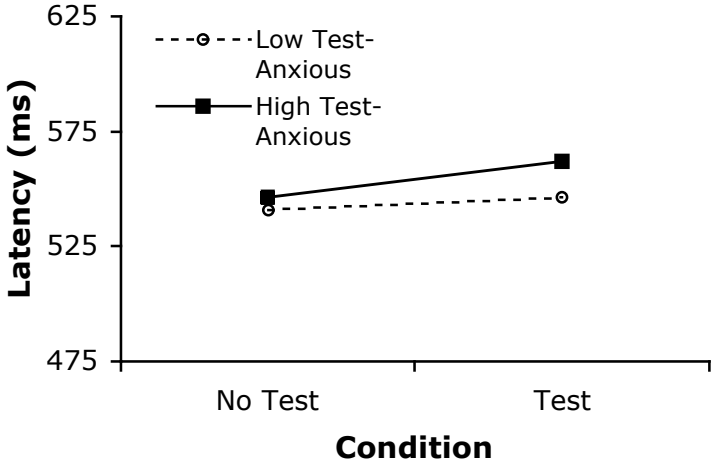


Figure 8. Dot-Probe Attentional Task Mean Latencies in Milliseconds for General-Threat Words (replaced by probe) Paired with Test-Threat Words

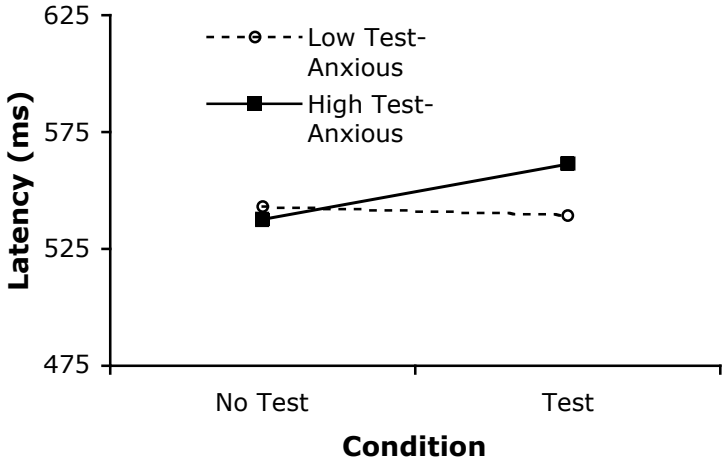


Figure 9. Dot-Probe Attentional Task Mean Latencies in Milliseconds for Test-Threat Words (replaced by probe) Paired with General-Threat Words

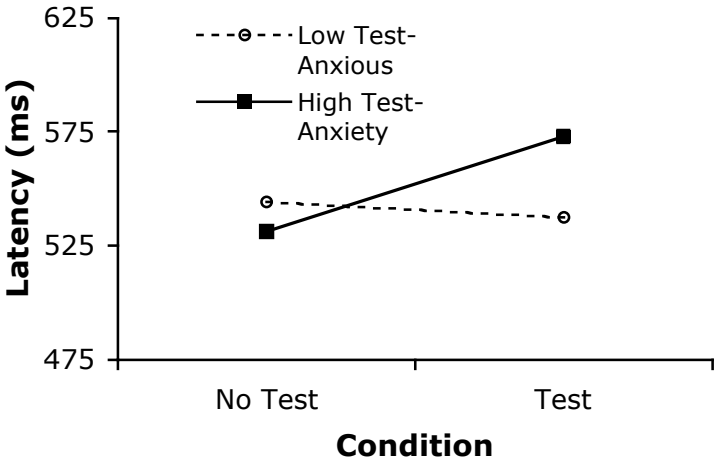


Figure 10. Dot-Probe Attentional Task Mean Latencies in Milliseconds for Test-Threat Words (replaced by probe) Paired with Test-Threat Control Words

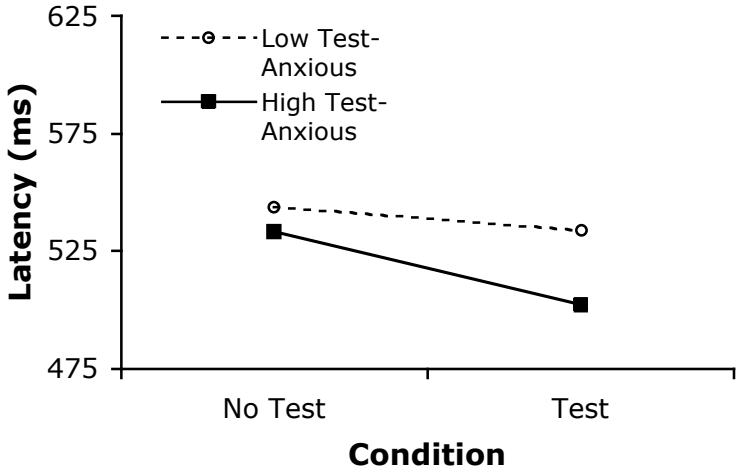


Figure 11. Dot-Probe Attentional Task Mean Latencies in Milliseconds for Test-Threat Control Words (replaced by probe) Paired with Test-Threat Words

