THE EFFECTS OF TRAIT ANXIETY, POTENTIALLY TRAUMATIC EVENTS, AND PSYCHOLOGICAL ADJUSTMENT ON ATTENTIONAL THREAT BIAS IN COLLEGE STUDENTS

A thesis presented to the faculty of the Graduate School of Western Carolina University in partial fulfillment of the requirements for the degree of Master of Arts in Psychology.

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February 2016

ACKNOWLEDGEMENTS

I would like to thank my thesis chair, Dr. Asberg, for her support and guidance throughout this project. I am also extremely grateful for the helpful input and support from Dr. McCord and Dr. Gordon. Without their encouragement and support, this thesis would not have been possible. Lastly, I would like to sincerely thank the members of my cohort for supporting me and keeping me sane throughout this process.

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ABSTRACT

THE EFFECTS OF TRAIT ANXIETY, POTENTIALLY TRAUMATIC EVENTS, AND PSYCHOLOGICAL ADJUSTMENT ON ATTENTIONAL THREAT BIAS IN COLLEGE STUDENTS

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Attentional biases towards threatening information are considered a highly adaptive process (e.g., Boyer & Bergstrom, 2011). However, differential processing of threat as a result of individual differences can result in attentional mechanisms that are biased towards threatening information at a level that is considered maladaptive. Previous research has suggested that individuals with high levels of trait anxiety and individuals who exhibit trauma symptomatology as a result of a potentially traumatic event (PTE) exhibit this maladaptive level of attentional threat bias that may in turn result in the maintenance of anxious states and debilitating trauma symptomatology, respectively (Ehlers & Clark, 2000; Kimble et al., 2014). The present study aimed to further explore trait anxiety and trauma symptomatology as they relate to attentional threat bias by examining trait anxiety and trauma symptomatology as predictors of attentional threat bias. A non-clinical sample was given self-report measures to assess trait anxiety, PTEs, and trauma symptomatology, and completed an eye-tracking paradigm to assess attentional threat bias. Though no relationship between trait anxiety and attentional threat bias was found, results suggest a significant relationship between trauma symptomatology and attentional threat bias.

CHAPTER ONE: INTRODUCTION

Human beings have evolved to evaluate their environment. This ability to evaluate one's environment has been necessary for survival when one is faced with danger. Theorists dating back to Darwin (1872) have argued that detection of threat is essential, such that when an immediate threat is present, we are able to allocate attentional resources in order to determine an appropriate response. This ability to quickly detect and respond to threats in the environment is considered highly adaptive, and is thought to be an automatic process that is deeply rooted in cognitive processes (Eilam & Mort, 2011). Though this process has been labeled highly adaptive (e.g., Boyer & Bergstrom, 2011; Neuberg, Kenrick, & Scaller, 2011), the tendency to allocate too many attentional resources towards a threat (i.e., showing a threat bias; Marks & Nesse, 1994) is considered maladaptive (see Stein & Nesse, 2011, for a commentary). Though these attentional mechanisms exist within us all, differences exist that may contribute to differential processing of threat.

One of these differences with the potential of influencing the processing of threat may lie within personality. One such trait that has been suggested and supported is anxiety. Individuals who score high in 'trait anxiety', or anxiety attributed to one's personality, have been shown to exhibit differential processing of threatening information. Specifically, those who score high in trait anxiety have been shown to allocate more attentional resources towards threatening information (Mogg et al., 2000; Massar, Mol, Kenemans, & Baas, 2011). This differential allocation of resources has been shown through facilitation of attention towards threat (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Ijzendoorn, 2007; Beck & Clark, 1997; Mogg & Bradley, 1998; Ohman, 1996; Wells & Matthews, 1994), and difficulty disengaging

from threat (Bar-Haim et al., 2007; Beck & Clark, 1997; Eysenck, Derakshan, & Santos 2007). Similarly, it has been suggested that those who are considered highly 'trait anxious' exhibit preferential processing of threatening information when faced with neutral and threatening information simultaneously (Bar-Haim et al., 2007; Mogg & Bradley, 1998). This tendency, whether it be preferential processing of threatening information, or difficulty disengaging resources away from threatening information, is known as attentional threat bias.

Attentional threat biases are not unique to subclinical anxiety. Individuals diagnosed with various anxiety disorders have also been shown to exhibit attentional threat bias. One anxiety disorder that has been given specific attention in this regard is Posttraumatic Stress Disorder (PTSD). Specifically, those diagnosed with PTSD have been shown to exhibit attentional biases when faced with threatening information. Additionally, individuals diagnosed with PTSD have been shown to exhibit attentional biases towards threatening information that is pertinent to the trauma they have experienced. For example, combat veterans diagnosed with PTSD have been shown to exhibit attentional biases for information pertaining to combat (Ashely, Honzel, Larsen, Justus, & Swick, 2013). This finding has been generalized to include those who have experienced a variety of different potentially traumatic events that have resulted in a PTSD diagnosis (Ehlers & Halligan, 2005; Lee & Lee 2012). Much of the literature concerning attentional threat biases has focused on trait anxiety and disorders such as PTSD separately. Though studies of attentional threat biases in PTSD have utilized measures of trait anxiety, the effects of trait anxiety and trauma symptomatology on the level of attentional threat bias that one exhibits is an area that has not been explored in depth.

CHAPTER TWO: LITERATURE REVIEW

Attentional Threat Bias

Attentional threat bias has been defined as the tendency to direct attentional resources towards threatening stimuli as compared to neutral stimuli in the environment (Bakeermans-Kranenburg, 2007; Mogg & Bradley, 1998). This process is thought to be an automatic and unconscious shifting of attentional resources (Moors & De Houwer, 2006). This process is considered highly adaptive; it allows for the quick detection of an imminent threat. From an evolutionary standpoint, this ability to quickly allocate attentional resources towards threat in our environment that may cause harm to us can be thought of as an automatic instinct for self-preservation. As one would expect, as threat value increases, so does attentional threat bias; the more threatening a stimulus is, the more attentional resources an individual delegates towards the stimulus (Mogg et al., 2000).

There are many existing theories concerning the underlying mechanisms of attentional threat bias. It is thought that fear is an underlying force that drives this attentional shift. Further, the amygdala has been implicated as a critical part of this evaluation of fear that may result in attentional threat bias, both for generally threatening information as well as threatening information that is also emotionally salient (Anderson & Phelps, 2001). Indeed, it is agreed upon that mechanisms underlying fear such as the amygdala serve to facilitate the detection of danger in the environment and facilitate reactions to these threats in an effective manner (Mogg & Bradley, 1998). It is believed that the amygdala uses limited stimulus information that allows for rapid response as well as more detailed information. The amygdala integrates these two types of

information, and thus plays an extremely crucial role in the interpretation of danger and threat in our environment (Ledoux, 1995).

It has been noted that individual differences such as emotional regulation strategies and individual methods of coping with negative emotions may play a role in the evaluation and allocation of attentional resources towards threatening stimuli (Gross, 1998). Individual differences in terms of clinical and subclinical anxiety (which will be addressed further in more detail), are also thought to play a role in attentional threat biases. In short, there are many factors as well as individual differences that may influence this complex attentional system.

The measurement of attentional threat bias has been an evolution, utilizing many different paradigms throughout the years. Many early paradigms utilized response times as a measure of attention. One of these paradigms is the modified stoop task (Stroop, 1935). In such studies, threatening and non-threatening words are paired along with a color (the word itself may be colored, or the background behind the word may be colored). Participants are asked to name the colors paired with each word as quickly and accurately as possible. Subjects are specifically told to ignore the semantic meaning of the words presented. Subjects who exhibit attentional threat bias are thought to attend to the semantic meaning of threatening words as opposed to neutral words. This is measured through response times; if a subject has a slower reaction time when naming threat word colors than neutral word colors, they are thought to exhibit attentional bias towards threat. This paradigm is commonly utilized to assess threat biases in populations with clinical anxiety disorders. Specifically, words that correspond to a threat that may evoke anxiety in specific populations (e.g., combat related words in veterans with PTSD) are used to measure these threat biases (McNally, Kaspi, Riemann, & Zeitlin, 1990).

Another common methodology for measuring attentional threat biases that also utilizes reaction time is the dot probe task, or visual probe task (MacLeod, Mathews, & Tata, 1986). Unlike the modified stroop task, experiments using this paradigm have used threatening words as well as pictorial scenes and threatening facial expressions as stimuli. In a dot probe task, a threatening stimulus is paired with a neutral stimulus and presented to subjects simultaneously. After a relatively short presentation, these stimuli disappear and a probe appears in the same spatial location as either the threatening stimulus (a congruent trial) or the neutral stimulus (an incongruent trial). The subject is instructed to press a button that is in concordance with the spatial location of the probe. A subject is thought to exhibit attentional bias towards threatening stimuli if they are slower to respond to probes that occur in place of a neutral stimulus as compared to their response time for a probe replacing a threatening stimulus.

The dot probe task has been utilized in many studies concerning attentional threat bias. For example, in an early study that utilized this visual attention paradigm, the group of participants who exhibited attentional bias towards threatening stimuli (threatening words in this case), were faster to respond to probes that replaced threatening stimuli than probes that appeared opposite threatening stimuli (MacLeod, Mathews, & Tata, 1986). This methodology has been carried over to the current decade, where similar results have been found (Tan, Ma, Gao, Wu & Fang, 2011).

A somewhat similar approach is known as the spatial cueing task, which also utilizes reaction time as a measure of attention. In a spatial cueing task, a fixation is briefly presented in the center of a computer screen. Following this brief fixation presentation, a stimulus (either threatening or non-threatening) is displayed in a rectangle on the left or right side of the screen. This stimulus is displayed briefly, then disappears. The initial fixation is once again presented in

the center of the screen. After this fixation is briefly presented, a target probe appears in the same spatial location as either the threatening stimulus (a valid trial) or the opposite spatial location (an invalid trial). Participants are asked to press a button (that corresponds to the spatial location of the target) to respond to the target probe. As with the dot probe task, an attentional bias is indicated by latent response times to target probes appearing in the spatial location opposite the location where the threatening stimulus appeared (Fox, Russo, Bowles, & Dutton, 2002).

Though paradigms used to measure attentional threat bias are distinct from each other, there is one component that links them. These measures all utilize reaction time as a measure of attention. While it is noted that the development of reaction time measures has been refined over time, it has been suggested that attention may not be best measured via reaction time of a participant. It has been suggested that measuring attention through reaction time is vulnerable to being confounded by factors such as emotional information. Specifically, emotional information may serve as a confound for meditating mechanisms such as response execution (Armstrong & Olatunju, 2012). Thus, it has been suggested that more direct measures of attention be utilized to measure attentional threat biases.

In recent years, the use of eye tracking technology has been used to measure attentional threat bias in a manner that is considered more direct. For the most part, eye tracking studies used to measure attentional threat bias utilize free viewing tasks in which threatening stimuli and neutral stimuli are presented simultaneously. Specifically, attentional threat bias is measured via gaze patterns. A participant who spends more dwell time viewing a threatening stimulus relative to a neutral stimulus, or is quicker to fixate on a threatening stimulus relative to a neutral stimulus, is thought to exhibit attentional threat bias towards threatening information. Additionally, a participant who initially allocates attention towards a threatening stimulus, and

then avoids this stimulus altogether is suspected to also exhibit attentional threat bias through avoidance behavior of threatening stimuli (Armstrong & Olatunju, 2012; Dodd, Hudson, Williams, Lazarus, & Byrow, 2014).

