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Facial Expression Discrimination in Adults Experiencing Posttraumatic Stress Symptoms

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FACIAL EXPRESSION DISCRIMINATION IN ADULTS EXPERIENCING POSTTRAUMATIC STRESS SYMPTOMS

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FACIAL EXPRESSION DISCRIMINATION IN ADULTS EXPERIENCING POSTTRAUMATIC STRESS SYMPTOMS

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I dedicate this thesis to my wife and son, Tiffany and Maddex Lee. Without your unconditional love and support none of this would have been possible. You both give me great strength!

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The present study examined the impact of posttraumatic stress symptoms (PTSS) on adults' ability to discriminate between various facial expressions of emotions. Additionally, the study examined whether individuals reporting PTSS exhibited an attentional bias toward threat-related facial expressions of emotions. The research design was a 2 (expression intensity) x 3 (emotional pairing) x 2 (PTSS group) mixed-model factorial design. Participants for the study were 89 undergraduates recruited from psychology courses at Western Kentucky University. Participants completed the Traumatic Stress Schedule to assess for prior exposure to traumatic events. A median split was used to divide the sample into two groups (i.e., low and high PTSS). Additionally, participants also completed a demographics questionnaire, the Impact of Events Scale-Revised, the Center for Epidemiological Studies Depression Scale, and the Depression Anxiety Stress Scales to assess for possible covariates. Then, participants completed the discrimination of facial expressions task and the dot probe position task. Results indicate that individuals experiencing high levels of PTSS have difficulty discriminating between threatening and non-threatening facial expressions of emotions; additionally, these individuals' difficulty is exacerbated by comorbid levels of anxiety symptoms. Furthermore, results suggests these individuals focus attention on threatening facial expressions while avoiding expressions that may activate memories associated with the prior trauma. These findings have significant clinical implications, as clinicians could

focus treatment on correcting these difficulties which should help promote more beneficial social interactions for these individuals experiencing high levels of PTSS. Additionally, these behavioral measures could be used to assess the effectiveness of treatment. Effective treatment should help alleviate these difficulties, which could be measured by improved performance on the discrimination of facial expressions task and the dot probe position task from baseline to post-treatment.

Introduction

The ability to discriminate facial expressions of emotion is an integral component of social interactions (Philippot & Fledman, 1990; Schmidt & Zachariae, 2009; Thomas, Bellis, Graham, & LaBar, 2007; Vicari, Reily, Pasqualetti, Vizzotto, & Caltagirone, 2000). Facial expressions provide valuable information regarding one's internal state. Individuals capable of accurately discriminating between various facial expressions should excel in social interactions compared to individuals less capable of discriminating, as this ability aids in their efforts to adapt in an ever-changing social environment. Difficulties in facial expression discrimination could create barriers for healthy social development and interaction. These difficulties could be exacerbated when individuals also suffer from various types of psychopathology.

Adults exhibiting abnormalities in emotion discrimination have been found to experience various mental health issues (Phillips, Drevets, Rauch, & Lane, 2003) such as Major Depressive Disorder (Gur et al., 1992; Mikhailova, Vladimirova, Iznak, Tsusulkovskaya, & Sushko, 1996), Bipolar Disorder (Rubinow & Post, 1992), alcohol dependence (Frigerio, Burt, Montagne, Murray, & Perrett, 2002), and Schizophrenia (Kington, Jones, Watt, Hopkin, & Williams, 2000; Mandal, Pandey, & Prasad, 1998). More recently, research has focused more on children and adolescents, finding deficits in facial expression discrimination ability in those individuals suffering from posttraumatic stress symptoms (PTSS; Blair, 2003; Masten et al., 2008). While there is an abundance of literature focused on facial expression discrimination ability in childhood and adolescence (for a review see McClure, 2000) and some research examining facial expression discrimination ability in those children and adolescents who have experienced

a traumatic event (Blair, 2003; Masten et al., 2008), research examining facial expression discrimination in adults experiencing PTSS is almost nonexistent.

In a recent study, Masten and colleagues (2008) examined the ability to recognize facial emotions among maltreated children with high rates of posttraumatic stress disorder (PTSD). Prior research has demonstrated that maltreated children show enhanced sensitivity for recognizing fearful facial expressions, and display a biased tendency to classify emotions as negative when categorizing facial expressions of emotions (Pollak & Kistler, 2002). Although prior research has examined maltreated children's ability to recognize facial expressions of emotions, research has failed to examine how symptoms of PTSD (i.e., PTSS) might relate to maltreated children's processing of emotions.

Masten and colleagues (2008) attempted to resolve this oversight with their study examining participants for PTSD, anxiety, and depression. In the maltreated group, 76% of participants met diagnostic criteria for PTSD. Additionally, 77% of these children with PTSD also met criteria for at least one other comorbid disorder (depression or anxiety). Both the maltreated group and control group completed the facial emotion identification task. Facial stimuli were chosen from an established set of photographs of faces exhibiting specific emotional expressions (Ekman & Friesen, 1976). Standardized happy, neutral, and fearful faces from eight different models (four males, four females) were used. Faces varied in intensity by intervals of 25%. Participants were asked to identify the faces as happy, neutral, or fearful by pressing the 1, 2, or 3 button as quickly as possible. Reaction time and emotional labeling were measured during the task. The

results indicated that maltreated children displayed faster reaction times than controls when labeling emotional facial expressions, particularly with regards to fearful faces.