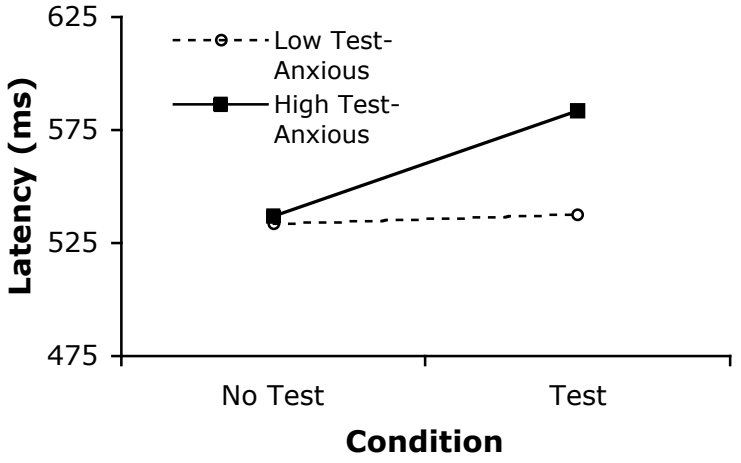
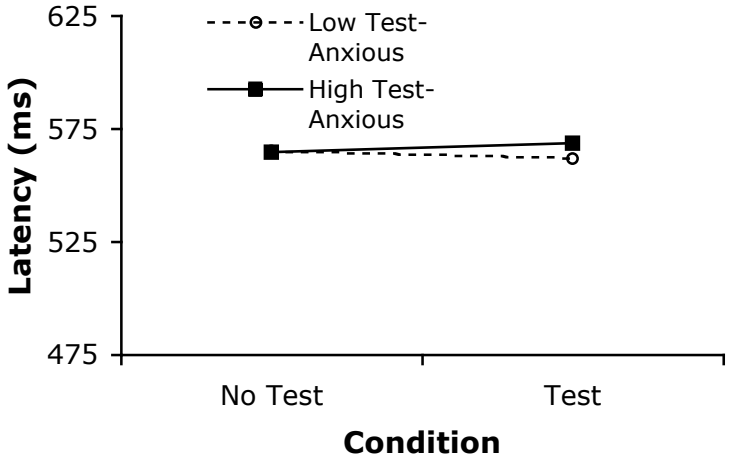


Figure 12. Dot-Probe Attentional Task Mean Latencies in Milliseconds for General-Threat Control Words (replaced by probe 1/2 of the time) Paired with Test-Threat Control Words (replaced by probe the other 1/2 of the time)



Correlations

RTT. RTT total score and subtest scores all were significantly positively correlated: worry $r = .966$, $p < .001$, tension $r = .944$, $p < .001$, test-irrelevant thoughts $r = .948$, $p < .001$, and bodily symptoms $r = .959$, $p < .001$. Please see Table 10 for separate intercorrelations of each of the RTT subscales. RTT scores, total and subscales, and GPA produced no significant correlations. RTT total score and all anxiety measures were significantly positively correlated: STAI-T $r = .760$, $p < .001$, STAI-S pretest $r = .525$, $p < .001$, STAI-S posttest $r = .662$, $p < .001$, MAACL-R pretest $r = .476$, $p < .001$, MAACL-R posttest $r = .613$, $p < .001$, and FNE $r = .531$, $p < .001$. RTT intercorrelations are summarized in Table 10.

Table 10. RTT Intercorrelations

Variables		1	2	3	4	5
1.	RTT total	□				
2.	RTT tension	.94**	□			
3.	RTT worry	.97**	.92***	□		
4.	RTT test irrelevant thoughts	.95**	.82**	.88**	□	
5.	RTT bodily symptoms	.96**	.86**	.89**	.92**	□

***p* < .01*

Computer tasks. StroopGT showed a significant positive correlation among some of the anxiety measures including: RTT worry, r =.291, p = .022, RTT total, r = .250, p = .050, and MAACL-R posttest, r = .309, p = .014 StroopTT showed a significant positive correlation with the following anxiety measures, RTT worry, r = .292, p = .021), RTT total, r = .251, p = .049, STAI State posttest, r = .298, p = .019, STAI Trait, r = .271, p = .033, and MAACL-R posttest, r = .371, p = .033. The dpTTTTC variable showed a significant negative correlation with RTT tension, r = -.276, p = .030 and FNE, r = -.293, p = .021.

Summary Results for Each Hypotheses

Hypothesis one. On the modified Stroop color-naming task, between groups comparison showed no significant differences between high test-anxious participants and low test-anxious participants for test-threatening stimuli. Analyses, however, demonstrated that a trend did exist.

Hypothesis two. On the modified Stroop color-naming task, high test-anxious participants demonstrated significant differences for response times for test-threat words compared with test-threat control words. This was not demonstrated for low test-anxious participants.

Hypothesis three. On the modified Stroop color-naming task, high test-anxious participants revealed no significant difference in response times for test-threat words versus general-threat words.

Hypothesis four. In the attentional dot-probe task, the location of the word and the probe did not have a significant effect on response latencies for any dependent variable. However, a trend was present for test-threat words when paired with test-threat control words for all participants.

Hypothesis five, exploratory hypothesis. Examining an elevation in state anxiety in the Stroop color-naming tasks showed, among high test-anxious (compared to low test-anxious) participants when they had an exam soon following their participation, significantly longer response latencies for words that contained test-threatening stimuli (hypothesis one). Similarly among high test-anxious (compared to low test-anxious) participants, although significant differences occurred regardless of an upcoming exam, the occurrence of the examination immediately following their participation produced more powerful results for test-threatening stimuli versus neutral stimuli. Furthermore, although there was a trend, high test-anxious participants showed no significant differences between test-threat words and general-threat words (hypothesis three) even when there was an exam pending.

Similarly, on the attentional dot-probe task, high test-anxious participants who had an exam pending yielded significantly shorter response latencies for test-threat words when paired with test-threat control words,

showing that their attention was oriented toward test-threat words. No significant differences existed between test-threat words when paired with general-threat words prior to an exam.

Chapter 4.

DISCUSSION

The primary purpose of the present study was to demonstrate attentional bias for threatening information relative to the testing environment among test-anxious participants. The investigation produced some interesting results; some of which were expected and some were not. Three primary findings are discussed.

Principal Findings and Implications

First finding. The results did not support some of the initial hypotheses. First, hypothesis one predicted that on the modified Stroop color-naming task, high test-anxious participants (compared to low test-anxious participants) would demonstrate significantly longer response latencies for test-threat words. Results showed response latencies between high test-anxious and low test-anxious participants for test-threatening stimuli were not significantly different. Although no statistically significant differences were present, a trend was shown for high test-anxious participants to exhibit longer response latencies for test-threat words.

Secondly, hypothesis four predicted that on the attentional dot-probe task, response latencies would be shorter or longer relative to the location of the word and the probe (e.g., high test-anxious participants' attention should be oriented towards the location and direction of threat words that are related to the participants' particular schema). Again, contrary to predictions, results demonstrated that high test-anxious participants did not exhibit significantly

different response latencies for test-threatening stimuli on the attentional dot-probe task. Although response latencies were not significantly different between high and low test-anxious participants, there was a trend for high test-anxious participants' attention to be oriented toward test-threatening stimuli when paired with control stimuli.