Through these various paradigms developed to measure attentional bias to threat, three observable components of threat bias have been found across different studies utilizing multiple different paradigms. The first is facilitated attention. Facilitated attention has been referred to as the ease or speed of which attention is drawn to a threatening stimulus. In their 1998 analysis of attentional threat biases, Mogg and Bradley suggested that attentional threat biases are mainly manifested through hypervigilance. Results of their study, which utilized reaction times in combination with initial eye movements, indicated that subjects who exhibited attentional threat biases oriented initial attentional resources towards threatening stimuli (Mogg & Bradley, 1998). This phenomenon has persisted as part of attentional threat bias for over a decade of research. For example, a recent 2014 study that utilized a free viewing task found that those who exhibited attentional threat bias oriented initial attention towards threatening stimuli, and were also overall vigilant towards threatening stimuli as compared to subjects who were not considered to exhibit this attentional bias. (Holas, Krejtz, Cypryanska, & Nezlek, 2014).

The second observable characteristic of attentional threat bias is difficulty disengaging from threat. This refers to the degree to which a threatening stimulus captures initial attentional resources, and as a result, causes difficulty in allocating attention away to another stimulus. Similar to facilitated attention, difficulty disengaging has also persisted across the literature concerning attentional threat biases. This component of attentional threat bias has been most commonly measured by paradigms that measure reaction time of subjects responding to other cues (e.g., dot probe tasks, visual search tasks, and spatial cueing tasks). For example, a 2001

study utilizing a cueing paradigm found that subjects suspected to exhibit attentional threat biases responded to invalid trials of the cueing task slower than other subjects. These results suggested that attentional biases consisted of a difficulty in disengaging attentional resources away from threatening stimuli when participants were asked to respond to a cue in a different spatial location (Fox et al., 2001). Further, a 2004 study that utilized a similar cueing task found similar results in those who exhibited attentional biases. Subjects who were biased towards threatening stimuli exhibited difficulty disengaging from threatening stimuli presented both centrally and peripherally (Poy, Eixarch, Del, & Avila, 2004).

The last observable characteristic of attentional threat biases is attentional avoidance of threat, or the tendency for attention to be preferentially allocated away from threatening stimuli, as if to avoid threatening information altogether. Though this pattern is not as commonly reported, it has been found in multiple studies of attentional threat bias. In recent years, this pattern has been observed as a component of facilitated attention; subjects who exhibited threat bias showed initial attention towards threatening stimuli and then appeared to avoid the threatening stimuli altogether. For example, in 2005, a study utilizing a visual probe detection task found that individuals that exhibited attentional threat bias attended initially to threatening stimuli. However, over the course of 1250 milliseconds, these subjects allocated their attention away from these threatening stimuli (Koster, Verschuere, Crombez, & Van Damme, 2005). Similarly, a 2004 study utilizing a similar paradigm found that attentional threat bias was exhibited as initial hypervigilance, as demonstrated by initial allocation towards threatening stimuli. In an additional condition in which threatening stimuli were presented for a longer duration, subjects exhibited an initial hypervigilance, followed by avoidance of the threatening stimuli (Mogg & Bradley, 2004).

Trait Anxiety

Throughout the vast body of research concerning attentional threat biases, it has been suggested that individual differences may result in differences in the *manifestation* of attentional threat bias. One of the most researched areas in terms of individual differences is trait anxiety. Trait anxiety can be defined as a trait within an individual's personality that predisposes one to respond to stressful and sometimes novel situations with anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Though researchers in this area concur that attentional threat biases exist in individuals with high levels of trait anxiety, the exact mechanism and manifestation of this bias is not fully understood.

As a result of this focus in the research, many theories have been developed in an attempt to explain how this personality trait difference may corrupt normal attentional resource allocation. One such model is the information processing model. This model focuses broadly on the cognitive processes underlying anxiety. Further, this model focuses on a combination of automatic and strategic processing mechanisms in terms of the allocation of attention in anxious individuals; automatic being involuntary, and strategic involving some degree of effort and control. Beck and Clark postulated a multi-step model that follows the process of attentional allocation in anxiety step by step. The first step has been labeled the initial registration phase. This is the rapid, automatic portion of attention that serves to initially identify stimuli in the environment, and consequently assign priority to those stimuli that are determined to threaten survival (Beck & Clark, 1997).

Furthermore, Beck and Clark postulate that in anxious individuals, this initial determination of where one should allocate attentional resources is biased. In other words, an anxious individual's initial orientation mechanisms are "tuned" to negative stimuli, which results

in an overall propensity to allocate attentional resources towards negative stimuli in the environment (Beck & Clark, 1997).

The second step in the information-processing model of anxiety is known as the immediate preparation phase. This phase is mainly composed of the activation of what is known as "primal mode"; a goal-directed strategy that an individual uses to minimize danger when faced with a threat in their environment (Beck, 1985). This may include seeking safety by fleeing or perhaps the preparation to defend oneself against a potential threat. In terms of anxiety, Beck and Clark put forward the notion that an anxious individual becomes hypervigilant to aspects of a situation that may be threatening (Beck & Clark, 1997). Indeed, recent research has suggested that this hypervigilance may play a role in potentiating anxious thoughts in anxious individuals, essentially creating a forward feedback loop (Kimble et al., 2014).

The final stage in the information-processing model of anxiety is secondary elaboration. Here, we see a switch from automatic processing to strategic attentional processes. Semantics begin to come into play, and an individual must use context to appraise a situation. At this point, an individual who is anxious may experience elevated levels of anxiety, perhaps due to the "primal mode" attentional mechanisms still dominating cognition. Due to the potential domination of these primal mechanisms over strategic ones, anxious individuals may not be able to strategically appraise a situation as a non-anxious individual would (Beck & Clark, 1997).

As research in this area developed, additional theories came into existence that aimed to explain differential threat processing in individuals who are considered highly trait anxious as compared to those who are low trait anxious. After the development of the information-processing model, others attempted to develop models that depicted threat bias in trait anxious individuals with more detail. In 1997, Williams and colleagues put forth the notion that those

who are highly trait anxious exhibit a permanent tendency to allocate attentional resources towards a threat at a pre-attentive stage, which is shown through these individuals rapidly "switching" their attention towards threatening cues. In contrast, they suggested that low trait anxious individuals exhibit the opposite; showing a permanent tendency to shift attentional resources away from threat. Similar to highly trait anxious individuals, this process occurs in a pre-attentive stage, after a stimulus or feature is judged by the individual to be threatening. A central component to this notion is the interaction hypothesis. This hypothesis states that as threat value increases, individuals who are highly trait anxious are more vulnerable to this threat, and thus become increasingly vigilant of threat. In contrast, those who are considered low trait anxious become increasingly avoidant of threat. This attentional pattern has been labeled the hypervigilant-avoidance hypothesis (Willams, Watts, MacLeod, & Mathews, 1997).

In 1998, Mogg and Bradley developed the cognitive motivational theory of anxiety. Mogg and Bradley refuted portions of Willams and colleagues' work; specifically in terms of the interaction hypothesis. Mogg and Bradley postulated that evolutionarily, a proper threat detection system is one that allows both high and low trait anxious individuals to allocate attention quickly towards threatening stimuli that is considered highly threatening (i.e., a wild animal about to attack). Thus, they believed that all individuals should exhibit elevated levels of attention to threat that crosses the threshold from moderate to severe. A threat detection system that does not allow this would be evolutionarily dysfunctional and maladaptive to survival (Mogg & Bradley, 1998).

According to the cognitive motivational model, there are two purposed systems that are believed to be at work; the Valence Evaluation System and the Goal Evaluation System. The Valence Evaluation System is composed of the amygdala and surrounding cortical structures. As

discussed previously, this system serves to evaluate threat in our environment. Mogg and Bradley purpose that there are multiple factors that influence this complex system. Situational context plays a role, as well as trait anxiety level, and an individual's prior learning. The model suggests that individuals who are highly trait anxious possess a Valence Evaluation System that is more sensitive than that of an individual with low trait anxiety. Consequently, highly trait anxious individuals attribute a high threat value to stimuli that may be trivial to individuals who are not highly trait anxious (Mogg & Bradley, 1998).

According to the cognitive-motivational model, the Valence Evaluation System feeds output into what is known as the Goal Engagement System. This system is responsible for determining where attention should be allocated. If a stimulus is interpreted as threatening by the Valence Evaluation System, perhaps due to a sensitive Valence Evaluation System in a trait anxious individual, cognition is interrupted in order to allocate attentional resources towards the threat. In contrast, if a stimulus is interpreted as non-threatening, cognition is not interrupted, and the stimulus is essentially disregarded. Through this model, a pattern of vigilance-avoidance in highly trait anxious individuals is illustrated. In other words, after initial rapid allocation of attentional resources towards threat, attention is diverted from threat. This avoidance is thought to occur in later stages of processing, and may be a result of an anxious individual attempting to avoid negative emotionality resulting from viewing features in the environment that they deem threatening (Mogg & Bradley, 1998).

In 1992, Eyesnck and colleagues attempted to explain the relationship between anxiety and cognition through the development of their processing efficiency theory. In terms of anxiety, the processing efficiency theory states that anxiety has a negative impact on cognitive efficiency, which Eyesnck defined as the relationship between the effectiveness of performance and the

effort and resources that are utilized for this performance. Within the framework of this theory, it is suggested that worry, which is a common feature of trait anxiety, plays a key role in this process. (Eyesnck & Calvo, 1992). Further, using the framework of the processing efficiency theory, the attentional control theory was developed.

Similar to previous models, the attentional control theory is founded on the suggestion that highly trait anxious individuals tend to preferentially allocate attention towards threatening stimuli or features in the environment. Specifically, the attentional control theory suggests that highly trait anxious individuals do not attend their attentional resources towards tasks unless there are threatening stimuli causing them to do so. In other words, it is suggested that attentional control is impaired in individuals with high trait anxiety. In contrast to the information-processing and cognitive motivational models, sources of threat may be internal or external within the framework of the attentional control theory. Consistent with previously discussed models, an external threat is a stimulus or feature in the environment that is interpreted as threatening by an individual, and thus draws attentional resources. In contrast, according to the attentional control theory, internal threats are mainly feelings of worry that an individual is experiencing, that may also serve as attentional distracters. Eysenck and colleagues purpose that this impairment of attention in anxious individuals results in impaired working memory performance (Eysenck, Derakshan, Santos, & Calvo, 2007).

In terms of experimental studies, there is an overall consensus that highly trait anxious individuals exhibit attentional bias towards threatening stimuli. A 2007 meta-analysis found that attentional threat bias in anxious individuals is a relatively robust finding that has been found in many studies utilizing various paradigms to measure threat bias (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007). Despite this consensus, there are differences

in experimental findings. Mainly, differences in results are believed to be attributed to the lack of theoretical agreement in terms of what exactly composes attentional threat bias, the underlying mechanisms involved, and disagreement in terms of the stages of attention that these processes operate.

Experimental Paradigms in Attentional Threat Bias

Within the literature, various paradigms have been used in an attempt to determine the components of attentional threat bias in trait anxiety. Specifically, studies have shown avoidance of threatening stimuli, delayed disengagement of threatening stimuli, and facilitated engagement towards threatening stimuli in trait anxious individuals. However, these studies have failed to come to a complete consensus regarding whether or not these patterns of attentional threat bias are present in those who are considered highly trait anxious. Throughout the attentional threat bias literature, it is clear that there is no consensus as to whether or not difficulty disengaging from threat is a unique component of trait anxiety. This lack of agreement may be credited to the number and variety of modifications to commonly used experimental paradigms that are used in these studies. It also may be due to different kinds of stimuli that are utilized (in this case word stimuli or facial stimuli).