Results from this study have many implications for future research. First, the high rates of comorbidity between PTSD, Major Depressive Disorder, and Generalized Anxiety Disorder suggest a need to better understand the characteristics of each disorder. Additionally, these high rates of comorbidity suggest that these three disorders may play a role in perpetuating and maintaining the debilitating consequences associated with each. These findings underscore the importance of examining not only PTSS, but also levels of depression and anxiety, in efforts to better understand the relationship between these disorders. Moreover, these results offer support for the hypothesis that individuals experiencing PTSS display an attentional bias for threat related cues; maltreated participants responded faster when identifying fearful faces compared to controls. This suggests that individuals experiencing post-traumatic distress may focus more attention on stimuli that they perceive as threatening. The goals of the current study were specifically designed to address these needs.

Posttraumatic Stress Disorder Diagnosis and Subthreshold Symptoms

Individuals who have experienced a trauma are at risk for developing numerous psychosocial difficulties, including PTSD and PTSS. PTSD can have a dramatic impact on patients' well-being and social functioning and poses a major public health significance due to high prevalence rates, chronicity, and disability (Cuthbert, 2002; Yehuda, 2002). According to the current *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association, 2000) diagnostic criteria, individuals develop PTSD after experiencing or

witnessing a traumatic event that involved actual or threatened death or injury, and they respond to this traumatic event with intense fear, helplessness, or horror (Criterion A). Furthermore, victims must experience symptoms which fall into three categories: re-experiencing, avoidance, and hyperarousal. Re-experiencing symptoms (Criterion B) include recurrent and intrusive thoughts about the traumatic event; these thoughts are difficult to control, can occur spontaneously, or triggered by some stimulus associated with the traumatic event (American Psychiatric Association, 2000). Avoidance symptoms (Criterion C) include avoidance of thoughts, feelings, places, or people associated with the trauma. Hyperarousal symptoms (Criterion D) include difficulty falling or staying asleep, irritability or outbursts of anger, difficulty concentrating, hypervigilance, and exaggerated startle response (American Psychiatric Association, 2000). In order to meet full diagnostic criteria, individuals must experience at least one re-experiencing symptom, three avoidance symptoms, and two hyperarousal symptoms. These symptoms must be present for at least one month (Criterion E) and cause clinically significant distress in one's functioning (Criterion F).

Although the diagnostic criteria state that a specific number of symptoms must be present to receive the diagnosis of PTSD, prior research has demonstrated individuals experiencing subthreshold PTSD often endorse similar levels of impairment as those individuals meeting full diagnostic criteria for PTSD (Carlier & Gersons, 1995; Marshall et al., 2001; Stein, Walker, Hazen, & Forde, 1997) and may experience increased functional impairment and other mental health and behavioral problems (Daviss et al., 2000; DeVries et al., 1999). Moreover, functional impairment, number of comorbid disorders, rates of comorbid major depressive disorder, and current suicidal ideation

increase linearly and significantly with each increase in number of PTSD symptoms, supporting the importance of understanding predictors of PTSS even in populations with relatively low rates of full PTSD. Because the current study aimed to examine a specific population (i.e., college students), it seemed unlikely to find a large enough sample of individuals diagnosed with PTSD. However, collecting a sample of individuals experiencing some symptoms of PTSD (i.e., PTSS) seemed possible and beneficial for research purposes, given prior research findings implicating impairment among individuals experiencing PTSS similar to impairments experienced by individuals diagnosed with PTSD.

Posttraumatic Stress Disorder Prevalence

Research has found that approximately 45%-84% of college students have experienced at least one traumatic event in their lifetime (e.g., Bernat, Ronfeldt, Calhoun, & Arias, 1998; Vrana & Lauterback, 1994). Vrana and Lauterbach (1994) assessed prevalence rates, trauma symptomatology, and gender differences in 440 undergraduate students and found that 84% of their sample reported experiencing at least one traumatic event, with one-third of their sample reporting experiencing four or more traumatic events. Furthermore, male participants reported a greater mean number of traumatic events compared to female participants and were significantly more likely than female participants to be involved in an accident or life-threatening situation. Female participants were more likely to have been raped or involved in an abusive adult relationship compared to male participants. Moreover, female participants exhibited a greater increase in PTSD symptoms compared to male participants who experienced a similar traumatic experience. Additionally, traumatized participants reported greater

symptoms of depression, anxiety, and PTSD symptomatology compared to nontraumatized participants.

More recent research offers support to Vrana and Lauterbach's (1994) findings. Kessler, Sonnega, Bromet, Hughes, and Nelson (1995) found that 60% of men and 50% of women have experienced at least one traumatic event during their lifetimes. Although these prevalence rates are slightly lower than the rates found by Vrana and Lauterbach, these findings underscore the need to better understand trauma and associated psychopathology. A slight difference was found between men and women in rate of exposure to traumatic events and type of traumatic experiences, with men more likely to experience physical attack, being in an accident, or witnessing a trauma; women were more likely to report rape, molestation, or physical abuse. Moreover, women appear to be more susceptible than similarly traumatized men to the debilitating consequences of PTSS regardless of the type of trauma experienced (Brewin, Andrews, & Valentine, 2000); these consequences include anhedonia, restricted range of affect, intrusive thoughts, and hypervigilance (American Psychiatric Association, 2000). The collective results of these findings demonstrated the likelihood of collecting a sample of college students experiencing PTSS and the impact of these symptoms on individuals' emotion discrimination ability and attention to emotion.