Both of these findings warrant some discussion. First, the lack of significant differences between the high and low test-anxious individuals responding to test-threatening stimuli is theorized in the literature that an elevation in state anxiety is necessary to activate test-related schemas and to reveal significant differences in performance (MacLeod & Mathews, 1988) on computer tasks prior to an exam (hypothesis five, exploratory hypothesis).

In the present study, high test-anxious participants scored higher on a state anxiety measure just prior to an exam compared to when they were administered the same measure not followed by an exam, suggesting successful elevation in state anxiety. With this elevation in state anxiety, significant differences in response latencies for test-threatening stimuli were found between high test-anxious participants and low test-anxious participants when they had an exam immediately following the experiment. Thus, high test-anxious participants took longer on the Stroop color-naming task to respond to test-threat words compared to low test-anxious participants prior to an exam. These longer response latencies support the theory that high test-anxious individuals shift their attention toward threatening stimuli (MacLeod et al., 1986) and therefore have an attentional bias for threat

(Taghavi et al., 1999). However, when no exam was imminent, even when the individual scored high on test anxiety, there was no attentional bias for test-threatening stimuli.

Similarly, on the attentional dot probe task, an elevation of state anxiety is necessary for significant differences in response latencies to emerge between high and low test-anxious individuals' attention to orient toward test-threatening stimuli. High test-anxious participants, just prior to an exam, exhibited significantly different response latencies compared to low test-anxious participants for test-threatening stimuli when paired with control stimuli. The theory that high test-anxious individuals shift their attention toward threatening stimuli (MacLeod et al., 1986) is due to an attentional bias for test-related threat (Taghavi et al., 1999), is once again supported.

The necessity of an elevation of state anxiety has some relevance to the activation hypothesis. Although the activation hypothesis predominately refers to depressogenic patterns, it could also be applied to patterns of anxiety. According to Beck (1983), cognitive schemas of depressive individuals are typically latent and must be activated. However, when primed and accessible, such patterns are hypothesized to produce cognitive distortions that may cause symptoms of depression (Riskind & Rholes, 1984). This would have important implications for the theory of test anxiety. Test anxiety itself is typically latent unless primed (e.g., just prior to or during an exam). Although the activation hypothesis was not specifically examined in

the present study, it is worthy of further investigation to examine the effects of distorted cognitions relative to the exam situation.

Second finding. Hypothesis three predicted that on the modified Stroop color-naming task high test-anxious participants would demonstrate significantly longer response latencies for threat words relative to their specific anxiety-related schemas (e.g., high test-anxious participants should have longer response latencies for test-threat words compared to general-threat words). Contrary to predictions, the results demonstrated that high test-anxious participants' response latencies were not statistically different between test-threatening stimuli and general-threatening stimuli on the Stroop color-naming task (hypothesis three). Furthermore, the results were unchanged and no significant differences were found among high test-anxious participants between test-threat words and general-threat words even if they had an upcoming exam.

One question arises from this unexpected finding that warrants some discussion. If hypothesis three was supported and high test-anxious individuals are sensitive only to environmental stimuli that are relative to their specific anxiety-related schema (i.e., greater sensitivity to the test environment compared to a general-threat), it could have suggested that test anxiety is a separate entity, best classified separately from generalized anxiety, social phobia, and specific phobia. However, since the results only show a trend, is test anxiety indeed a separate entity from generalized anxiety that warrants a separate classification?

On face value, the answer to this question, according to hypothesis three, should be “no”, and the results of this finding would suggest that high test-anxious individuals are perhaps not necessarily sensitive only to environmental stimuli relative to their specific anxiety related schema (Williams et al., 1997). However, despite the fact that high test-anxious participants did not respond with significantly longer latencies to test-threat words compared with general-threat words, it does not necessarily mean that no sensitivity to anxiety relative schema exists. It should be noted that in the previous finding, high test-anxious participants were specifically sensitive to test-threatening stimuli compared to control stimuli (e.g., responding slower to test-threat words compared to control words). This was not evident between general-threat words and general-threat control words. These data suggest that there is some sensitivity to specific anxiety related schema.

Anticipatory anxiety could also explain the lack of significant difference between test-threat words and general-threat words. Anticipatory anxiety is the anxiety that an individual usually experiences before a challenging activity (Chua, Krames, Toni, Passingham, & Dolan, 1999), or in this case, an exam. Most often, anticipatory anxiety is at a substantially greater level than what an individual would actually experience during an exam. Thus, anticipatory anxiety may influence response latencies toward general-threat words as well.

Another point that warrants some discussion is the discovery that low test-anxious and high test-anxious groups demonstrated significant

differences on a trait anxiety measure. This finding would suggest that test-anxious participants are also highly anxious in general. Thus, it would demonstrate that the general-threat words would also be salient for them. This point will be given further elaboration later in the methodological limitations. Of course, more research is needed to further investigate the classification of test anxiety.

Third finding. One finding that was consistent with predictions supported hypothesis two. This hypothesis predicted that on the modified Stroop color-naming task, high test-anxious participants (compared to low test-anxious participants) would demonstrate significantly longer response latencies for test-threat words when compared to test-threat control (neutral) words due to the focus on the threat. Consistent with predictions, results showed that high test-anxious participants were significantly slower to respond to test-threatening stimuli compared to control stimuli.

This was an interesting finding, although somewhat contradictory to hypothesis five, which required an upcoming exam to elevate state anxiety to reveal significant differences. Present findings demonstrate that among high test-anxious participants, and when comparing the words themselves (test-threatening stimuli compared with control stimuli), an elevation in state anxiety is not necessary to activate an individual's test-related schema. It also appears that high test-anxious individuals are sensitive to test-related threat whether or not they are shown to be high versus low in state anxiety (i.e., have an upcoming exam or not). When high test-anxious participants

were examined just prior to an exam, they also took longer to respond to a test-threat word compared to a control word.