One such study that examined difficulty with disengagement of threat in trait anxious individuals was conducted by Massar and colleagues in 2011. This study utilized a cueing paradigm with stimuli in the form of threatening and neutral faces. Additionally, Massar and colleagues utilized aversive stimulation in an attempt to bring out this attentional pattern in participants. In line with previous research implicating fear as a major underlying component of attentional threat bias, Massar and colleagues paired threatening stimuli with an aversive noise (in this case a human scream). Initial findings suggested that an individual's level of trait anxiety

did not account for any differences between trait anxious and non-trait anxious participants in terms of attentional threat bias. In other words, all participants (regardless of trait anxiety level) exhibited slowed responses to invalid targets (targets that appeared in the opposite location that the threatening stimulus appeared in). This slowed response time in responding to a target after a threat cue suggests a delayed disengagement from threatening stimuli. This finding is in line with the cognitive-motivational model of anxiety, which suggests that all individuals exhibit attentional bias towards threatening information that crosses a certain threshold (Massar & Kenemans, 2011).

Due to this finding, Massar and colleagues attempted to replicate the experiment. Findings of this experiment were consistent with their previous finding, in that both high and low trait anxious participants exhibited difficulty disengaging from threatening stimuli as suggested by slowed reaction times when responding to invalid targets. However, in this study, it was found that trait anxious participants exhibited facilitated attention towards threatening stimuli (as indicated by significantly faster reaction times when responding to targets that appeared in the same spatial location as threatening stimuli as compared to participants who were not trait anxious). The findings of this study suggested that delayed disengagement from threatening stimuli is found in both high and low trait anxious individuals, while facilitated engagement of threatening stimuli may be a unique feature of trait anxiety (Massar & Kenemans, 2011).

The finding that both trait anxious and non-trait anxious individuals experience difficulty disengaging from threatening stimuli is not a universal finding. A study conducted in 2001 by Fox and colleagues suggested quite the opposite. This study utilized an attentional cueing task with both word and facial stimuli. The first portion of the experiment used strictly word stimuli, and found that all subjects (regardless of trait anxiety level) exhibited a difficulty disengaging

from threatening word stimuli, as indicated by slowed response times on invalid trials. As with Massar's findings, this evidence is in line with the cognitive-motivational model of anxiety. In a second portion of this study, word stimuli were replaced with facial stimuli. Results from this portion of the experiment found that trait anxious participants took significantly longer to localize targets on invalid trials than non-trait anxious participants. This finding suggests that difficulty engaging from threatening stimuli (specifically threatening facial stimuli) is a characteristic unique to highly trait anxious individuals (Massar & Kenemans, 2011).

In 2008, Mogg and colleges utilized a central cueing task in order to add further evidence of this phenomenon to the literature. Similar to previous studies, a spatial cueing paradigm was utilized. Results of this study indicated that participants who where trait anxious exhibited significantly slower reaction times when responding to cues following threatening stimuli than participants who were not trait anxious. These results suggest that there is a difficulty disengaging from threat in trait anxious individuals. However, Mogg and colleges also utilized a central cueing paradigm in a follow up portion of the study in order to assess the reaction time slowing effect of these threat cues. The central cueing task differs from a spatial cueing paradigm in terms of attentional shift. Stimuli in this modification of the spatial cueing task do not require any attentional shift on the part of the participant because the stimuli are presented centrally (not on the rightmost or leftmost side of a screen). This data was adjusted for the slowing effect of reaction time. Findings showed that there was no longer evidence for this difficulty disengaging from threat in trait anxious individuals. Though this was a contradictory finding, it brought to light issues that may exist in using spatial cueing paradigms (specifically reaction time) as a measure of attentional threat bias (Mogg, Holmes, Garner, & Bradley, 2008).

Similar to Mogg and colleges, an earlier study conducted in 2002 produced results that supported evidence for delayed disengagement in those high in trait anxiety. In order to assess any difficulties disengaging from threat, a modified cueing paradigm was used. In this design, time was increased between the presentation of the stimuli and the presentation of a neutral cue. This modification in presentation was utilized in order to assess dwell time of threatening stimuli. In other words, a participant is given more time between the presentation of threatening stimuli to dwell on or process what they have seen. This increased dwell time was suspected to evoke difficulty in disengagement from threatening stimuli that would be reflected in reaction times that are significantly slower on invalid trials as compared to valid trials. Results did not reach statistical significance, which suggests that there is more evidence needed to determine whether or not difficulty disengaging from threatening stimuli is a unique characteristic of trait anxious individuals (Fox, Russo, & Dutton, 2002).

To further explore the possibility of attentional disengagement difficulty in trait anxiety, Fox and colleagues utilized a strategy similar to Massar's in a follow up portion of their 2002 study. In this study, Fox utilized a mood induction procedure in an attempt to elevate state anxiety levels in trait anxious participants. This mood induction procedure was found to be effective in those who were classified as trait anxious, but not participants who were not considered trait anxious. In other words, participants who were trait anxious took significantly longer to disengage from threatening stimuli, as shown by their significantly slower reaction times on invalid trials. In contrast to the findings in the first portion of the study, utilization of the mood induction procedure was found to evoke this attentional pattern in trait anxious participants (Fox, Russo, & Dutton, 2002).

In 2014, Burgess and colleagues also conducted a study to assess difficulty with disengagement from threat in trait anxious individuals. Instead of utilizing visual stimuli in the form of facial stimuli or pictorial scenes depicting threat, this study utilized a lexical decision task. In this design, strings of letters were presented to participants. Participants responded by deciding whether or not this string of letters comprised a word or a non-word. Within this design, threatening words were incorporated and followed by strings of letters that were presented to the participant (an engagement trial). Additionally, disengagement trials were incorporated, in which participants made a lexical decision for a threatening word followed by presentation of a non-word. Results of this study suggested that trait anxious individuals exhibited facilitated attention for threatening stimuli, as indicated by significantly faster time taken to make a lexical decision for threatening words that followed the presentation of non-words. However, results of the disengagement bias trials were inconclusive, as there was no difference between anxiety level and time these individuals took to judge non-words that were presented immediately after threatening words. This study further added to the amount of ambiguity surrounding the existence of delayed disengagement of threat in high trait anxious individuals (Burgess, Cabeleria, Cabrera, Bucks, & MacLeod, 2014).

Another attentional pattern that has been tested throughout the literature falls in line with the hypervigilant-avoidance hypothesis (Williams, Watts, MacLeod, & Mathews, 1997). As with studies that have aimed to assess difficulties with disengagement in trait anxiety, a variety of studies have aimed to assess the plausibility of the hypervigilance-avoidance hypothesis using a variety of diverse designs.

In 1994, Mogg and colleagues utilized a spatial cueing paradigm with stimuli in the form of threatening and neutral words. Reaction times to neutral targets following threatening stimuli

indicated that trait anxious participants shifted attention towards the spatial location of threat words, while reaction times of participants who were not trait anxious exhibited more avoidant behavior. These findings were in concurrence with the hypervigilant portion of the hypervigilance-avoidance hypothesis (Mogg, Bradley, & Hallowell, 1994). The paradigm utilized for this study did not allow for the thorough evaluation of avoidance towards threatening stimuli over time. Thus, studies conducted in more recent years have aimed towards assessing the plausibility of the hypervigilance-avoidance hypothesis in a way that allows attention to be directly assessed over time.

With the development of eye tracking technology, there has been a shift in the study of attentional threat bias in trait anxiety. In 2011, Onnis and colleagues utilized a modified spatial cueing paradigm in which facial stimuli were used. Like previous studies that aimed to induce certain attentional patterns in trait anxious participants, Onnis and colleagues aimed to induce a hypervigilant-avoidant pattern of attention in participants. In this case, a mild electrical shock was utilized in order to condition participants to threatening facial stimuli. Instead of responding to a neutral probe following the presentation of stimuli, participants were asked to detect small changes in pictorial stimuli; in this case, one of the pair of facial stimuli was programmed to either change in eye color or direction in which the eyes were averted. Gaze patterns were measured simultaneously using an eye tracker. Results indicated that trait anxious participants displayed a tendency to avert attention towards threatening stimuli during the first portion of stimuli presentation, followed by a tendency to avert attention away from threatening stimuli during the latter portion of stimuli presentation. These findings are in support of the hypervigilance-avoidance hypothesis. Specifically, it was suggested that this pattern of attention

is indicative of a dysfunction of the Valence Evaluation System component of the cognitive motivational model (Onnis, Dadds, & Bryant, 2011).

In 2014, a study conducted by Holas and colleagues also used eye-tracking technology in an attempt to evaluate the plausibility of the hypervigilance-avoidance hypothesis in trait anxiety. Similar to Onnis and colleagues, facial stimuli were used. Threatening facial stimuli were paired with neutral facial stimuli in a free viewing task, in which pairs of stimuli were presented simultaneously to participants. In concordance with the hypervigilance portion of the hypervigilant-avoidant hypothesis, high trait anxious participants were significantly faster to attend to threatening expressions as compared to low trait anxious participants. In terms of avoidance of threatening stimuli, results were marginally significant. It was found that high trait anxious participants were faster to divert their attention away from threatening stimuli as compared to low trait anxious participants. However, this finding did not achieve a level of significance necessary to fully support the hypervigilance-avoidance hypothesis (Holas, Krejz, Cypryanska, & Nezlek, 2014). It has been noted that avoidant attentional patterns have been found in similar eye tracking studies attempting to capture this attentional pattern in individuals with clinical levels of anxiety (Dodd et al., 2014). However, throughout the literature, it is still not entirely clear if the hypervigilant-avoidance hypothesis is applicable to trait anxiety.

In terms of studies assessing attentional threat bias in trait anxiety, there are multiple inconsistencies. The first lies in the lack of consistent findings in studies that have been geared towards determining if there is a difficulty disengaging from threatening stimuli that is unique in high trait anxious individuals. The second is the lack of consistent findings in terms of the hypervigilance-avoidance hypothesis in high trait anxious individuals. This lack of consistency warrants the need for additional research, in hopes that a consistent pattern of attentional threat

bias in trait anxiety may be established. Additionally, research that aims to extend current findings to specific clinical anxiety disorders has been called for (Onnis, Dadds, & Bryant 2011).

Trauma

As defined by DSM-5, a traumatic event is an event that involves real or perceived threat. An individual may directly experience a traumatic event firsthand, such as threatened or actual physical or sexual assault, a severe natural disaster, a severe vehicle accident, or a sudden medical event that is catastrophic in nature. An individual may also experience a traumatic event secondhand. This may occur through the witnessing of serious injury to another person, witnessing physical or sexual abuse of another person, or witnessing violent acts of war or disaster. Additionally, a potentially traumatic event (PTE) may also occur through an individual learning of someone close to them (such as a family member or close friend) experiencing a traumatic event (APA, 2013).

In terms of college students, the experience of traumatic events is quite frequent. Studies assessing the incidence of potentially traumatic events (PTEs) in undergraduate college students have estimated that anywhere from 52 percent (Owens & Chard, 2006) to a staggering 96 percent (Scarpa, 2001) of college students have experienced some variation of a PTE. Similarly, a 2009 study reported that 85 percent of college students reported having experienced at least one PTE (Fraizer et al., 2009). According to Fraizer and colleagues' study of over 1,000 undergraduate college students, the most common events experienced were unexpected death of a family member or friend, an accident, a loved one surviving a life-threatening event, family violence, unwanted sexual attention, and sexual assault (Fraizer et al., 2009).