Gender Differences in Facial Expression Recognition

Gender differences not only appear in relation to PTSS susceptibility, but also in relation to facial expression recognition. Although research examining this discrepancy has provided mixed results, a common explanation involves women's enhanced capacity for empathy. Early theorists relied upon cultural stereotypes and hypothesized that

females are socialized to acquire expressive traits, such as empathy (Hoffman, 1977). Eisenberg and Lennon (1983) reported that studies utilizing self-report measures found gender differences related to capacity for empathy; other studies that used alternative measures of empathy, such as facial expression or physiological arousal, found no such differences. Additionally, early experimental findings alluded to women's enhanced capacity for empathy early in development. Simner (1971) found that newborn female infants were more likely than newborn male infants to cry in response to the taped sound of another infant's cry. This finding suggests that women's enhanced empathetic capacity may be biologically engrained and present at birth. More recent research has shown that women are better than men at decoding non-verbal cues (Farris, Treat, Viken, & McFall, 2008). Furthermore, it has been reported that women are better than men in recognizing affective facial expressions (Montagne, Kessels, Frigerio, de Haan, & Perrett, 2005), women display a negative evaluation bias for facial expressions while men display a positive evaluation bias (Natale, Gur, Gur, 1983), and women are more accurate than men in regards to recognition of facial expressions of emotions (Thayer & Johnson, 2000).

A recent meta-analytic review (McClure, 2000) offers support for the hypothesis of a female advantage in facial expression recognition ability. McClure (2000) reviewed 104 studies that examined infants', children's, and adolescents' abilities to recognize facial expressions of emotion. Results indicated a statistically significant female advantage for facial expression recognition from infancy through adolescence. These results support previous findings that indicate a female advantage in nonverbal processing skills across a wide range of ages (Hall, 1978). Since females display an

advantage in facial expression recognition ability from infancy through adolescence, it is plausible that adult females would display a similar advantage.

Hypothesized Theory on PTSD Development

Although many theories of PTSD exist, most underscore the importance of intrusive thoughts. Horowitz (1979) proposed that intrusive thoughts are expected, following a traumatic event. Because these intrusive thoughts create distress, individuals begin avoiding these thoughts in an attempt to reduce distress. Avoidance may be positively reinforced because of the temporary decrease in distress (Lawrence, Fauerbach, & Munster, 1996). Although avoidance temporarily reduces distress, it does not eliminate the intrusive distressing thoughts and may actually maintain the psychological distress. Intrusive thoughts may reemerge and the individual may oscillate between intrusive and avoidant states (Horowitz, 1979).

Other researchers hypothesize that avoidance symptoms are maladaptive coping mechanisms that may be a consequence of intrusive thoughts and are designed to help individuals lower their anxiety levels (Creamer, Burgess, & Pattison, 1992). Often, individuals with PTSD make deliberate efforts to avoid thoughts, conversations, or situations associated with the traumatic event in order to decrease their own levels of distress. Avoidance does not have to be deliberate; some individuals experience amnesia and cannot recall certain aspects of the traumatic event. Avoidance may also be displayed by emotional numbing symptoms, such as blunt or flat affect (American Psychiatric Association, 2000).

Alternative explanations implicate hyperarousal symptoms in the development and maintenance of PTSD, as these symptoms may be directly associated with re-

experiencing symptoms (Nixon & Bryant, 2005). In efforts to avoid re-experiencing symptoms, individuals may enter a state of hyperarousal (e.g., hypervigilance) and focus their attention on recognizing and identifying environmental threat cues. Corroborating evidence suggests that individuals with PTSD have an attentional bias to threat-related stimuli (McNally, Clancy, Schacter, & Pitman, 2000; McNally, Kaspi, Reimann, & Zeitlin, 1990; Williams, Mathews, & MacLeod, 1996). An attentional bias to threat-related stimuli is most commonly identified utilizing the Stroop paradigm (MacLeod, 2005). This modified Stroop test requires participants to name the color of emotionally laden words. For example, participants may be exposed to the word "explosion" written in blue font. The participants' task is to name the color of the font as quickly as possible. It has been hypothesized that longer response times indicate that attentional resources are preferentially devoted to the meaning of the words and interfere with the primary task of naming the color (Johnson & Hasher, 1987). Studies have reported slowed color naming for threat related words in individuals experiencing PTSD (Bryant & Harvey, 1995; Cassiday, McNally, & Zeitlin, 1992; Foa, Feske, Murdock, Kozak, & McCarthy, 1991; Harvey, Bryant, & Rapee, 1996; Paunovic, Lundh, & Ost, 2002), generalized anxiety disorder (Mathews & MacLeod, 1985), panic disorder (Ehlers, Margraf, Davies, & Roth, 1988), and social phobia (Watts, McKenna, Sharrock, & Trezise, 1986).

Other researchers have investigated attentional biases in other clinical populations using alternative methodology. Mogg and Bradley (1999) assessed attentional biases in anxiety using a probe detection task. Participants were exposed to two images of a single individual for a duration of 500 ms. The images only differed by facial expression (i.e., threatening, happy, or neutral). When the images were removed, a dot probe was placed

in the location of one of the images. Participants were instructed to identify the location of the dot probe as quickly as possible. Results show that individuals reporting more anxiety symptoms responded faster when the dot probe replaced the location of threatening images. Conversely, individuals reporting few symptoms of anxiety responded faster when the dot probe replaced happy images. These results further demonstrate an attentional bias for threatening stimuli in those individuals endorsing anxiety symptoms. Although this study involves a different clinical population, the methodology could be applied when examining attentional biases in PTSD. Using pictures of human expressions, rather than written text, more closely resembles the social environment of everyday life. Adapting this method to examine another clinical population will increase the knowledge concerning attentional biases in individuals exposed to a trauma and create an opportunity to gain a deeper understanding of how these attentional biases may have consequences on everyday social interactions.