Present findings suggest that the words themselves distract high test-anxious participants and their attention is oriented toward the test-threat word. Similar to individuals with depression and anxiety disorders, test-anxious students may have a tendency to use a disproportionate amount of their cognitive resources focusing on threat and task irrelevant concerns (Eysenck, 1992; Muller, 1992, Zeidner, 1980). Furthermore, high test-anxious individuals have an increased susceptibility to distraction when receiving an anxiety-provoking stressor (Keogh, & French, 2001). These findings are consistent with previous research examining children (Alting, & Markham, 1993) and college students (Keogh, & French, 2001) that showed participants had high distractibility toward threatening stimuli (e.g., test-threat), thus having selective bias toward threatening cues.

Overall, this study gave evidence suggesting that high test-anxious individuals are distracted by threatening stimuli (e.g., words containing test-threat) and are likely to interpret these stimuli as potential threat (Eysenck, 1992; Mathews & MacLeod, 1985). Thus, high test-anxious individuals demonstrated an attentional bias for test-threatening stimuli.

Methodological Limitations

First, the lack of significant findings among high test-anxious individuals for test-threat words versus general-threat words warrants some discussion. First, as was mentioned previously, the lack of significance is

likely due to high test-anxious participants being also highly anxious in general, as demonstrated on a trait anxiety measure. Thus these individuals are also likely to be as sensitive to general-threat words as they are to test-threat words. It would have been desirable to separate out general-anxious individuals (high trait anxiety scores) from high test-anxious individuals (high RTT scores) who were not highly anxious in general (low trait anxious). In retrospect, this would have been the ideal. However, since trait anxiety and test anxiety highly correlate this might have been difficult. Perhaps this should be pursued in further studies on test anxiety.

Second, it would have been informative to include a group of individuals who met criteria for an anxiety disorder to further evaluate sensitivity to one's own anxiety-related schema. However, given the limited time and resources, it would not have been manageable to recruit such a group and proceed with diagnosis or assessment to determine inclusive criteria. Since this study was specifically examining attentional bias among test-anxious individuals, not including such a group was justified. However, comparing general-anxious and test-anxious individuals is worthy for future investigation.

Third, in retrospect, it would have been useful to have the participants in the test condition (exam immediately following the experiment) complete a post-exam questionnaire inquiring about their exam experience, including exam grade. With this information, correlational analyses could have been conducted to investigate whether test performance and test anxiety, including

the sub-components of test anxiety measured by the RTT, were correlated. Although previous research has established that test performance is not correlated with emotionality (Morris & Perez, 1972) and is correlated with worry (Spielberger & Vagg, 1995), it would have been favorable here to investigate the correlation of test-irrelevant thoughts, bodily symptoms, and test performance.

Fourth, it would have been useful to request the participants to indicate the length of time they prepared for their upcoming exam, on the post questionnaire. This would help to tease out some potential confounds of the study, including poor study habits that may have affected one group or condition differentially. That is, if the participants spend little time preparing, are they likely to exhibit some attentional bias prior to an exam independently of their test anxiety assessed by the RTT? This could be an interesting follow up study.

Lastly, some information could have been gained by including other demographic variables such as ethnicity. Previous research that examined predictor variables such as ethnicity has shown that, for instance, Hawaiian students have higher anxiety scores measured by the STAI compared to Japanese students (Hishinuma, Miyamoto, Nishimura, & Nahulu, 2000). When specifically examining test anxiety for a statistics course, ethnicity was a factor that affected outcome results (Baloglu, & Zelhart, 2003). Further test-anxiety studies should include predictor variables such as ethnicity to examine such affects.

Recent Developments

Researchers have been interested in the emotional reactions of students while taking exams since the beginning of last century. The interest in test anxiety produced a wealth of information that focused on how test anxiety relates to performance. In the 1950s and subsequent years, specific measures in test anxiety were developed in hopes of measuring test anxiety separately from other anxiety disorders (Stober & Pekrun, 2004). In the 1960s and 1970s, major advancements included distinctions between state and trait anxiety (Cattell & Scheier, 1966; Spielberger, 1966) and distinctions between worry and emotionality (Liebert & Morris, 1967). The developments in the 1970s and 1980s showed developments in model construction, specifically cognitive models and the role attention plays in test anxiety (Zeidner, 1998). The number of scientific publications on test anxiety began to decrease after its peak in the 1980s. However, in recent years the study of test anxiety is still flourishing and has shown some promising developments (Stober & Pekrun, 2004) in coping, performance, and self-control. These deserve further discussion.

First, researchers are now examining practical interventions that address test anxiety such as coping strategies. For instance, Stober (2004) examined four dimensions of test anxiety that varied somewhat from Sarason's (1984) RTT. The four dimensions include worry (concerns about being evaluated and consequences of failure), emotionality (perception of autonomic reactions that are evoked by the exam), interference

(preoccupation of intrusive thoughts), and lack of confidence (belief that failure is imminent), all of which influence coping strategies for pre-test anxiety and uncertainty.

Stober (2004) outlined three strategy types: task orientation and preparation, seeking social support, and avoidance. One hundred sixty-two students were administered a multidimensional measure of test anxiety and they were asked about their coping strategies regarding pre-exam anxiety and uncertainty. Results showed that different dimensions of test anxiety reveal relationships with coping strategies, along with significant gender differentiations. First, it was found that worry correlated with preparation and avoidance among females. Second, emotionality correlated with seeking social support in males and preparation among females. Third, lack of confidence correlated with avoidance among females. These results suggest that the main components of coping with test anxiety display different relationships with coping strategies (Stober, 2004).

Second, researchers have reexamined the relationship between test anxiety and performance, along with significant gender effects. Although the present study lacks significant findings when examining GPA and test anxiety measured by the RTT and gender effects, only 62 participants were examined and the female-male split was not equal. Nevertheless, other research has shown that these relationships do exist.

One such project (Chapel, Blanding, Silverstein, Takahashi, Newman, Gubi, & McCann, 2005) evaluated 5,414 participants. Participants were

asked to provide their cumulative GPAs. Participants were also administered a measure of test anxiety. Results showed that among graduate students, low test-anxious females had significantly higher GPAs compared to high test-anxious females. However, no differences were shown among males. Furthermore, it was shown that females had significantly higher GPAs and test anxiety scores than males. This research demonstrated the influence of gender differences and supports the theory that test anxiety is related to performance.