The experience of a PTE has been shown to produce many negative outcomes. For example, a 2014 study found that college students who had experienced at least one PTE

reported significantly larger decreases in functioning than students who had not experienced a PTE. Specifically, these students reported significantly more overall distress and poorer mental and physical heath functioning (Anders, Fraizer, & Shallcross, 2014). Further, trauma incidence has been connected with depression. For example, a study conducted in 2009 that utilized a sample of over 500 college students found that a history of sexual trauma was positively correlated with depressive symptomatology (Swanholm, Vosvick, & Chng, 2009). It has also been suggested that undergraduate students who have experienced a PTE report lower life satisfaction, more general distress, and lower GPAs (Anders, Fraizer, & Shallcross, 2012).

One of the most heavily studied outcomes of a PTE is the development of Posttraumatic Stress Disorder (PTSD). PTSD is a mental disorder that is characterized by the re-experiencing of a traumatic event in the form of reoccurring nightmares or flashbacks that are involuntary in nature. As a result of these debilitating symptoms, an individual with PTSD may experience states of hypervigilance, which many times results in an individual exhibiting avoidant behavior towards external reminders of the traumatic event experienced. Most importantly, these symptoms further distress an individual who has experienced a traumatic event, and significantly impair functioning (APA, 2013).

Though it has been suggested that trauma is a relatively frequent occurrence (especially in undergraduate college students), not all those who experience a PTE develop PTSD symptoms as a result. In fact, as compared to the number of individuals experiencing traumatic events, the number of PTSD diagnoses is much lower. For example, in a recent study of PTEs in a large undergraduate student sample, 63 percent of students reported experiencing an unexpected death of a loved one. However, only 6 percent of these students reported experiencing symptoms

specific to PTSD as a result. Similar patterns were shown with students who reported experiencing a traumatic accident, family violence, and sexual assault (Frazier, et al., 2009).

Due to this discrepancy, the exploration of factors that may influence an individual's probability of developing this debilitating disorder have become a focal point in the research of PTSD. In terms of attention, it has been suggested that those with persistent PTSD exhibit a preferential processing of stimuli in the environment that are salient to the specific traumatic event experienced. It is suspected that this form of attentional bias potentially plays a role in the maintenance of PTSD symptoms. In other words, due to this preferential processing, stimuli in the environment that are deemed threatening (due to their salience to the traumatic event experienced) become "triggers" that may cause an individual to experience the trademark symptoms of PTSD, such as intrusive memories and involuntary flashbacks (Ehlers & Clark, 2000).

Similar to individuals who are highly trait anxious, those who have PTSD exhibit a similar pattern of attentional biases towards stimuli that they deem threatening. Specifically, those who have developed PTSD as a result of a traumatic event exhibit a tendency to direct attentional resources towards stimuli in the environment that may be pertinent to the trauma experienced (i.e., Ashley, Honzel, Larsen, Justus, & Swick, 2013; Ehring & Ehlers, 2011). For example, an individual who has experienced a severe car accident may exhibit a tendency to shift attention towards a bright light in the environment if the light happens to resemble oncoming headlights that are a part of their memory of the car accident. This attentional pattern may cause an individual to experience an involuntary flashback. Additionally, it has been suggested that this pattern of attentional bias may perpetuate and maintain symptoms in these individuals (Ehlers & Clark, 2000).

Similar to attentional biases exhibited by individuals who are highly trait anxious, various cognitive models have been developed in an attempt to dissect the complex attentional processes that are embedded within PTSD. In 2000, Ehlers and Clark attempted to parse apart the various components of PTSD that cause individuals to experience these involuntary flashbacks and intrusions. Three of the main features that Ehlers and Clark attributed to this complex process are the appraisal of the trauma, the memory of the traumatic event, and implicit memory processes (Ehlers & Clark, 2000).

In terms of the appraisal of the trauma, Ehlers and Clark put forward the notion that those with persistent PTSD are unable to see a trauma as a time limited event. As a result, these individuals may create a sense of serious current threat (that may be either internal or external in nature). This creation of a state of serious current threat creates an overgeneralization, in which an individual begins to perceive normal activities as more dangerous than they actually are. According to Ehlers and Cark, this may generate an overall avoidance of stimuli in the environment that are seen as pertinent to the traumatic event experienced by the individual (Ehlers & Clark, 2000).

Ehlers and Clark also postulated that the memory of the traumatic event and implicit memory systems play a significant role in PTSD. Specifically, they put forward the notion that stimuli that trigger an individual with persistent PTSD do not necessarily have to have a strong semantic association with the traumatic event. In contrast, stimuli that these individuals exhibit attentional threat bias towards may be temporally associated with a trauma. In other words, stimuli that are associated with a time immediately before or after a traumatic event occurred may be equally as distressing as stimuli that are associated with the traumatic event itself (Ehlers & Clark, 2000).

In terms of implicit memory, it is suggested that strong perceptual priming plays a key role in the triggering of a flashback or intrusive memory in those with PTSD. In other words, cues or stimuli that directly trigger a flashback or intrusive memory are more likely to be noticed by these individuals. Beck and Clark believed that this selective attention to threat cues is a cognitive process that increases the frequency of these debilitating thought intrusions and trauma related emotions. Further, they postulate that rumination of the traumatic event also plays a role in this selective attention towards threatening cues (Ehlers & Clark, 2000).

Also similar to attentional threat bias in trait anxiety, the amygdala has been implicated as an underlying structure contributing to attentional threat biases towards trauma pertinent stimuli. Specifically, research has suggested that PTSD is characterized by a hypoactive prefrontal cortex and a hyperactive amygdala. For example, an fMRI study conducted in 2006 found that those with PTSD exhibited heightened amygdala responses towards threatening facial stimuli as compared to healthy controls (McNally, 2006). In an additional study, heightened amygdala response was accompanied by diminished activation of the prefrontal cortex when participants with PTSD were exposed to pictorial trauma pertinent stimuli (Yang, Wu, Hsu, & Ker, 2004).

Attentional Threat Bias in PTSD

There is a general consensus throughout the literature that individuals with PTSD exhibit attentional threat bias towards stimuli that are pertinent to traumatic events experienced in a variety of different contexts. Specifically, experimental findings have shown support for Ehlers and Clark's model of PTSD (Michael, Ehlers, & Halligan 2005), as well as heightened attentional capture and facilitated attention towards trauma salient stimuli (i.e., Felmingham, Rennie, Manor, & Bryant, 2011; Lee & Lee 2012; Olatunji, Armstrong, McHugo, & Zald, 2013).

For example, a 1995 study utilizing a color naming stroop task found that motor vehicle accident survivors with PTSD symptoms exhibited attentional bias towards stimuli in the form of vehicle accident pertinent threat words. Specifically, vehicle accident survivors with PTSD symptoms named colors paired with threatening word stimuli significantly slower than motor vehicle accident survivors who did not have PTSD symptoms. This finding suggested that attentional threat bias in PTSD is only present when the threat value of a stimulus is salient to the traumatic event experienced (Bryant & Harvey, 1995).

Similarly, a 2012 study conducted by Lee and colleagues found similar results in survivors of dating violence. This study utilized eye-tracking technology and used stimuli consisting of violent images depicting various levels of domestic violence. Similar to studies that explored attentional threat bias in trait anxiety, threatening stimuli are paired with neutral stimuli and presented simultaneously to participants. In terms of gaze patterns, it was found that participants with PTSD symptoms attended longer to violent stimuli across all time intervals of stimuli presentation. Lee and colleagues suggested that this pattern, which they called a maintenance bias, is indicative of a difficulty disengaging from trauma pertinent stimuli in those with PTSD symptoms (Lee & Lee, 2012).

Further, multiple studies of military veterans with PTSD symptomatology have shown similar results. Results of a 2013 study utilizing an emotional stroop task paradigm suggested that veterans of combat in Iraqi or Afghanistan conflicts displayed a unique attentional bias for trauma related words as compared to veterans who had also been through a potentially traumatic combat incident, but did not develop PTSD symptoms as a result. Specifically, participants who had PTSD symptoms were slower to name font colors of combat trauma words as compared to

veterans who had not developed PTSD symptoms as well as healthy civilian controls (Ashley, Honzel, Larsen, Justus, & Swick, 2013).

An additional study in 2013 also utilized military veterans with and without PTSD symptoms. In this study, Olatunji and colleagues utilized what has been termed an emotional attentional blink RSVP task. In this paradigm, neutral pictures (in this case photos depicting landscapes or architectural photos) are presented in a rapid sequence. Within this rapid sequence, there is a target photo, which is rotated 90 degrees. It is the participant's job to detect these target photos. Also within this rapid string, there is a distracter image. In the case of this study, the distracter photos were ones depicting combat-related scenes. Results indicated that veterans with PTSD symptoms were less accurate in detecting target photos that occurred after combat related distracters as compared to veterans who had not developed PTSD symptoms as a result of combat. On a broad scale, this evidence of attentional capture provided support for Ehlers and Clark's postulation that stimuli that are salient to a traumatic event experienced by an individual may be preferentially processed by individuals with persistent PTSD (Olatunji, Armstrong, McHugo, & Zald, 2013).

A 2005 study by Michael and colleagues also showed support for Ehlers and Clark's belief that stimuli that are salient to a traumatic event experienced are preferentially processed by individuals with persistent PTSD. In a word stem completion task that utilized assault words, general threat words, and neutral words, it was found that assault survivors with PTSD symptoms were primed towards assault-related words. This effect did not apply to general threat or neutral words. In concordance with Ehlers and Clark, these results supported the notion that stimuli salient to a traumatic event experienced have a processing advantage over other stimuli. Further, Michael and colleagues hypothesized that this preferential processing of stimuli may be

what causes those with PTSD to be "triggered". Specifically, it was questioned whether these and similar findings serve as a possible explanation as to why intrusive memories and flashbacks occur in PTSD (Michael, Ehlers, & Halligan 2005).

In 2011, Felmingham and colleagues used eye-tracking technology to examine gaze patterns in survivors of non-sexual assault with PTSD symptoms as compared to participants who were also survivors of assault, but did not develop PTSD symptoms. Stimuli in the form of salient assault related words and neutral words were presented to participants. It was found that participants with PTSD symptoms made significantly more initial fixations to trauma words than participants without PTSD symptoms. These results are seen as additional evidence for both heightened attentional capture and facilitated attention towards trauma salient stimuli in those with PTSD (Felmingham, Rennie, Manor, & Bryant, 2011).

Purpose

The present study aims to explore trait anxiety level and trauma as they relate to attentional threat bias. Given that similar patterns of attentional threat bias have been found in those with high trait anxiety and those with PTSD symptomatology, the present study aims to examine trait anxiety and trauma symptomatology as predictors of attentional threat bias. This study will divide trauma symptomatology into symptoms that are common following the occurrence of a potentially traumatic event and symptoms that are specific to PTSD. This division of trauma symptomatology and PTSD specific symptoms will serve as a reflection of the literature (i.e., not all who experience a potentially traumatic event will develop PTSD symptoms). Though studies of attentional threat bias towards trauma pertinent stimuli in PTSD have incorporated measures of trait anxiety, evaluating these variables as part of a continuum that serves to predict level of attentional threat bias is something that is not found in the recent

literature. Given the frequent occurrence of potentially traumatic events in undergraduate college students, results of this study may aid in the understanding of the attentional mechanisms underlying symptomatology commonly found in survivors of trauma, including those with PTSD symptoms. Additionally, results may shed light on the far-reaching attentional effects that a potentially traumatic event may have on undergraduate college students. In gaining a better understanding of such, these predictors could potentially be incorporated in prevention and intervention programming on college campuses.