Attentional biases may perpetuate traumatized individuals' distress by aiding in developing and maintaining individuals' fear networks. During hypervigilant states, individuals may exhibit an attentional bias to threat cues, resulting in a lack of attention to non-threatening cues. For example, if an individual has a biased tendency to notice threatening faces, then this individual may incorrectly assume that a large crowd of people are hostile based on the individual's biased perception. This incorrect assumption could lead to social isolation, as the individual may not feel comfortable interacting with others characterized by hostility. Previous research has shown that social isolation can create negative consequences for individuals and leads to self-defeating behaviors (Twenge, Catanese, & Baumeister, 2002). Conversely, if this same individual can be

made aware of this attentional bias and helped to overcome it, then perhaps the social isolation, negative consequences, and self-defeating behaviors can be avoided and replaced with more beneficial social interactions.

Although research suggests that PTSD and other forms of psychopathology are associated with an attentional bias to threat-related words, these studies have yet to examine if this attentional bias is also prevalent when examining facial displays of emotions and how this potential negative bias affects social interactions. Human interaction can aid in overcoming the debilitating consequences associated with various types of psychopathology, but, if these debilitating consequences are also interfering with one's ability to accurately discriminate between facial expressions of emotions, then social interactions could become detrimental to one's recovery. For example, if an individual suffering from PTSD has an attentional bias toward threat-related facial expressions of emotions, then this individual may focus attention on these negative expressions rather than noticing other expressions that are equally as prevalent. This biased attention may perpetuate or exacerbate the individual's hyperarousal symptoms (e.g., hypervigilence) and prevent the individual from interacting with other individuals that display expressions that are not threat related. Exclusively noticing and interacting with individuals that display threatening facial expressions could result in an exhausting existence that is not conducive to ones' mental and physical health. Since social interaction is a daily occurrence and helpful in overcoming debilitating symptoms (Twenge et al., 2002), examining this attentional bias as it relates to the ability to discriminate facial displays of emotions could provide valuable knowledge related to diagnosis, treatment, and recovery.

Clinical Implications

Social interactions occur daily and provide individuals with an opportunity to reap many benefits. Social interaction has been described as an intrinsic drive that is vital for survival and well-being (Baumeister & Leary, 1995). Social interaction provides social support, access to necessary resources, protection from external dangers, and access to potential mates (Buss, 1990, 1991). Furthermore, Baumeister and Leary (1995) argue that social interaction is so important to our survival that it qualifies as one of our basic human needs, along with sustenance and shelter. Conversely, social exclusion has been associated with many negative consequences including self-defeating behaviors (Twenge et al., 2002). For individuals suffering from PTSS, their perceptions of others may be negatively impacted by their own levels of distress.

The proposed study aims to further current knowledge concerning individuals suffering from PTSS and their ability to perceive external stimuli. More specifically, the current study will examine the impact of PTSS in traumatized adults on their ability to decipher various facial expressions of emotions. Findings from this study can help aid in the development of effective interventions for adults who have experienced a traumatic event. For example, if individuals experiencing PTSS exhibit an attentional bias toward threat related cues, then treatment could focus on decreasing this attentional bias. Specific interventions could be designed to help clients balance their attention between threat related and non-threat related cues.

Furthermore, this attentional bias could serve as a PTSD assessment. For instance, soldiers returning from deployment may be reluctant to seek treatment for PTSD (Hoge et al., 2004). Often, a negative stigma is attached to those that seek

treatment for mental health issues, and this negative stigmatization is particularly prevalent in the military. Soldiers may be reluctant to seek mental health treatment because they are particularly concerned with how peers and individuals in leadership positions will perceive them. In fact, Hoge and colleagues (2004) found that of the soldiers whose responses met the screening criteria for a mental disorder, only 23% to 40% reported that they had received aid from any type of mental health professional. Moreover, participants whose responses were positive for a mental disorder were twice as likely to report concern about possible stigmatization and other barriers to seeking mental health care compared to participants whose responses were negative for a mental disorder. This finding suggests those that are most in need of treatment may be the most reluctant to seek treatment. Furthermore, this finding alludes to the need for an assessment that avoids the pitfalls associated with highly face valid self-report measures, yet still can objectively discriminate between individuals experiencing PTSS and those individuals not experiencing PTSS. Additionally, these findings are supported by civilian studies that have found similar results (Kessler et al., 2003).

As research has suggested, individuals experiencing mental disorders may be reluctant to seek treatment and associate a negative stigma concerning mental health issues. It seems plausible that soldiers may underreport symptoms in an effort to avoid this stigma. This becomes especially important when self-report measures are used that are highly face valid. When utilizing highly face valid self-report measures, soldiers may be able to quickly deduce the assessment's purpose and, as a consequence, may falsify their responses. If individuals suffering from PTSS do show an attentional bias to threat related cues compared to healthy controls, then this computerized assessment could be

administered to many individuals in a matter of minutes and could quickly identify those in most need of treatment. An advantage of this type of assessment would have over traditional paper and pencil self-report measures is that this assessment would have low face validity, which would make it difficult for individuals to deduce the assessment's purpose. Furthermore, the computerized administration would allow for many more individuals to be screened in a much quicker fashion as compared to traditional paper-and-pencil assessments.

Additionally, this attentional bias or difficulty discriminating between various facial expressions of emotions could be used to measure therapy's effectiveness. If individuals experiencing PTSS exhibit this attentional bias or discrimination difficulty, then one could measure their performance on these computerized tasks before therapy begins in order to establish baseline levels. Then, after implementation of effective therapeutic interventions, these individuals could be administered the same computerized task again to see if their performance has improved. If specific interventions were designed to help overcome these difficulties, one would expect performance to improve from baseline to post-treatment. In this regard, this attentional bias and discrimination difficulty could help in the development and implementation of effective treatment.