Third, researchers (Oaten & Cheng, 2005) examined how test anxiety impairs self-control. Self-regulation is a process that involves the ability to alter thought processes, emotions, and behaviors. Participants taking exams were compared to those who did not have upcoming exams. They examined regulatory behaviors (e.g., consumption, physical activity, self-care, spending habits, emotional control, sleep patterns, keeping appointments), depression, trait anxiety, self-control, perceived stress, emotional distress, and performance on a modified version of a Stroop color-word task.

Results demonstrated that participants with test anxiety show breakdowns in self-control behaviors and impaired functioning on the Stroop task (e.g., longer response latencies in color naming) that were not evident in the control group. Self-control behaviors included changes in consumption behaviors (e.g., smoking, caffeine, junk food), physical activity (e.g., frequency and duration of exercise), self-care (e.g., brushing teeth, changing clothes), household chores (e.g., laundry, dishes), and regulatory behaviors

(e.g., emotional control, sleeping in). Perceived stress and emotional distress also changed from their baselines. The control group showed no such changes, suggesting that during stressful life events, such as upcoming exams, self-regulation may begin to fail (e.g., self-care, drinking, smoking) where control was once successful prior to the stress.

Other developments related to the present study include reexamining the Stroop task. Researchers (Algom, Chajut, & Lev, 2004) examined the emotional Stroop phenomenon that challenged the selective attention mechanism. The Stroop effect is the difference in performance of color-naming between congruent (e.g., the word green printed in green ink) and incongruent (e.g., the word green printed in red ink) stimuli. Differences in performance are a result of selective attention. The emotional Stroop effect, on the other hand, is the difference in performance of color-naming neutral (e.g., the word flower) and emotionally salient (e.g., the word snake) stimuli. Differences in performance are due to inhibitory mechanism (e.g., reading) or a slowdown effect, which is different than selective attention.

Algom et al. (2004) implemented several experiments addressing various components of the emotional Stroop effect. Results revealed some interesting conclusions demonstrating that the Stroop effect and the emotional Stroop effect are independent of one another. First, it was demonstrated that the effect of the emotional Stroop task was not sensitive to task-irrelevant variation (e.g., emotional stimuli hindered both color-naming and reading), suggesting a generic slowdown, not selective attention.

Reading was hindered regardless of word length, frequency, category, or abstractness. Results also demonstrated that an emotional delay is present when a lexical decision task is replaced with reading, and that the effect is present with alternating tasks. These findings suggest that instead of a selective attention mechanism that accounts for the emotional Stroop effect, it is more reasonable to assume that a threat-driven slowdown is responsible. Since this study challenges some classic findings, researchers of this study suggest separating the classic Stroop effect from the emotional Stroop effect in that there are two entities that deserve separate attention (Algom et al., 2004).

The present findings, using an emotional Stroop color-naming task, demonstrated that an attentional bias among test-anxious individuals exists when state anxiety is induced. These findings suggest that test-anxious individuals "selectively attend" to test-threatening stimuli. However, this statement cannot yet be affirmed with respect to selective attention and current methodology implemented in the present study. Rather, what can be proven and what the data reveal about test-anxious individuals, is a slowdown effect when color-naming emotionally salient stimuli (e.g., test-threat words). Whether these results were influenced by a generic slowdown versus selective attention is yet to be fully understood and more research is encouraged in this area.

Future Directions

Demonstrating attentional bias among test-anxious individuals has some important implications for future study. First, it would be informative to continue the investigation of attentional bias relative to individual's schemas. That is, are test-anxious individuals more sensitive to test-threat stimuli compared to general-threat stimuli? Although this was not found to be the case in the present study, possibly due to some methodological limitations, it would still be worthy of investigation. This could prove valuable in the classification of test anxiety separate from other areas of anxiety. Furthermore, the classification of test anxiety can ultimately lead to effective treatments for test-anxious students.

Second, since an elevation in state anxiety is necessary for attentional bias among test-anxious individuals, investigation of specific anxiety related triggers would be an informative study. Thus, what elements of the upcoming exam trigger an elevation in state anxiety? Future studies could examine specific elements of an upcoming exam including the environment, lack of preparedness, other students, the instructor, ruminating thoughts of failure, and the dread of physiological reactions such as panic. Once these elements are better understood, effective coping strategies could be implemented in an attempt to reduce state anxiety prior to an upcoming exam.

Finally, the more that is learned about test anxiety, the more practical applications toward treating test anxiety should be investigated. More research is needed to investigate a student's strengths and weaknesses

when taking an exam in order to develop effective treatments. The implications of the present study could guide the development of new assessment devices and treatment approaches that focus on the specific needs of students whose performance is not dependent upon ability, intelligence, or study habits. The results of the present study implicating the role of attentional bias should further the development of treatment strategies that emphasize stress reduction, focused attention, and task relevant test-taking skills (Keogh & French, 2001) as well as appropriate study habits. Demonstrating the impact of stress and how it relates to situational anxiety could also guide treatment strategies. Investigating attentional bias among test-anxious participants can be quite informative with respect to maintenance and reinforcement of anxiety.

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APPENDICES

Appendix A

General Information Forms

Participant #_____

Pre-screening Contact Form

This form will be kept separate and confidential form other materials. Your name will only be used to contact you by email to inquire of your interest in participating in the second part of the experiment.

Name: _____

Email Address or Fist Class name (e.g., John H. Smith)

_____

Psychology Course Number and section (e.g., PSY 100 02): _____

Course Instructor: _____

Participant #_____

Demographic Information

1. What is your age? _____

2. What is your gender? Circle one

   Male

   Female

3. What is your current cumulative GPA, if unsure estimate? _____

4. What is your class status? Circle one

   Freshman

   Sophomore

   Junior

   Senior

   Graduate Student

5. Do you suffer from color blindness? Circle one

   YES

   NO

6. Are you currently taking any psychotropic medications? Circle one

   YES

   NO

7. Would you be willing to participate one hour prior to an exam?

   YES

   NO

Appendix B

Measures

Participant # _____

Reactions to Test – Abbreviated Form

(Developed by Sarason, 1984 and revised by Benson & Bandalos, 1992)

Below are statements that may or may not be relevant to you. Based on your personal experience, please indicate how frequently you experience these feelings or thoughts during testing situations. Please use the scale below and circle the number that best reflects how frequently you experience these responses.