Hypotheses

Initial hypotheses involve the emergence of several bivariate relationships. Given previous research, we expect trait anxiety scores to correlate positively with attentional threat bias; i.e., the fixation duration of threatening stimuli relative to neutral stimuli (hypothesis 1). We also hypothesize that trauma symptomatology (both trauma symptomatology and PTSD specific symptomatology) will correlate positively with the fixation duration of threatening stimuli relative to neutral stimuli (hypothesis 2).

Additionally, we hypothesize that trauma symptoms (that are not specific to PTSD) and trait anxiety will both contribute unique variance to a regression model. Specifically, trait anxiety and trauma symptoms will be used to predict attentional threat bias in the form of fixation duration of threatening stimuli relative to neutral stimuli (hypothesis 3). Similarly, we hypothesize that trait anxiety and PTSD symptom severity will contribute unique variance to a separate regression model. Specifically, trait anxiety and PTSD symptom severity will be used to predict attentional threat bias in the form of fixation duration of threatening stimuli relative to neutral stimuli (hypothesis 4).

Lastly, we hypothesize that trait anxiety will serve as a predictor of PTSD symptom severity after controlling for potentially traumatic events[1] (hypothesis 5). Further, we expect that this relationship will be influenced by level of attentional threat bias (hypothesis 6).

[1] Potentially traumatic events can be measured in terms of frequency or load (number of different traumatic events), but irrespective of measurement, "traumatic events" as a variable has shown poor predictive abilities. Alternatively, we planned to examine hypothesis five and six only among participants who endorse having experienced at least one traumatic event (expected prevalence of approximately 85%; Fraizer et al. 2009).

CHAPTER THREE: METHOD

Participants

Following IRB approval, undergraduate students were recruited through Western Carolina University's Department of Psychology Research Participation System (SONA). Students from the participant pool were fulfilling course requirements for a general Psychology course. In order to achieve adequate power, 107 participants were recruited. Data from ten participants were discarded due to inaccurate eye-tracking metrics, leaving a final sample of 97. The mean age for this sample was 18.36-years (SD= .92) Moreover, 69.1% (n = 67) of the sample was female and 30.9% (n = 30) was male. In terms of race and ethnicity, the sample was composed mostly of Caucasian participants (83.5%, n = 81), while 10.3% of the sample were African American (n = 10), 4.1% were Hispanic (n = 4), and 2.1% were Asian/Pacific Islander (n = 2). The participant demographics were consistent with the population from which the sample was drawn.

Measures

Trait Anxiety

The State-Trait Anxiety Inventory-Form Y (STAI) was used to measure trait anxiety in participants. This inventory includes 20 questions designed to measure state anxiety and 20 questions designed to measure trait anxiety. Scores on both the state and trait portions range from 20 to 80. Items are scored on a 4-point Likert scale, with responses ranging from "almost never" to "almost always", with higher scores indicating a higher level of trait anxiety. Items measuring trait anxiety include: "I worry too much over something that doesn't really matter" and "I feel that difficulties are piling up so that I cannot overcome them". The STAI is a widely used tool in

studies of trait and state anxiety; it has been estimated that over 3,000 studies have utilized this measure (Grös, Antony, Simms, & McCabe, 2007). The trait portion of the STAI has shown good internal consistency, with alpha values ranging from 0.72 to 0.96. Additionally, the trait portion of the STAI has shown good test-retest reliability, with an average alpha of 0.88 (Barnes, Harp, & Jung, 2002). In the current study, the Cronbach alpha for the Trait portion of the STAI was 0.95, and the alpha for the State portion was 0.94.

Incidence of PTE(s)

The Trauma History Screen (THS) was used to measure exposure to high magnitude stressor events as well as events that are associated with persistent posttraumatic distress (Carlson et al. 2005). This measure is used by the National Center for Posttraumatic Stress Disorder in order to assess common potentially traumatic events in a civilian population. This self-report measure asks about thirteen different potentially traumatic events (PTEs) ranging from experiencing a natural disaster to physical assault. The THS asks whether such an event has occurred; responders select yes or no. If an event is endorsed, participants will indicate how many times this particular event has been experienced. For example, one item asks responders to indicate whether they have experienced "a really bad car, boat, train, or airplane accident". If the response for this item is "yes", responders are asked to indicate the "number of times something like this has happened". For every event that "bothered" an individual at a high level emotionally, additional information is requested. This information includes a free response section in which the event can be described in more detail. It also includes additional questions about these events, which allow individuals to indicate how long they were bothered by this event emotionally, as well as how much it bothered them emotionally (both on a 5 point Likert scale). For the purposes of the present study, type of traumatic event experienced as well as

traumatic load, and overall frequency of traumatic events were used in demographic descriptive statistics.

The THS has been validated on several different samples, including a large sample of undergraduate female students from a Midwestern university (Carlson et al., 2011). In Carlson et al. (2011), the THS yielded good test-retest reliability for high magnitude stressor scores (average alpha value of 0.87) as well as persistent posttraumatic stress scores (average alpha value of 0.82). Moreover, about 75% of participants reported at least one high magnitude stressor event, with the most common being sudden death of a close friend or relative (Carlson et al., 2011).

Trauma Symptomatology

The Trauma Symptom Checklist-40 (TSC-40) was used to assess symptoms indicating distress resulting from traumatic events that occurred in either childhood or adulthood (Elliot & Briere, 1992). The TSC-40 asks respondents to indicate how often they have experienced each symptom listed in the last two weeks. Responses range from 0 (“never”) to 3 (“often”). Symptoms listed on the TSC-40 include “insomnia”, “uncontrollable crying”, “feeling isolated from others” and “loneliness”. The TSC-40 yields a total score that ranges from 0-120. In addition to the overall score, the TSC-40 provides scores for six separate subscales (Anxiety, Depression, Dissociation, Sexual Abuse Trauma Index, Sexual Problems, and Sleep Disturbances). Previous research utilizing a college student population has found a mean total score of 25.62 (Brandyberry & McNair-Semands, 1998). Additionally, the TSC-40 possesses good reliability, with subscale alpha values ranging from 0.66-0.77. Full-scale alpha values range from 0.89 to 0.91 (Lee & Waters, 2003). For the purposes of the present study, the total score, as

well as individual subscale scores were utilized. In this study, the Cronbach alpha was 0.92 for the total score, and subscale alphas ranged from 0.71 to 0.83.

The PTSD Checklist 5 (PCL-5) (Weathers et al., 2013) was used to assess PTSD symptoms in participants. The PCL-5 is a 20 item self-report measure that is designed to assess the 20 DSM-5 symptoms of PTSD. Respondents indicate that they experience each symptom on a scale ranging from "not at all" to "extremely" on a Likert scale ranging from 0 to 4. From PCL-5 scores, a total severity score (ranging from 0-80) can be derived. Additionally, individual severity scores that correspond to each of the four symptom specific clusters can be calculated (specifically DSM-5 clusters B, C, D, and E). These clusters correspond to the reoccurring flashbacks and nightmares (cluster B), avoidant behavior (cluster C), affect and mood alterations that are negative in nature (cluster D), and changes in reactivity and arousal (Cluster E) that are present in PTSD (APA, 2013). Moreover, responders are asked to indicate if they have experienced symptoms "within the past month". For example, one item asks responders to indicate whether or not they have experienced "repeated, disturbing, and unwanted memories of the stressful experience" within the past month. In a study utilizing college students, the PCL-5 demonstrated good internal consistency, yielding an alpha value of 0.95 (Armour et al., 2014). For the present study, the Cronbach alpha was 0.93 for the total score, and subscale alphas ranged from 0.79 to 0.89 in this sample. Though the PCL-5 can be used to make provisional diagnoses of PTSD, it was not used in this way for the present study. For the purposes of the present study, overall total severity scores as well as severity scores corresponding to individual clusters were used.

Attentional Threat Bias

A Tobii TX300 Binocular Eye-Tracker (1920x1080 pixels) was used to measure attentional threat bias. Specifically, fixation duration of threatening stimuli relative to neutral stimuli was used as a measure of attentional threat bias. To quantify threat bias, "scores" were computed based on the pairings selected for the viewing task. To compute the level of bias for threatening stimuli paired with neutral stimuli, total fixation duration for all threatening stimuli (in seconds) was divided by total fixation duration for all threatening stimuli added to total fixation duration for all neutral stimuli paired with those threatening stimuli. This score represents the amount of time a participant spent fixating on threatening stimuli in threatening-neutral pairings throughout the entire duration of the task in terms of percentage. This procedure was repeated in order to quantify attentional biases for threatening stimuli when paired with negative stimuli and negative stimuli when paired with neutral stimuli. Though not originally stated in hypotheses, in order to thoroughly examine eye-tracking metrics, total fixation duration was also examined separate from computed scores. In other words, the total number of seconds participants spent fixating on all threatening stimuli included in the task, the total number of seconds spent fixating on neutral stimuli, and the total number of seconds spent fixating on negative stimuli were examined. Similar to the computed bias scores, total number of seconds spent fixating on stimuli within specific pairings were also examined. For example, within threat-neutral pairings, total number of seconds spent fixating on threatening stimuli when paired with neutral stimuli throughout the entire task was examined separately from total number of seconds fixating on neutral stimuli when paired with threatening stimuli. Using this same method, total fixation duration throughout the whole task for threatening-negative pairings and negative-neutral pairings were examined.

Stimuli for the eye-tracking portion of the study were derived from the International Affective Picture System (IAPS; Lang, Baradley, & Cuthbert, 2008), and the NimStim facial stimuli set (Tottenham et al., 2009). The IAPS is a large set of emotionally-evocative visual stimuli designed to provide standardized materials for use in studies of emotion and attention. All stimuli included in this set have been rated in terms of valance and arousal by a normative sample.

Furthermore, the NimStim facial stimuli set is composed of 672 depictions of various facial expressions by 43 professional actors. These facial stimuli include facial expressions from a variety of ethnicities (African-American, Asian, European, and Latino-American). Facial expressions depict eight different emotions: happy, sad, angry, fearful, surprised, disgusted, neutral, and calm. In the initial development of these stimuli, untrained research participants were able to correctly label the emotions depicted, with a mean kappa score of 0.79 across all facial expressions in the stimulus set (Tottenham et al., 2009).

Similar studies exploring attentional threat biases have classified facial expressions displaying anger as threatening (Holas, Krejtz, Cypryanska, & Nezlek, 2014). These facial expressions were used in combination with neutral facial stimuli.

Procedure

Rating Task and Selection of Stimuli

To ensure that images selected for the eye-tracking portion of the study elicited "threat", a rating procedure was conducted. Images chosen to be rated by students were selected based on arousal ratings provided in the IAPS Technical Manual (Tottenham et al., 2009). A portion of images rated highly by the normative sample in arousal (specifically images that met a cutoff rating of 6 or above on the 9 point Likert scale) were selected to be included in the rating task as

potentially threatening images. Likewise, images rated low in arousal by the normative sample (specifically images rated as a 2 or below on the 9 point Likert scale) were selected for inclusion in the rating task in an effort to select images that were truly "neutral". Facial stimuli selected from the Nimstim facial stimuli set were also included in the rating task to determine if "angry" facial stimuli were to be included in the eye-tracking task as threatening images. Following IRB approval, 40 undergraduate Psychology students were recruited to complete the rating task as optional extra credit in their respective courses. The sample was composed of 22 males and 18 females, ages ranging from 18-32. Students viewed a slideshow of 89 images. Each image was labeled with a number. Participants were given a scantron sheet, and were instructed to rate each image on a scale of 1 (not threatening to me at all) to 5 (extremely threatening to me). Images were displayed individually for 5 seconds each. After each image was presented, a tone signified that participants had an additional 2 seconds to record their response on their scantron. Responses were scored, and mean threat ratings for each image rated were computed.