Current Study

The goals of the current study were threefold. First, this study sought to provide valuable knowledge regarding the impact of PTSS on adults' ability to discriminate facial expressions of emotions. Because other researchers have found evidence suggesting deficits in discrimination ability relating to facial expressions of emotions in other clinical populations (i.e., Major Depressive Disorder, Bipolar Disorder, and

Schizophrenia), it seems plausible that similar results would be likely to emerge when examining the ability of individuals experiencing PTSS. It was hypothesized that individuals who report PTSS would require less intensity of threatening expressions (i.e., anger and fear) for correct identification compared to controls (i.e., individuals who do not report PTSS).

Moreover, this study sought to provide evidence that increased reports of psychopathology (i.e., PTSS, depression, and anxiety) were correlated with greater deficits in the ability to discriminate facial expressions of emotions. Additionally, this study aimed to examine whether individuals reporting PTSS would exhibit an attentional bias toward threat-related facial expressions of emotions (i.e., anger and fear). Because other researchers have found evidence suggesting an attentional bias for threat related cues in individuals experiencing Generalized Anxiety Disorder (Mogg & Bradley, 1999), it seemed possible that individuals experiencing PTSS would also exhibit similar attentional biases. It was hypothesized that individuals who report PTSS would respond significantly quicker when identifying threat cues versus non-threat cues compared to controls, thereby suggesting an attentional bias.

Finally, given prior research suggesting gender differences in capacity for empathy and rates of PTSD, additional exploratory analyses were proposed to examine potential gender differences in facial expression discrimination. It was anticipated that women would require less intense expressions for correct identification compared to men. Due to the lack of research and possible low statistical power due to unequal between group sample sizes, these analyses were considered exploratory.

Method

Participants

Eighty nine college students were recruited via an on-line database at Western Kentucky University. Of these participants, 72 (80.9%) were female and 17 (19.1%) were male. The participants ranged in age from 18 to 29, with a mean age of 19.24 (*SD* = 1.90 years). The ethnicity of the sample was 72 (80.9%) Caucasian, 11 (12.4%) African American, 2 (2.2%) Asian, 1 (1.1%) Hispanic, 1 (1.1%) Multi-racial, 1 (1.1%) Pacific Islander, and 1 (1.1%) participant self-classified as other. As compensation for their time, participants had the option of receiving either $10 or extra credit points for undergraduate Psychology courses after participation was completed.

Materials

Demographics. Participants completed a demographics questionnaire that assessed for age, gender, grade point average (GPA), vision impairments not corrected, hearing impairments not corrected, level of impact that participants' psychopathology affects physical health, any medications the participants are currently taking, and participation in prior treatment (See Appendix A).

Snellen Visual Acuity Test. Participants' visual acuity was assessed using the Snellen Visual Acuity Test (See Appendix B). Originally developed by Dutch ophthalmologist Herman Snellen in 1862, this test is the most widely used instrument to estimate visual acuity. The Snellen chart is printed with 11 lines of block letters. The first line consists of one very large letter. Subsequent rows have increasing numbers of letters that decrease in size. A person taking the test covers one eye, and reads aloud the

letters of each row, beginning at the top. The smallest row that can be read accurately indicates the visual acuity in that eye.

Traumatic Stress Schedule. Participants' exposure to traumatic events was assessed using the Traumatic Stress Schedule (TSS; Norris, 1990; See Appendix C). Norris and Perilla (1996) reported evidence suggesting a high test-retest correlation of .82. More recent research supports these findings, as Norris and Hamblen (2004) reported a moderate coefficient alpha (.76) and suggested the TSS may be useful as a quick screen for exposure to traumatic events. The TSS is a self-report measure that assesses for exposure to 10 traumatic event categories in the general population (e.g., "Did anyone ever take something from you by force or threat of force, such as in a robbery, mugging, or hold up?").

Impact of Event Scale-Revised. PTSD symptom severity was assessed using the Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1997; See Appendix D). Weiss and Marmar (1997) reported evidence suggesting a high internal consistency, with coefficient alphas ranging from .79 to .92 for the various symptom clusters. More recent research supports these findings, as Creamer, Bell, & Failla (2003) reported a high coefficient alpha (.96) for the IES-R and a high correlation (r = .84) between the IES-R and the PTSD Checklist—another widely used assessment that measures posttraumatic stress symptoms. The IES-R is a 22-item self-report measure that reflects the current DSM-IV-TR diagnostic criteria for PTSD. The IES-R is composed of seven items measuring re-experiencing symptoms (e.g., "I found myself acting or feeling like I was back at that time"), eight items measuring avoidance symptoms (e.g., "I avoided letting myself get upset when I thought about it or was reminded of it"), and seven items

measuring hyperarousal symptoms (e.g., "I was jumpy and easily startled"). The items provide a total score and a subscale score for each symptom cluster (i.e., re-experiencing, avoidance, and hyperarousal symptoms); total scores range from 0 to 88. Participants were asked to rate the amount of difficulties they have experienced on a scale of 0 (*not at all*), 1 (*a little bit*), 2 (*moderately*), 3 (*quite a bit*), and 4 (*extremely*). Cronbach's alpha for the current study was .94.