Not at all typical of me 1	Only somewhat typical of me 2	Quite typical of me 3	Very typical of me 4

1.	I feel distressed and uneasy before a test.	1 2 3 4
2.	I feel jittery before tests.	1 2 3 4
3.	While taking a test, I feel tense.	1 2 3 4
4.	I am anxious about tests.	1 2 3 4
5.	I have uneasy feelings before an important test.	1 2 3 4
6.	The thought, "What happens if I fail this test?" goes through my mind during tests.	1 2 3 4
7.	During a difficult test, I worry whether I will pass it.	1 2 3 4
8.	While taking tests, I find myself thinking how much brighter other people are.	1 2 3 4
9.	After a test, I say to myself, "It's over and I did as well as I could.	1 2 3 4
10.	Thoughts of doing poorly interfere with my concentration during tests.	1 2 3 4
11.	During tests I think of how poorly I am doing.	1 2 3 4
12.	During tests I find myself thinking of things unrelated to the material being tested.	1 2 3 4
13.	I think about current events during a test.	1 2 3 4
14.	I have fantasies a few times during a test.	1 2 3 4
15.	While taking tests, I sometimes think about being somewhere else.	1 2 3 4
16.	During tests, I find I am distracted by thoughts of upcoming events.	1 2 3 4
17.	I feel the need to go to the toilet more often.	1 2 3 4
18.	I get a headache before a test.	1 2 3 4
19.	My mouth feels dry during a test.	1 2 3 4
20.	I sometimes find myself trembling before or during tests.	1 2 3 4

Participant # _____

mind garden

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-1

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

		NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1.	I feel calm	1	2	3	4
2.	I feel secure	1	2	3	4
3.	I am tense	1	2	3	4
4.	I feel strained	1	2	3	4
5.	I feel at ease	1	2	3	4
6.	I feel upset	1	2	3	4
7.	I am presently worrying over possible misfortunes	1	2	3	4
8.	I feel satisfied	1	2	3	4
9.	I feel frightened	1	2	3	4
10.	I feel comfortable	1	2	3	4
11.	I feel self-confident	1	2	3	4
12.	I feel nervous	1	2	3	4
13.	I am jittery	1	2	3	4
14.	I feel indecisive	1	2	3	4
15.	I am relaxed	1	2	3	4
16.	I feel content	1	2	3	4
17.	I am worried	1	2	3	4
18.	I feel confused	1	2	3	4
19.	I feel steady	1	2	3	4
20.	I feel pleasant	1	2	3	4

Participant # _____

mind garden

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-2

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel.

		NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
21.	I feel Pleasant	1	2	3	4
22.	I feel nervous and restless	1	2	3	4
23.	I feel satisfied with myself	1	2	3	4
24.	I wish I could be as happy as others seem to be	1	2	3	4
25.	I feel like a failure	1	2	3	4
26.	I feel rested	1	2	3	4
27.	I am "calm, cool, and collected"	1	2	3	4
28.	I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29.	I worry too much over something that really doesn't matter	1	2	3	4
30.	I am happy	1	2	3	4
31.	I have disturbing thoughts	1	2	3	4
32.	I lack self-confidence	1	2	3	4
33.	I feel secure	1	2	3	4
34.	I make decisions easily	1	2	3	4
35.	I feel inadequate	1	2	3	4
36.	I am content	1	2	3	4
37.	Some unimportant thoughts runs through my mind and bothers me	1	2	3	4
38.	I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39.	I am a steady person	1	2	3	4
40.	I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Participant # _____

The Multiple Affect Adjective Check List (MAACL)

DIRECTIONS

Please check off of the words below which describe how you feel right now at the present moment.

- ☐ Active
- ☐ Afraid
- ☐ Aggressive
- ☐ Alone
- ☐ Annoyed
- ☐ Anxious
- ☐ Apprehensive
- ☐ Bored
- ☐ Calm
- ☐ Complaining
- ☐ Confused
- ☐ Content
- ☐ Critical
- ☐ Cross
- ☐ Cruel
- ☐ Daring
- ☐ Destroyed
- ☐ Disagreeable
- ☐ Disgusted
- ☐ Distraught
- ☐ Distracted
- ☐ Enthusiastic
- ☐ Fearful
- ☐ Forlorn
- ☐ Free
- ☐ Freaked
- ☐ Friendly
- ☐ Frightened
- ☐ Furious
- ☐ Good
- ☐ Jittery
- ☐ Joyful
- ☐ Hopeless
- ☐ Hopeless
- ☐ Hopeful
- ☐ Happy
- ☐ Hostile
- ☐ Horrified
- ☐ Humored
- ☐ Incensed
- ☐ Interested
- ☐ Lonely
- ☐ Lost
- ☐ Loving
- ☐ Mad
- ☐ Mean
- ☐ Merry
- ☐ Mild
- ☐ Miserable
- ☐ Nervous
- ☐ Panicky
- ☐ Peaceful
- ☐ Polite
- ☐ Rejected
- ☐ Satisfied
- ☐ Scared
- ☐ Secure
- ☐ Shaky
- ☐ Suffering
- ☐ Tame
- ☐ Tender
- ☐ Tense
- ☐ Understanding
- ☐ Whole
- ☐ Wild
- ☐ Worried

Participant # _____

FEAR OF NEGATIVE EVALUATION SCALE (FNE)

Please read each of the following statements carefully and indicate how characteristic it is of you according to the following scale:

1 – Not at all characteristic of me.
2 – Slightly characteristic of me.
3 – Moderately characteristic of me.
4 – Very characteristic of me.
5 – Extremely characteristic of me.