Mean threat ratings collected in this rating task were used to select the final set of stimuli to be included in the eye-tracking portion of the study. For the purposes of this study, images that obtained a mean rating of 3.5 or higher on the 5 point Likert scale were selected as threatening images for inclusion in the viewing task. Images that obtained a mean rating of 1.5 or below were selected as neutral images. In order to distinguish potential biases that may exist for negative images from biases for threatening images, "negative" images were also. These images were selected utilizing the valence ratings provided by the normative sample in the Technical Manual as well as the ratings provided by students. Images included in the rating task that did not meet the cutoff of 3.5 for classification as "threatening", but were rated low in valence by the

IAPS norming sample (3 or below on the 9 point Likert scale) were selected for inclusion in the viewing task as "negative non threatening" images.

The viewing task utilized in the study was constructed using Tobii Studio. Specifically, 26 images were selected from the rating task as "threatening" images. These images were split into two sets of 13 threatening images. The first set of threatening images were paired with 13 neutral images selected from the rating task. This set of threatening images was then paired with 13 negative non threatening images selected from the rating task. The second set of 13 threatening images was paired with a second set of 13 neutral images selected from the rating task, as well as a separate 13 negative non-threatening images selected from the rating task. To assess potential biases for negative images, an additional set of 13 negative images were paired with a separate 13 neutral images. No facial stimuli included in the rating task met the cutoff for classification as "threatening". However, in light of previous research, and to assess any biases that may exist for emotional facial information, eight separate pairings composed of neutral faces paired with angry faces were included in the viewing task. In total, participants viewed threatening images paired with neutral images, threatening images paired with negative images, negative images paired with neutral images, and facial stimuli pairings. In total, the viewing task was composed of 77 pairs of images.

Each pairing was constructed in Tobii Studio such that one image was on the left-most side of the screen, and one on the right-most side of the screen. It was ensured that each image was equidistant from the center of the screen, and that every image was identical in terms of dimensions. Within each image set, images were paired randomly with their counterparts. Once final pairings were determined, a randomization procedure was used to determine which side of the screen each image was placed on. Each pairing was set to display for 5,000ms, as previous

research has suggested that displaying stimuli in this time frame yielded good reliability (Waechter, Nelson, Wright, Hyatt, & Oakman, 2014). The task advanced automatically until the end of the task was reached. The presentation of the task was randomized, such that no participant viewed the task in the same order.

Lab Procedure

Upon entering the lab, participants read the informed consent document that reviewed the risks, benefits, and general study information. Based on this information, participants indicated whether or not they chose to participate in the study by signing the informed consent form. Due to the fact that there were two measures in the study that required participants to reflect on any potentially traumatic events experienced as well as symptoms they may be experiencing as a result, participants were told that the researchers are aware of the potential for negative reactions generated by certain questions. After signing the informed consent form, participants completed a brief demographic survey. Participants then completed all self-report measures. Following completion of these measures, participants completed the eye-tracking portion of the study. In order to ensure confidentiality, each participant was assigned an ID number that served to connect their self-report measures to their eye-tracking data. Following completion, participants were given a debriefing form with contact information for the investigator, the IRB, and Counseling and Psychological Services (CAPS).

Analyses

To address hypotheses 1 and 2, a correlation matrix was examined to assess bivariate associations between trait anxiety and computed attentional threat bias score, as well as the association between trauma symptomatology (both PTE and PTSD specific) and computed bias scores. Separate correlation matrices were examined to assess associations between subscales of

each measure of trauma symptomatology and computed bias scores. Further, trait anxiety and trauma symptomatology measures were examined in a separate correlation matrix using total fixation duration (in seconds) on all threatening, neutral, and negative images throughout the task, as well as all pairings as described previously. Separate correlation matrices were examined to assess bivariate associations between subscales of each measure of trauma symptomatology and total fixation durations.

Due to insufficient correlations necessary to enter trait anxiety into a multiple regression model, hypotheses 3 and 4 could not be addressed. Similarly, hypotheses 5 and 6 could not be addressed due to insufficient correlations necessary to perform the mediation/moderation analysis.

CHAPTER FOUR: RESULTS

Results of this study found that 88 percent of participants reported experiencing one or more potentially traumatic events (see table 1 for distribution of traumatic events). Prior to assessing bivariate relationships, descriptive statistics for all study measures were examined (see Table 2 for descriptive statistics for all self-report measures and pertinent subscales). Previous research suggests that anxiety levels are typically higher in female college students (Bayram & Bilgel, 2008), and that higher rates of trauma symptomatology and PTSD are found in females (Olff, Langeland, Draijer, & Gersons, 2007; Tolin & Foa, 2006). To examine potential gender differences in this sample, a series of t-tests were examined for differences in mean scores between male and female participants. Given that many studies pertaining to attentional threat bias have not addressed gender differences, eye-tracking metrics were also included in the series of t-tests. Contrary to previous research, males and females did not differ significantly with regards to trait anxiety, total trauma symptom score as measured by the TSC-40, or PTSD symptom severity score as measured by the PCL-5 in this sample. Though none of the comparisons reached significance, males and females differed in terms of the bias score computed for threatening stimuli when paired with negative stimuli at a level that approached significance $t(95) = 1.92$, $p = .058$. Similarly, males and females differed in terms of total fixation duration on all negative stimuli in the task $t(95) = -1.74$, $p = .08$, and total fixation duration on all threatening stimuli in the task at a level that approached significance $t(95) = 1.97$, $p = .053$.

Next, to assess bivariate relationships between trait anxiety, trauma symptomatology, and eye tracking metrics, a correlation matrix was examined. The trait anxiety score as measured by the STAI was significantly correlated with total trauma symptom score as measured by the

TSC-40 (r=0.64, p<0.01). The trait anxiety score was also significantly correlated with total PTSD symptom severity score as measured by the PCL-5 (r= 0.65, p<0.01).

In terms of eye-tracking metrics, correlations between study variables and computed attentional bias scores were examined first. Trait anxiety score as measured by the STAI was not found to be correlated significantly with bias scores for threatening-neutral, threatening-negative, or negative-neutral pairings. Similarly, trauma symptom severity score as measured by the TSC-40 was also not found to be correlated significantly with bias scores computed for any of the three pairings in the task. Given that trait anxiety did not correlate significantly with the computed bias score for threatening-neutral pairings, hypothesis 1 was not supported.

In addition, the symptom severity score specific to PTSD as measured by the PCL-5 was significantly correlated with the computed bias score for threatening stimuli when paired with negative stimuli (r= 0.20, p<0.05), but was not significantly correlated with scores computed for threatening-neutral or negative-neutral pairings. When individual cluster scores within the PCL-5 were examined, cluster E score was significantly correlated with bias score for threatening stimuli when paired with neutral stimuli (r= 0.23, p<0.05), and with bias score for threatening stimuli when paired with negative stimuli (r= 0.21, p<0.05). Despite this finding, neither the TSC-40 or PCL-5 total symptom scores were significantly correlated with computed bias scores for threatening stimuli in threatening-neutral pairings. Thus, hypothesis 2 was not supported.

As stated previously, in order to thoroughly assess any potential bivariate relationships between trait anxiety, trauma symptomatology, and eye-tracking metrics, total fixation duration separate from computed scores was examined in a separate correlation matrix. Similar to results found with computed bias scores, there were no significant correlations found between trait anxiety and total fixation duration for all threatening, neutral, or negative stimuli throughout the

task, or within any specific pairings. Total trauma symptom severity score as measured by the TSC-40 was significantly correlated with total number of seconds fixated on threatening stimuli throughout the task (r= 0.21, $p<0.5$). The TSC-40 total score was also significantly correlated with total number of seconds fixating on threatening stimuli within threatening-negative pairings throughout the task (r=0.22, $p<0.05$), and with total number of seconds fixating on threatening stimuli within threatening-neutral pairings (r=0.20, $p<0.05$).

When examining specific subscales within the TSC-40, the depression subscale score was found to be significantly correlated with total number of seconds fixated on threatening stimuli throughout the task (r= 0.20, $p<0.05$). The depression subscale score was also significantly correlated with the total number of seconds fixating on threatening stimuli when paired with negative stimuli (r= 0.22, $p<0.05$). The sexual problems subscale score was significantly correlated with total number of seconds fixated on all threatening stimuli throughout the task (r= 0.27, $p<0.01$), total number of seconds fixated on threatening stimuli within threatening-negative pairings (r= 0.24, $p<0.05$), and total number of seconds fixated on threatening stimuli within threatening-neutral pairings (r=0.27, $p<0.01$).

Total PTSD symptom severity score as measured by the PCL-5 was found to be significantly correlated with total number of seconds fixating on threatening stimuli throughout the task (r=0.20, $p<0.05$), and with total number of seconds fixated on threatening stimuli when paired with negative stimuli throughout the task (r= 0.23, $p<0.05$). When examining specific cluster scores within the PCL-5, Cluster D score was found to be significantly correlated with total number of seconds fixating on threatening stimuli when paired with negative stimuli throughout the task (r= 0.21, $p<0.05$). Cluster E score was found to be significantly correlated with total number of seconds fixated on threatening stimuli throughout the task (r= 0.25,

$p<0.05$). With regards to specific stimuli pairings, Cluster E score was significantly correlated with total number of seconds fixated on threatening stimuli within threatening-negative pairings ($r=0.26$, $p<0.01$), and total number of seconds fixated on threatening stimuli within threatening-neutral pairings ($r= 0.23$, $p<0.05$).

Overall, hypothesis 1 was not supported using the computed bias score for threatening stimuli within threatening-neutral pairings, or when utilizing total fixation duration on all threatening stimuli throughout the task and within threat-neutral pairings. Though hypothesis 2 was not supported using computed bias scores, significant positive correlations emerged between both measures of trauma symptomatology and total fixation duration on threatening stimuli throughout the task. It was noted that though not an original part of statistical planning, these correlations suggest a relationship between trauma symptomatology and this attentional measure of threat perception.