Center for Epidemiological Studies Depression Scale. Depression symptoms were assessed using the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977; See Appendix E). The CES-D is a 20-item self-report measure that has been widely used (Faulstich, Carey, Ruggiero, Enyart, & Gresham, 1986; Golding & Aneshensel, 1989; Hertzog, Van Alstine, Usala, Hultsch, & Dixon, 1990). Evidence suggests the CES-D is a psychometrically sound measure, as Radloff (1977) reported a high internal consistency with a coefficient alpha of .85. Furthermore, Thrane et al. (2004) and Covic et al. (2009) reported evidence suggesting strong convergent validity of the CES-D in the measure's positive correlation with other measures of depression, such as the Youth Self Report (Achenbach, 1991) and the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). Additionally, Radloff (1977) offered evidence for the measure's validity by showing a decrease in participants' CES-D scores after participating in treatment for depression. Participants in the current study were asked to rate how often they felt or behaved during the past week. Examples of items include: "I was bothered by things that usually don't bother me," "I felt that everything I did was an effort," and "I felt lonely." Participants responded on a scale of 0 (*rarely or none of the time*), 1 (*some or a little of the time*), 2 (*occasionally or a moderate amount of the time*),

and 3 (*most or all of the time*). Total scores range from 0 to 60. Cronbach's alpha for the current study was .70.

Depression Anxiety Stress Scales. Anxiety symptoms were assessed using the Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995a; Lovibond & Lovibond, 1995b; See Appendix F). The DASS is a 42-item measure that aims to capture three distinct dimensions of negative emotional states (i.e., depression, anxiety, and stress/tension). Evidence suggests the DASS has excellent internal consistency and a replicable three-factor structure (Antony, Beiling, Cox, Enns, & Swinson, 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997; Page, Hooke, & Morrison, 2007). Additionally, the DASS has strong construct validity, as demonstrated by the ability of the Anxiety and Depression Scales to discriminate between anxious and depressed individuals (Antony et al., 1998; Brown et al., 1997). Participants in the current study were asked to indicate how much the statements apply to them using a 0 to 3 scale, where 0 = *did not apply to me at all*, 1 = *applied to me to some degree or some of the time*, 2 = *applied to me to a considerable degree or a good part of the time*, and 3 = *applied to me very much or most of the time*; total scores range from 0 to 126. Examples of items include: "I found it difficult to relax," "I felt I was close to panic," and "I had a feeling of shakiness." Cronbach's alpha for the current study was .96.

Discrimination of facial expressions task. Participants were presented with photographs of individuals depicting one of three emotions (anger, happiness, and fear) at two different intensities (i.e., 40%, and 80%) on a computer screen, and were asked to indicate which one emotion they see in each photo. The stimuli consist of photographs of faces taken from the Montreal Set of Facial Displays of Emotion (MSFDE; Beaupré &

Hess, 2005), and these photographs are ethnically diverse as well as evenly distributed across gender. Overall, participants completed 192 trials (3 emotions × 2 intensities × 8 targets × 4 repetitions), randomly divided into three blocks of 64 trials. Each trial started with a screen depicting the possible response options (i.e., 1 = happy, 2 = angry, 3 = afraid) in the bottom one-third of the screen (500 ms). On the next screen, a target photograph appeared in the upper two-thirds of the screen just above the response options. Participants had up to 1400 ms to respond before the trial timed out. Once a response was registered by the participant, the trial ended and the next trial sequence began. The participant's response and reaction time were logged by the computer program (E-Prime; PSTnet.com). Overall, each trial took no more than 1900 ms, and the duration of the task itself was 8-10 minutes.

For the current study, discrimination sensitivity was measured using d′, a metric that captures the extent to which individuals' distribution of accurate responses (or hits) deviates from their distribution of false alarms (MacMillan & Creelman, 2005). Hit rates and false alarm rates were calculated for each emotional pairing (i.e., anger-fear, anger-happy, and fear-happy) at each intensity. These hit rates and false alarm rates were then compared to generate d′ values for each emotional pairing and each expressive intensity.

Dot probe position task. Participants were presented with pairs of photographs on a computer display. If a photograph captured the participants' attention, then they shifted their attention toward that photo. This shift in attention was operationalized by measuring how fast participants responded to dot probes that appeared in the place of one of the photographs for each pair after the photographs disappeared from the display. On each trial, a fixation cross was presented in the center of the display for 500 ms.

Afterwards, two photographs were presented simultaneously for 500 ms – one appearing on the left half of the screen and one appearing on the right half of the screen. Each photograph depicted the same target individual (adapted from the same set of stimuli described in the discrimination of facial expressions task; Beaupré & Hess, 2005), but each was expressing a different emotion (i.e., anger, fear, or happiness at 60% intensity, or no emotion). Participants were presented with pairs that included faces expressing anger, happiness, fear, or no emotion (i.e., neutral). After the 500 ms interval, the photographs disappeared, and a dot probe emerged in the location of one of the two photos. The participants had up to 1200 ms to press one of two buttons to indicate which side of the screen the probe was on (as in Mogg & Bradley, 1999). Once a response was registered by the participant, the trial ended and the next trial sequence began. The participant's responses and reaction time were logged by the computer program (E-Prime; PSTnet.com). Overall, there were 192 trials, 2 (side of display: left and right) × 6 pairings (angry-afraid, angry-happy, afraid-happy, angry-neutral, happy-neutral, and afraid-neutral) × 8 targets (4 males and 4 females) × 2 repetitions, randomly divided into three blocks of 64 trials. Each trial took no more than 1900 ms, so the duration of the task was approximately 10-15 minutes.

For the current study, the participant's reaction time was operationalized to represent where the participant's attention was located at the time that the dot probe emerged on the display. Faster reaction times on any given trial type reflect a greater investment of attention in the location of the probe on one of the photos depicted within that trial type, whereas slower reaction times reflect less of an attentional investment.

Procedure

Participants were recruited from undergraduate Psychology courses. Participants received $10 or extra credit points for undergraduate Psychology courses after participation was completed. Participants signed up on-line, via Study Board. Participants completed the informed consent, demographics questionnaire, and TSS on-line, before coming to session in Gary Ransdell Hall. Once participants arrived at the session, they completed the Snellen visual acuity test and then filled out the CES-D, the DASS, and the IES-R. Participants were then logged on to a computer and completed the discrimination of facial expressions task. Next, participants completed the dot probe position task, also administered via computer. Finally, participants were debriefed and thanked for their participation.