1). I worry about what other people think of me even when I know it doesn't make any difference.	1	2	3	4	5
2). I am unconcerned even if I know people are forming an unfavorable opinion of me.	1	2	3	4	5
3). I am frequently afraid of other people noticing my shortcomings.	1	2	3	4	5
4). I rarely worry about what kind of impression I am making on someone.	1	2	3	4	5
5). I am afraid that others will not approve of me.	1	2	3	4	5
6). I am afraid that others will find fault with me.	1	2	3	4	5
7). Other peoples' opinions of me do not bother me.	1	2	3	4	5
8). When I am talking to someone, I worry about what they may be thinking of me.	1	2	3	4	5
9). I am usually worried about what kind of impression I make.	1	2	3	4	5
10). If I know someone is judging me, it has little effect on me.	1	2	3	4	5
11). Sometimes I think I am too concerned about what other people think of me.	1	2	3	4	5
12). I often worry that I will say or do the wrong things.	1	2	3	4	5

Appendix C

Stroop Color-Naming Task and Attentional Dot-Probe Task Word List

(category, mean emotional rating, and number of letters)

Nbr of Letters	Word	Word Category	Rating	Nbr of Letters	Word	Word Category	Rating
8	Accident	General-Threat	3.67	8	Calendar	Neutral/Control	0.750
5	Alone	General-Threat	3.17	5	Coast	Neutral/Control	0.167
9	Ambulance	General-Threat	3.33	9	Butterfly	Neutral/Control	0.250
6	Coffin	General-Threat	3.92	6	Camera	Neutral/Control	0.667
5	Crash	General-Threat	2.58	5	Chair	Neutral/Control	0
6	Deadly	General-Threat	3.75	6	Handle	Neutral/Control	0.333
5	Death	General-Threat	4.24	5	Jeans	Neutral/Control	0.167
5	Abuse	General-Threat	3.50	5	Elbow	Neutral/Control	0.083
7	Disease	General-Threat	3.00	7	Sticker	Neutral/Control	0.333
8	Distress	General-Threat	3.00	8	Elephant	Neutral/Control	0
4	Rape	General-Threat	4.67	4	Glue	Neutral/Control	0.083
5	Fatal	General-Threat	3.50	5	Grass	Neutral/Control	0
6	Fright	General-Threat	3.67	6	Coffee	Neutral/Control	1.08
7	Illness	General-Threat	3.42	7	Dresser	Neutral/Control	0
6	Insane	General-Threat	3.33	6	Penny	Neutral/Control	0.833
6	Murder	General-Threat	3.83	6	Pencil	Neutral/Control	0
4	Pain	General-Threat	3.83	4	Belt	Neutral/Control	0.083
6	Scared	General-Threat	3.50	6	Finger	Neutral/Control	0.333
3	Kill	General-Threat	3.67	3	Map	Neutral/Control	0.667
3	War	General-Threat	4.24	3	Pen	Neutral/Control	0.833
6	Cancer	General-Threat	3.67	6	Candle	Neutral/Control	0.667
9	Slaughter	General-Threat	4.17	9	Triangles	Neutral/Control	0.667
7	Trapped	General-Threat	3.00	7	Network	Neutral/Control	1.00
9	Suffocate	General-Threat	4,24	9	marketing	Neutral/Control	0.333
6	Poison	General-Threat	3.92	6	Tissue	Neutral/Control	0.667
10	Discomfort	General-Threat	2.83	10	Evaluation	Test-Threat	2.75
5	Drown	General-Threat	3.00	5	Final	Test-Threat	3.41
6	Jitters	General-Threat	2.67	5	Grades	Test-Threat	3.33
7	Seizure	General-Threat	2.83	7	Nervous	Test-Threat	3.58
4	Sick	General-Threat	2.42	4	Pass	Test-Threat	2.75
7	Spiders	General-Threat	2.58	7	Tension	Test-Threat	3.17
6	Stroke	General-Threat	2.92	7	College	Test-Threat	3.08
7	Trouble	General-Threat	3.09	7	Failure	Test-Threat	4.50
5	Snake	General-Threat	2.58	5	Essay	Test-Threat	2.67
7	Falling	General-Threat	2.83	7	Mistake	Test-Threat	2.33

Stroop Color-Naming Task and Attentional Dot-Probe Task Word List *continued.*

Nbr of Letters	Word	Word Category	Rating	Nbr of Letters	Word	Word Category	Rating
9	Challenge	Test-Threat	3.08	9	Spaghetti	Neutral/Control	0.333
4	Mind	Test-Threat	2.92	4	Tape	Neutral/Control	0.250
4	Time	Test-Threat	2.33	4	Soda	Neutral/Control	0
4	Test	Test-Threat	3.67	4	Shoe	Neutral/Control	0.167
5	Panic	Test-Threat	4.42	5	Tulip	Neutral/Control	0.250
5	Worry	Test-Threat	3.25	5	Table	Neutral/Control	0.083
9	Confusion	Test-Threat	2.67	9	Cucumbers	Neutral/Control	0
8	Cramming	Test-Threat	2.58	8	Pinecone	Neutral/Control	0
5	Doubt	Test-Threat	2.67	5	Water	Neutral/Control	0.417
4	Exam	Test-Threat	3.25	4	Sock	Neutral/Control	0
11	Frustration	Test-Threat	3.33	11	Specialized	Neutral/Control	1.00
5	Hurry	Test-Threat	2.33	5	Radio	Neutral/Control	0.500
10	Incomplete	Test-Threat	2.50	10	Taillights	Neutral/Control	0.500
9	Incorrect	Test-Threat	2.97	9	Firelight	Neutral/Control	1.17
11	Performance	Test-Threat	3.00	11	Associative	Neutral/Control	0.833
8	Problems	Test-Threat	3.17	8	Eggplant	Neutral/Control	0.083
4	Quiz	Test-Threat	2.67	4	Tree	Neutral/Control	0.417
8	Remember	Test-Threat	2.67	8	Blankets	Neutral/Control	0.417
8	Studying	Test-Threat	2.42	8	Speakers	Neutral/Control	1.08
5	Wrong	Test-Threat	3.17	5	Rayon	Neutral/Control	0
8	Memorize	Test-Threat	2.97	8	Arkansas	Neutral/Control	0.250
12	Intelligence	Test-Threat	2.58	12	Breadbaskets	Neutral/Control	0.417
6	Stupid	Test-Threat	3.33	6	Purely	Neutral/Control	0.417
4	Math	Test-Threat	3.00	4	Hull	Neutral/Control	0.833
5	Error	Test-Threat	2.67	5	Phone	Neutral/Control	0.500
5	Plant	Neutral/Control	1.08	5	Purse	Neutral/Control	.083
4	Plug	Neutral/Control	.083	4	Sack	Neutral/Control	.333
3	Ear	Neutral/Control	.333	3	Mud	Neutral/Control	.750
5	Stamp	Neutral/Control	.250	5	Brick	Neutral/Control	.500
4	Hair	Neutral/Control	.833	4	Hair	Neutral/Control	.417
6	Zipper	Neutral/Control	.333	6	Letter	Neutral/Control	.667
4	Clip	Neutral/Control	0	4	Open	Neutral/Control	.417
4	Door	Neutral/Control	.417	4	Lace	Neutral/Control	.250
5	Shirt	Neutral/Control	.167	5	Stairs	Neutral/Control	.167
5	Apple	Neutral/Control	.500	5	Seeds	Neutral/Control	0