Table 1: Distribution of Traumatic Events

Event	Number	Percent
A really bad car, boat, train, or airplane accident	23	23.7
A really bad accident at work or home	10	10.3
A hurricane, flood, earthquake, tornado, or fire	24	24.7
Hit or kicked hard enough to injure – as a child	26	26.8
Hit or kicked hard enough to injure – as an adult	12	12.4
Forced or made to have sexual contact – as a child	9	9.3
Forced or made to have sexual contact – as an adult	11	11.3
Attack with a gun, knife, or weapon	7	7.2
During military service – seeing something horrible or being badly scared	1	1.0
Sudden death of close family or friend	47	48.5
Seeing someone die suddenly or get badly hurt or killed	33	34.0
Some other sudden event that made you feel very scared, helpless or horrified	46	47.4
Sudden move or loss of home and possessions	20	20.6
Suddenly abandoned by spouse, partner, parent, or family	28	28.9

Table 2: Gender Differences Among Study Variables

	Males		Females				95% Confidence Interval	
Variable	M	SD	M	SD	*t*(95)	*p*	Lower Limit	Upper Limit
Trait Anxiety	41.77	14.69	45.58	12.83	-1.29	.19	-9.67	2.04
TSC-40	25.30	16.78	31.61	18.27	-1.61	.11	-14.09	1.46
PCL-5	17.83	14.01	21.66	17.43	-1.05	.29	-11.00	3.35
Negative-Neutral Bias	0.57	0.08	0.55	0.08	0.90	.36	-0.02	0.05
Threat-Negative Bias	0.59	0.11	0.54	0.11	1.92	.058*	0.00	0.10
Threat-Neutral Bias	0.65	0.12	0.60	0.13	1.70	.09	0.00	.10
All negative	71.03	12.21	76.12	13.77	-1.74	.08*	-10.89	0.71
All neutral	60.23	14.37	66.21	18.66	-1.55	.12	-13.59	1.63
All threat	132.02	28.77	119.69	28.65	1.97	.053*	-0.18	24.84

*Approaching significance $p<0.08$

Legend

1. Trait Anxiety- total score as measured by the *STAI*
2. TSC-40- *Trauma Symptom Checklist-40* total trauma symptom score
3. PCL-5- *PTSD Checklist* total symptom severity score
4. Negative-Neutral Bias- Percentage of seconds fixated on negative stimuli relative to neutral stimuli
5. Threat-Negative Bias- Percentage of seconds fixated on threatening stimuli relative to negative stimuli
6. Threat-Neutral Bias- Percentage of seconds fixated on threatening stimuli relative to neutral stimuli
7. All negative- total number of seconds fixated on all negative stimuli in task
8. All neutral- All neutral-total number of seconds fixated on all neutral stimuli in task
9. All threat- All threat-total number of seconds fixated on all threatening stimuli in task

Table 3: Descriptive Statistics for all Self-Report Measures and Subscales

	M	SD	Range
Traumatic Load	3.02	2.15	0-10
Number of PTEs	7.24	9.61	0-52
Trait Anxiety	44.4	13.47	20-75
TSC-40 Total Score	29.66	17.98	0-75
TSC-40 Dissociation	5.30	4.43	0-17
TSC-40 Anxiety	6.04	4.28	0-20
TSC-40 Depression	7.16	5.19	0-23
TSC-40 SATI	3.93	3.73	0-16
TSC-40 Sleep Disturbance	7.58	4.28	0-18
TSC-40 Sexual Problems	3.04	4.23	0-17
PCL-5 Total Score	20.47	16.47	0-65
PCL-5 Cluster B	4.41	4.51	0-19
PCL-5 Cluster C	2.67	2.54	0-8
PCL-5 Cluster D	7.09	7.06	0-26
PCL-5 Cluster E	6.21	5.09	0-19

Table 4: Correlations Between Total Scores for Self-Report Measures and Bias Scores

Variable	1.	2.	3.	4.	5.	6.
1. STAI - Trait Anxiety	-					
2. TSC-40 - Trauma Symptoms	.64***	-				
3. PCL-5 – PTSD Symptoms	.65***	.83***	-			
4. Negative-Neutral Bias	.03	.11	.04	-		
5. Threat-Negative Bias	.06	.19	.20**	.37***	-	
6. Threat-Neutral Bias	.02	.18	.15	.52***	.85***	-

** Correlations significant at the 0.05 level

***Correlations significant at the 0.01 level

Legend

1. Trait Anxiety- total score as measured by the *STAI*
2. TSC-40- *Trauma Symptom Checklist-40* total trauma symptom score
3. PCL-5- *PTSD Checklist* total symptom severity score
4. Negative-Neutral Bias- Percentage of seconds fixated on negative stimuli relative to neutral stimuli
5. Threat-Negative Bias- Percentage of seconds fixated on threatening stimuli relative to negative stimuli
6. Threat-Neutral Bias- Percentage of seconds fixated on threatening stimuli relative to neutral stimuli

Table 5: Correlations Between TSC-40 Subscales and Bias Scores

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Dissociation	-								
2. Anxiety	.70***	-							
3. Depression	.71***	.70***	-						
4. SATI	.86***	.61***	.69***	-					
5. Sleep Disturbance	.48***	.52***	.70***	.55***	-				
6. Sexual Problems	.49***	.27***	.55***	.61***	.40***	-			
7. Negative-Neutral Bias	.06	-.06	.11	.09	.08	.18*	-		
8. Threat-Negative-Bias	.16	-.02	.17*	.19*	.19*	.21**	.37***	-	
9. Threat-Neutral Bias	.12	-.02	.14	.17*	.17	.23**	.51***	.85***	-

*Correlation approaching significance $p<0.08$
**Correlations significant at the 0.05 level
***Correlations significant at the 0.01 level
Legend

1. Dissociation-Total dissociation symptom score as measured by the *TSC-40*
2. Anxiety- Total anxiety symptom score as measured by the *TSC-40*
3. Depression- Total depression symptom score as measured by the *TSC-40*
4. SATI- Total sexual abuse trauma index score as measured by the *TSC-40*
5. Sleep Disturbance- Total sleep disturbance symptom score as measured by the *TSC-40*
6. Sexual Problems- Total sexual problems symptom score as measured by the *TSC-40*
7. Negative-Neutral Bias- Percentage of seconds fixated on negative stimuli relative to neutral stimuli
8. Threat-Negative Bias- Percentage of seconds fixated on threatening stimuli relative to negative stimuli
9. Threat-Neutral Bias- Percentage of seconds fixated on threatening stimuli relative to neutral stimuli

Table 6: Correlations Between PCL-5 Cluster Scores and Bias Scores

Variable	1.	2.	3.	4.	5.	6.	7.
1. Cluster B	-						
2. Cluster C	.66***	-					
3. Cluster D	.70***	.59***	-				
4. Cluster E	.49***	.43***	.68***	-			
5. Negative-Neutral Bias	-.08	-.02	.07	.13	-		
6. Threat-Negative Bias	.17*	.07	.18*	.23**	.37***	-	
7. Threat-Neutral Bias	.10	.05	.12	.21**	.51***	.85***	-

*Correlation approaching significance $p<0.08$

**Correlations significant at the 0.05 level

***Correlations significant at the 0.01 level

Legend

1. Cluster B-Total intrusion symptom score as measured by the *PCL-5*
2. Cluster C-Total avoidance symptom score as measured by the *PCL-5*
3. Cluster D-Total alteration in negative mood and cognitions symptom score as measured by the *PCL-5*
4. Cluster E- Total alteration in arousal and reactivity symptom score as measured by the *PCL-5*
5. Negative-Neutral Bias- Percentage of seconds fixated on negative stimuli relative to neutral stimuli
6. Threat-Negative Bias- Percentage of seconds fixated on threatening stimuli relative to negative stimuli
7. Threat-Neutral Bias- Percentage of seconds fixated on threatening stimuli relative to neutral stimuli

Table 7: Correlations Between Total Scores for Self-Report Measures and Total Fixation Duration

Variable	1.	2.	3.
1.TraitAnxiety	-		
2.TSC-40	.64***	-	
3.PCL-5	.65***	.83***	-
4.All negative	-.01	-.09	-.12
5. All neutral	-.00	-.14	-.09
6. All threat	.05	.21**	.20**
7. Negative in negative-neutral	.08	.14	.09
8. Negative in threat-negative	-.04	-.15	-.16
9.Neutral in negative-neutral	.01	.03	.03
10.Neutral in threat-neutral	-.00	-.16	-.12
11.Threat in threat-negative	.09	.22**	.23**
12. Threat in threat-neutral	.03	.20**	.18*

*Correlation approaching significance $p<.08$
**Correlations significant at the 0.05 level
***Correlations significant at the 0.01 level
Legend

1. Trait Anxiety- total score as measured by the *STAI*
2. TSC-40- *Trauma Symptom Checklist-40* total trauma symptom score
3. PCL-5- *PTSD Checklist* total symptom severity score
4. All negative- total number of seconds fixated on all negative stimuli in task
5. All neutral-total number of seconds fixated on all neutral stimuli in task
6. All threat-total number of seconds fixated on all threatening stimuli in task
7. All negative in negative-neutral- total number of seconds fixated on all negative stimuli paired with neutral stimuli in task
8. Negative in threat-negative- total number of seconds fixated on negative stimuli paired with threatening stimuli in task
9. Neutral in negative-neutral- total number of seconds fixated on neutral stimuli paired with negative stimuli in task
10. Neutral in threat-neutral-total number of seconds fixated on neutral stimuli paired with threatening stimuli in task

11. Threat in threat-negative- total number of seconds fixated on threatening stimuli paired with negative stimuli in task
12. Threat in threat-neutral-total number of seconds fixated on threatening stimuli paired with neutral stimuli in task

Table 8: Correlations Between TSC-40 Subscales and Total Fixation Duration

Variable	1.	2.	3.	4.	5.	6.
1.Dissocation	-					
2.Anxiety	.70***	-				
3.Depression	.71***	.70***	-			
4.SATI	.86***	.61***	.69***	-		
5.Sleep Disturbance	.48***	.52***	.70***	.55***	-	
6.Sexual Problems	.49***	.27***	.55***	.61***	.40***	-
7. All negative	-.13	-.00	-.04	-.13	-.11	-.07
8.All neutral	-.11	.03	-.10	-.14	-.15	-.18*
9. All threat	.14	-.02	.20**	.18*	.17*	.27***
10. Negative in negative-neutral	.06	-.06	.16	.10	.10	.23**
11. Negative in threat-negative	-.16	.02	-.11	-.17*	-.16	-.16
12. Neutral in negative-neutral	-.03	.07	-.03	-.05	-.05	-.10
13.Neutral in threat-neutral	-.12	.02	-.11	-.15	-.17	-.19*
14.Threat in threat-negative	.15	-.01	.22**	.18*	.18*	.24**
15. Threat in threat-neutral	.13	-.02	.17*	.18*	.16	.27***

*Correlations approaching significance $p<.08$

**Correlations significant at the 0.05 level

***Correlations significant at the 0.01 level

Legend

1. Dissociation-Total dissociation symptom score as measured by the *TSC-40*
2. Anxiety- Total anxiety symptom score as measured by the *TSC-40*
3. Depression- Total depression symptom score as measured by the *TSC-40*
4. SATI- Total sexual abuse trauma index score as measured by the *TSC-40*
5. Sleep Disturbance- Total sleep disturbance symptom score as measured by the *TSC-40*
6. Sexual Problems- Total sexual problems symptom score as measured by the *TSC-40*
7. All negative- total number of seconds fixated on all negative stimuli in task
8. All neutral-total number of seconds fixated on all neutral stimuli in task
9. All threat-total number of seconds fixated on all threatening stimuli in task

10. All negative in negative-neutral- total number of seconds fixated on all negative stimuli paired with neutral stimuli in task
11. Negative in threat-negative- total number of seconds fixated on negative stimuli paired with threatening stimuli in task
12. Neutral in negative-neutral- total number of seconds fixated on neutral stimuli paired with negative stimuli in task
13. Neutral in threat-neutral-total number of seconds fixated on neutral stimuli paired with threatening stimuli in task
14. Threat in threat-negative- total number of seconds fixated on threatening stimuli paired with negative stimuli in task
15. Threat in threat-neutral-total number of seconds fixated on threatening stimuli paired with neutral stimuli in task