Results

Preliminary Analyses

Participants were divided into two groups using a median split based on PTSS level (i.e., low/high) using symptoms reported on the IES-R. Participants' median score on the IES-R was 2.375 (*SD* = 2.26). Those participants with a score higher than the median were classified as high PTSS (*N* = 46); participants in the high PTSS group reported scores that ranged from 2.38 to 8.46. Participants with a score lower than the median were classified as low PTSS (*N* = 43); participants in the low PTSS group reported scores that ranged from 0 to 2.25. Independent samples *t*-test indicated a significant difference in level of PTSS between the low and high PTSS groups, $t(87) = -13.191$, $p < .001$, Cohen's $d = 2.83$.

Potential covariates included age, gender, GPA, and overall depression and/or anxiety scores (See Table 1). Results suggest only depression and anxiety scores were significantly correlated with PTSS. In the high PTSS group, the mean depression score was 21.37 (*SD* = 6.72, range = 11 to 46) and the mean anxiety score was 6.65 (*SD* = 6.82, range = 0 to 23). In the low PTSS group, the mean depression score was 18.49 (*SD* = 5.13, range = 5 to 34) and the mean anxiety score was 2.51 (*SD* = 2.81, range = 0 to 10). Independent samples *t*-tests indicated significant differences in level of depression between the low and high PTSS groups, $t(87) = -2.261$, $p = .026$, Cohen's $d = 0.48$ and significant differences in level of anxiety between the low and high PTSS groups, $t(87) = -3.699$, $p < .001$, Cohen's $d = 0.79$.

Table 1
Demographic Information for PTSS Groups

Characteristic	Low PTSS (*n* = 43)	High PTSS (*n* = 46)
GPA [*M* (*SD*)]	3.01 (0.93)	3.22 (0.78)
Age [*M* (*SD*)]	19.60 (2.41)	18.89 (1.18)
Gender		
Female [*n* (%)]	32 (74.4%)	40 (87 %)
Male [*n* (%)]	11 (25.6%)	6 (13 %)
Ethnicity [*n* (%)]		
Caucasian	33 (76.7 %)	39 (84.8 %)
African American	7 (16.3 %)	4 (8.7 %)
Asian	2 (4.7 %)	0 (0 %)
Hispanic	1 (2.3 %)	0 (0 %)
Multi-racial	0 (0%)	1 (2.2%)
Pacific Islander	0 (0%)	1 (2.2 %)
Other	0 (0 %)	1 (2.2 %)
Depression (CES-D) [*M* (*SD*)]	18.49* (5.13)	21.37* (6.72)
Anxiety (DASS) [*M* (*SD*)]	2.51** (2.81)	6.65** (6.82)

Note. CES-D = Center for Epidemiological Studies Depression Scale; DASS = Depression Anxiety Stress Scales
* $p < .05$ ** $p < .01$

Effects of PTSS on Facial Expression Discrimination

To evaluate whether individuals who report higher levels of PTSS would require less intensity of threatening expressions (i.e., anger and fear) for correct identification compared to individuals who report lower levels of PTSS, a 2 (expression intensity) × 3 (emotional pairing) × 2 (PTSS group) mixed-model Analysis of Variance (ANOVA), with expression intensity and emotional pairing as within-subjects variables and PTSS group as a between-subjects variable, was conducted on the d′ values (See Table 2) from the discrimination of facial expression task.

Table 2
Participants' d′ Values for Facial Expression Discrimination Ability

Emotional Pairing	Low PTSS (n = 43)	High PTSS (n = 46)
Happiness-Anger		
40 % intensity [*M* (*SD*)]	3.68 (1.04)	3.56 (1.07)
80 % intensity [*M* (*SD*)]	5.29 (0.65)	5.18 (0.84)
Happiness-Fear		
40 % intensity [*M* (*SD*)]	3.00 (1.12)	2.80 (0.90)
80 % intensity [*M* (*SD*)]	5.24 (0.76)	5.01 (0.90)
Anger-Fear		
40 % intensity [*M* (*SD*)]	4.75 (0.89)	2.33 (0.74)
80 % intensity [*M* (*SD*)]	5.90 (1.15)	4.11 (1.09)

Note. Higher d′ values indicate more discrimination ability (i.e., easier to differentiate between the two emotions).

Overall, main effects of emotional pairing, $F(2, 174) = 63.706$, $p < .001$, $\eta^2 = .423$, and expression intensity, $F(1, 87) = 706.178$, $p < .001$ $\eta^2 = .890$, were qualified by a two-way emotional pairing by expression intensity interaction, $F(2, 174) = 7.962$, $p < .001$, $\eta^2 = .084$. There was no main effect of PTSS group, as individuals in the high PTSS group did not display greater d′ values than those in the low PTSS group (i.e., no main effect of PTSS group), $F(1, 87) = 1.650$, $p = .202$, $\eta^2 = .019$.

To further investigate the relationship between level of PTSS and one's ability to discriminate between facial expressions of emotions, correlations were examined within each PTSS group between the level of PTSS symptoms reported and emotion discrimination ability at each expression intensity level (See Table 3). Mean-wise, individuals within the high PTSS group displayed higher discrimination performance when expression intensity was high, but, with respect to correlations, discrimination performance was correlated with level of PTSS for some of the emotional pairings.