Appendix D

Consent and Debriefing Forms

"Pre-Screening Test Anxiety Study"

Consent and Debriefing Form

I am Darla Lawson, a doctoral student in the Psychology Department here at the University of Maine. I am conducting an experiment, and I would welcome your participation if you are an adult (age 18 or older, or provide a signed permission slip), meet initial criteria based upon the questionnaire assessment, and a student enrolled in a psychology course. Thank you for expressing interest in this study. My colleagues and I are interested in test anxiety. It is believed that students with test anxiety often have difficulties taking examinations. The purpose of this study is to examine distractions and attention among students who are test-anxious.

What will you be asked to do?
I will be asked to complete a series of questionnaires that measure levels of anxiety. For example "I feel nervous", "I often worry that I will say or do the wrong things", and "While taking a test, I feel tense." If any of the questions are too disturbing or upsetting, I have the option of leaving these questions blank

Risks
One risk of this study is that I may feel uncomfortable or anxious at some point during the questionnaires. However, I will not be required to do anything that is considered to be unduly stressful than are typically experienced in daily life.

Voluntary
I understand that my participation is voluntary and that I may withdraw my participation at any time without loss of experimental credit. You may leave any test item blank.

Benefits
You will receive 1 experimental credit for participating in this portion of the study. Your responses will help the researchers to learn more about test anxiety so that we may help students to ease their anxiety during testing situations.

Confidentiality
All of the information that I provide will be kept confidential. Questionnaires will be identified by a number code only (e.g., 012). My name that I provide to receive my credit hours will be kept separate from all other identifying information.

Who do I contact if I have questions?
If you have any questions about this study, please contact Darla Lawson via First Class email at darla_lawson@umit.maine.edu. If you have any questions about your rights as a research participant, please contact Gayle Anderson at Research and Sponsored Programs: (207) 581-1498, 415 Corbett Hall, Campus or on First Class (Gayle Anderson).

Thank you for your interest in this study.

"Test Anxiety Study"

Consent and Debriefing Form

I am Darla Lawson, a doctoral student in the Psychology Department here at the University of Maine. I am conducting an experiment, and I would welcome your participation if you are an adult (age 18 or older, or provide a signed permission slip), meet initial criteria based upon the questionnaire assessment, and a student enrolled in a psychology course. Thank you for expressing interest in this study. My colleagues and I are interested in test anxiety. It is believed that students with test anxiety often have difficulties taking examinations. The purpose of this study is to examine distractions and attention among students who are test-anxious.

What will you be asked to do?
I will be asked to complete a series of questionnaires that measure levels of anxiety. For example "I feel nervous", "I often worry that I will say or do the wrong things", and "While taking a test, I feel tense." If any of the questions are too disturbing or upsetting, I have the option of leaving these questions blank. I will then be asked to complete a series of computer tasks. For example, identifying a color of a word or responding to a probe (*) that appears on the screen. The study will require approximately two hours of my time to which I will earn two credit-hours to apply towards my psychology course.

Risks
One risk of this study is that I may feel uncomfortable or anxious at some point during the questionnaires or computer tasks. However, I will not be required to do anything that is considered to be unduly stressful than are typically experienced in daily life.

Voluntary
I understand that my participation is voluntary and that I may withdraw my participation at any time without loss of experimental credit. You may leave any test item blank.

Benefits
You will receive 3 experimental credits for participating in this portion of the study. Your responses will help the researchers to learn more about test anxiety so that we may help students to ease their anxiety during testing situations.

Confidentiality
All of the information that I provide will be kept confidential. Questionnaires will be identified by a number code only (e.g., 012). My name that I provide to receive my credit hours will be kept separate from all other identifying information.

Who do I contact if I have questions?
If you have any questions about this study, please contact Darla Lawson via First Class email at darla_lawson@umit.maine.edu. If you have any questions about your rights as a research participant, please contact Gayle Anderson at Research and Sponsored Programs: (207) 581-1498, 415 Corbett Hall, Campus or on First Class (Gayle Anderson).

Thank you for your interest in this study.

BIOGRAPHY OF THE AUTHOR

Darla Jane Lawson was born in Van Nuys, California on October 19, 1969. She was raised in Southern and Central California and graduated from Chowchilla Union High School in 1987. She attended the University of Tennessee at Chattanooga and graduated in 1999 with a Bachelor's degree in Anthropology and in 2001 she graduated with a Master of Science degree in Research Psychology with an emphasis in Statistics. She then continued her education at the University of Maine and graduated with a Master of Arts in 2004 in Clinical Psychology. Darla has just completed her internship at the Knoxville Iowa Veterans Administration Hospital with a special emphasis in Neuropsychology and is a candidate for the Doctor of Philosophy degree in Clinical Psychology form the University of Maine in August 2006. She was accepted for a residency position in adult and pediatric Neuropsychology at Indiana Neurosciences Institute at St. Vincent's Hospital in Indianapolis, Indiana.