Table 9: Correlations Between PCL-5 Cluster Scores and Total Fixation Duration

Variable	1.	2.	3.	4.
1.Cluster B	-			
2.Cluster C	.66***	-		
3.Cluster D	.70***	.59***	-	
4.Cluster E	.49***	.43***	.68***	-
5.All negative	-.15	-.06	-.10	-.10
6.All neutral	-.02	-.02	-.07	-.17
7.All threat	.15	.07	.18*	.25**
8. Negative in negative-neutral	-.00	.00	.11	.18*
9. Negative in threat-negative	-.15	-.06	-.15	-.18*
10. Neutral in negative-neutral	.14	.05	-.00	-.06
11. Neutral in threat-neutral	-.08	-.05	-.09	-.19*
12.Threat in threat-negative	.17	.08	.21**	.26***
13.Threat in threat-neutral	.13	.06	.15	.23**

*Correlations approaching significance $p<.08$

**Correlations significant at the 0.05 level

***Correlations significant at the 0.01 level

Legend

1. Cluster B-Total intrusion symptom score as measured by the *PCL-5*
2. Cluster C-Total avoidance symptom score as measured by the *PCL-5*
3. Cluster D-Total alteration in negative mood and cognitions symptom score as measured by the *PCL-5*
4. Cluster E- Total alteration in arousal and reactivity symptom score as measured by the *PCL-5*
5. All negative- total number of seconds fixated on all negative stimuli in task
6. All neutral-total number of seconds fixated on all neutral stimuli in task
7. All threat-total number of seconds fixated on all threatening stimuli in task
8. All negative in negative-neutral- total number of seconds fixated on all negative stimuli paired with neutral stimuli in task
9. Negative in threat-negative- total number of seconds fixated on negative stimuli paired with threatening stimuli in task

10. Neutral in negative-neutral- total number of seconds fixated on neutral stimuli paired with negative stimuli in task
11. Neutral in threat-neutral-total number of seconds fixated on neutral stimuli paired with threatening stimuli in task
12. Threat in threat-negative- total number of seconds fixated on threatening stimuli paired with negative stimuli in task
13. Threat in threat-neutral-total number of seconds fixated on threatening stimuli in task

CHAPTER FIVE: DISCUSSION

Traumatic events are common among emerging adults in college. Consistent with previous studies (e.g., Fraizer et al., 2009), the vast majority of participants (88%) in this study reported at least one traumatic event, ranging from sudden death of a close family member or friend to physical and sexual assault. The study assessed further the extent to which trait anxiety and different types of trauma symptomatology correspond with threat bias, as measured by an eye-tracking paradigm.

Results of t-tests to examine potential gender differences found no significant differences between males and females in terms of trait anxiety, general trauma symptomatology, or PTSD specific symptomatology. However, results suggested that males and females in this sample differed in terms of the appraisal of stimuli as evidenced by gender differences in various eye-tracking metrics that approached significance. Specifically, results suggested that males spent more time fixating on threatening stimuli relative to negative stimuli than females. Similarly, results suggested that males spent more time fixating on all threatening stimuli included in the task than females. In contrast, results suggested that females spent more time fixating on all negative stimuli included in the task than males. Although these differences did not reach full statistical significance, these findings suggest that males and females may manifest differing responses to threatening and negative stimuli.

Although gender comparisons using the specific metrics utilized in this study are not found in the current literature, studies utilizing differing physiological responses to threatening and emotionally valenced stimuli have found significant gender differences. For example, a study utilizing EEG response found that males manifested a larger response to threatening

stimuli than females (Sass et al., 2010). Further, previous research has suggested that males possess what is known as low-road superiority (LeDoux, 1995). Originating from research examining the processing of emotions from a neuroscience perspective, individuals with low-road superiority respond quickly and directly after accepting threatening information, as opposed to individuals with high-road superiority, in which individuals process the threatening information combined with environmental information (Zhao, Zhang, Chen, & Zhou, 2014). Given this postulation that males may process threatening information faster than females, it may be that faster threat detection serves as a precursor for an overall bias towards threat that is greater in males than in females. Future research may benefit from the further investigation of gender differences in the perception of threat.

Contrary to previous research examining the relationship between trait anxiety and attentional biases to threat, this study found no relationship between trait anxiety and fixation duration of threatening stimuli relative to neutral stimuli, or total fixation duration for all threatening stimuli in the viewing task. Further, no support for established evidence seen in previous research with regard to hypervigilance (which would be suggested through significant positive correlations between trait anxiety and all threatening stimuli in the task, as well as bias scores within threatening-neutral pairings) were observed in the data. Similarly, no evidence for avoidance of threatening stimuli (which would be suggested through significant negative correlations between trait anxiety and all threatening images in the task, as well as bias scores within threatening-neutral pairings). These findings do not provide support for the cognitive-motivational model; a popular theoretical approach in the literature. In other words, in this study, increasing levels of trait anxiety did not result in increased perception to threatening stimuli

manifested through increased fixation duration on threatening stimuli relative to neutral stimuli, or total fixation duration on all threatening stimuli throughout the viewing task.

Further adding to the lack of consistent findings with eye-tracking metrics, no significant correlations were found between trait anxiety and fixation duration with regard to negative or neutral stimuli. This overall lack of significant findings suggests that in this study, trait anxiety had no bearing on which stimuli participants fixated on throughout the duration of the viewing task. Lack of significant findings pertaining to trait anxiety are consistent with the ambiguity and lack of theoretical agreement that exists within the literature. Additionally, inconsistent measurement of bias to threat results in a lack of consensus as to what attentional threat bias consists of, and whether or not measures used are able to accurately measure attention to threatening stimuli. Though eye-tracking technology has been suggested as a direct measure of attention as compared to cueing paradigms (Fox, Russo, & Dalton, 2002), recent studies utilizing eye-tracking technology have also yielded findings that are contradictory in nature to their theoretical origins (Quigley, Nelson, Carriere, Smilek, & Purdon, 2012). Furthermore, these inconsistencies result in difficulties comparing this study to others in the literature in terms of findings.

Another potential explanation for the lack of significant findings in terms of trait anxiety may lie in attention. As suggested in previous studies, those with high levels of trait anxiety have been shown to exhibit impaired attention in multiple areas (Eyesnck, Derakshan, Santos, & Calvo, 2007). Though this study did not utilize a sample composed of only those with clinical levels of anxiety, the relationship between trait anxiety and attentional bias to threatening stimuli may have been influenced by attentional control. Given these findings, future research may

benefit in utilizing an additional measure of attentional control in combination with eye-tracking technology.

Despite lack of significant findings specific to trait anxiety, this study yielded significant findings with regard to both measures of trauma symptomatology and eye-tracking metrics. Interestingly, only one significant correlation emerged in terms of trauma symptomatology and computed bias scores. Specifically, findings suggested that as general trauma symptom score (as measured by the TSC-40) increased, the percentage of time fixated on threatening stimuli relative to negative stimuli also increased. Though a small positive correlation emerged between TSC-40 trauma symptom score and the percentage of time fixated on threatening stimuli relative to neutral stimuli, an acceptable level of significance was not reached.

Although not a part of the original statistical plan, several significant correlations emerged within total fixation duration metrics and trauma symptomatology. First, findings suggested that as general trauma symptoms as measured by the TSC-40 increased, the total number of seconds spent fixating on all threatening stimuli included in the viewing task also increased. Results also suggested that as TSC-40 total trauma symptom score increased, the total number of seconds spent fixating on threatening stimuli when paired with negative stimuli, and the total number of seconds spent fixating on threating stimuli when paired with neutral stimuli increased.

Similarly, results also suggested that as PTSD total symptom severity score increased, total number of seconds spent fixating on all threating stimuli in the viewing task, as well as threatening stimuli when paired both with negative and neutral stimuli also increased. Overall, these findings suggest that both general trauma symptoms and PTSD specific symptoms have some effect on the processing of threatening information, as measured by total fixation duration

in this study. Additionally, results suggest that though the calculation of bias scores is a popular method of quantifying attentional biases in the literature (Waechter, Nelson, Wright, Hyatt, & Oakman, 2014), in this study existing relationships between trauma symptomatology and eye-tracking metrics were best captured when utilizing total fixation duration as opposed to the calculated bias scores.

When examining individual cluster scores within the PCL-5, results suggested that as Cluster E severity scores increased, total fixation duration on all threatening stimuli in the task, as well as threatening stimuli paired with both negative and neutral stimuli increased. Diagnostically, Cluster E is associated with marked changes in arousal, reactivity, and hypervigilance following a traumatic event. Though this study did not utilize a clinical sample, this finding lends support to previous research suggesting that attentional allocation to threatening stimuli occurs with the elevated autonomic arousal often associated with PTSD (Felmingham, Rennie, Manor, & Bryant, 2011).

This study also found that as trait anxiety increased, both general trauma symptomatology as measured by the TSC-40 and PTSD specific symptom severity as measured by the PCL-5 both increased. Trait anxiety was also a significant predictor for PTSD symptom severity when controlling for potentially traumatic events among participants, accounting for 43.9% of variance in PTSD symptom severity scores as measured by the PCL-5. Interestingly, though trait anxiety was shown to be strongly correlated with both measures of trauma symptomatology, and both measures of trauma symptomatology yielded positive correlations with total fixation duration on all threatening stimuli and within both pairings containing threatening stimuli, no relationship between trait anxiety and any eye-tracking metrics were observed. Though trait anxiety and trauma symptomatology are correlated, trait anxiety is not a

pre-requisite for the development of trauma symptomatology following a potentially traumatic event. Previous research has suggested that maladaptive cognitive coping strategies, including rumination and worry, predict the development of chronic PTSD (Spinhoven, Penninx, Krempeniou, Hembert, & Elzinga, 2015). However, such studies have measured anxiety as it pertains to worry, trait-rumination, and cognitive appraisals of potentially traumatic events experienced. Though trait anxiety is often characterized by excessive worrying and rumination, it is not specific to trauma, and can exist independently. This differentiation may provide some explanation for findings in this study.

Results of this study must be interpreted in light of multiple limitations. First, this study utilized a non-clinical sample of undergraduate college students. As a result, these findings may not be generalizable to other populations, as most studies in this area have been conducted using clinical samples composed of individuals who have experienced specific types of trauma (e.g. veterans who have developed PTSD symptoms as a result of combat experience). Further, this study utilized a set of stimuli that were "generally threatening". Other studies in this area have utilized stimuli specific to one type of traumatic event (e.g. images of vehicle wreckage in samples composed of survivors of car accidents). Though distribution of type of potentially traumatic event was collected, types of events experienced had no bearing on which stimuli were selected for the task. Given that a clinical sample and stimuli pertinent to specific traumas were not used as in previous research, results may not generalize to clinical samples. Additionally, the development of this viewing task did not allow for the valid evaluation of first fixation duration during immediate presentation of each pairing, and thus could not address first fixations as a measure of initial avoidance or hypervigilance.

It was also noted that the sample utilized for this study was primarily Caucasian, and thus may not be representative in terms of the more diverse general population. Furthermore, all data collected pertaining to the presence of potentially traumatic events, trait anxiety, and trauma symptomatology were self-reported by participants. Given that a majority of data used was collected via self-report, participants may not have been completely forthcoming in terms of types of traumatic events experienced, as well as trait anxiety levels, and trauma symptoms experienced. The study relied also on the ability of participants to draw from memory to recall the types of events they experienced, and the extent to which any particular events in the past were influencing current psychopathology can not be known. Despite these observed limitations, findings of this study warrant the further investigation of the attentional mechanisms involved in threat perception within the framework of both trait anxiety and trauma symptomatology.

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