Specifically, within the high PTSS group, individuals experiencing more PTSS had more difficulty discriminating between happiness and anger at 40% intensity, (r = -.41, p = .005, N = 46), anger and fear at 40% intensity, (r = -.28, p = .059, N = 46), and happiness and fear at 80% intensity, (r = -.38, p = .010, N = 46). All other correlations were non-significant ($p > .05$)

Table 3
Relationship Between Level of PTSS and Ability to Discriminate Between Facial Expressions of Emotions at Different Intensities

Emotional Pairing	Low PTSS (n = 43)	High PTSS (n = 46)
Happiness-Anger		
40 % intensity	.22	-.41**
80 % intensity	.02	-.13
Happiness-Fear		
40 % intensity	-.09	-.18
80 % intensity	.03	-.38**
Anger-Fear		
40 % intensity	-.21	-.28+
80 % intensity	-.08	-.21

Note. $^{+}p = .059$ $^{**}p \leq .01$

In an effort to improve the purity of the sample, participants who did not report exposure to prior traumatic events—as measured by the TSS—were excluded and analyses were conducted again to see if the results varied (See Table 4). Similar to results from the Omnibus ANOVA, main effects of emotional pairing, $F(2, 140) = 56.804$, $p < .001$, $\eta^2 = .448$, and expression intensity, $F(1, 70) = 581.536$, $p < .001$, $\eta^2 = .893$, were qualified by a two-way emotional pairing by expression intensity interaction, $F(2, 140) = 8.102$, $p < .001$, $\eta^2 = .104$. There was no main effect of PTSS group, as individuals in the high PTSS group did not display greater d′ values than those

in the low PTSS group (i.e., no main effect of PTSS group), $F(1, 70) = 1.326$, $p = .253$, $\eta^2 = .019$. Mean-wise, individuals within the high PTSS group displayed higher discrimination performance when expression intensity was high, but, with respect to correlations, discrimination performance was correlated with level of PTSS for some of the emotional pairings. Specifically, within the high PTSS group, individuals experiencing more PTSS had more difficulty discriminating between happiness and anger at 40% intensity, ($r = -.43$, $p = .008$, $N = 37$), anger and fear at 40% intensity, ($r = -.39$, $p = .018$, $N = 37$), and happiness and fear at 80% intensity, ($r = -.41$, $p = .018$, $N = 37$). All other correlations were non-significant ($p > .05$).

Table 4
Relationship Between Level of PTSS and Discrimination Ability Among all Participants with Prior Trauma History

Emotional Pairing	Low PTSS ($n = 35$)	High PTSS ($n = 37$)
Happiness-Anger		
40 % intensity	.22	-.43**
80 % intensity	-.02	-.08
Happiness-Fear		
40 % intensity	.03	-.19
80 % intensity	-.01	-.41*
Anger-Fear		
40 % intensity	-.20	-.39*
80 % intensity	.00	-.32

Note. $^{*}p < .05$ $^{**}p < .01$

Relationship Between Comorbid Psychopathology and Discrimination Ability

In order to investigate the second hypothesis, a correlational analysis was conducted to examine the relationship between individuals' level of psychopathology (i.e., depression, anxiety, and PTSS) and their ability to discriminate between facial

expressions of emotions. When the analysis was conducted on the overall sample, no significant correlations were noted. However, when participants who did not report exposure to prior traumatic events were excluded from the analysis, a significant correlation emerged; individuals that reported higher levels of PTSS and anxiety had more difficulty discriminating between happiness and anger at 40% intensity (r = -.33, p = .045, N = 37).

Attentional Bias Toward Threat-Related Cues

To examine whether individuals reporting PTSS exhibited an attentional bias to threat-related facial expressions of emotions (i.e., anger and fear), independent samples *t*-tests were conducted on the reaction times from the dot-probe task for individuals in the low PTSS group compared to individuals in the high PTSS group when attending to threatening versus non-threatening expressions of emotions. Specifically, *t*-tests were examined to compare the time that participants needed to indicate which facial expression a dot probe appeared behind for the following emotional pairings: happiness-anger, happiness-fear, neutral-anger, and neutral-fear. Overall, no significant differences in reaction times were noted between the two groups (e.g., all p. > .05). In other words, participants in both the high and low PTSS groups deployed their attention toward the paired facial expressions in the same way, on average.

In an effort to improve the purity of the sample, participants who did not report exposure to prior traumatic events were excluded and analyses were conducted again to see if the results varied. Overall, no significant differences in reaction times were noted between the two groups (e.g., all p. > .05). Again, participants in both the high and low PTSS groups deployed their attention toward the paired facial expressions in the same

way, on average. To further investigate the relationship between PTSS and an attentional bias to threat-related facial expressions of emotions, correlations were examined within each PTSS group between the level of PTSS reported and reaction times from the dot-probe task. As a result of this, two significant correlations emerged. When examining individuals in the low PTSS group, higher levels of PTSS were correlated with faster reaction times when participants were probed for their attention to angry expressions in the angry-happy pairing (r = -.35, p = .042, N = 35). When examining individuals in the high PTSS group, higher levels of PTSS were correlated with slower reaction times when participants were probed for their attention to fearful expressions in the fearful-happy pairing (r = .33, p = .050, N = 37).

Finally, due to unequal sample sizes and concerns regarding statistical power, the present study did not conduct the proposed exploratory analyses examining potential gender differences in facial expression discrimination.

Discussion

The current study examined the impact of PTSS on college students' ability to discriminate between various facial expressions of emotions. The ability to discriminate facial expressions of emotion is a vital component of social interactions (Philippot & Fledman, 1990; Schmidt & Zachariae, 2009; Thomas et al., 2007; Vicari et al., 2000), and difficulties in facial expression discrimination could create barriers for healthy social development and interaction. Prior research has found evidence suggesting that other clinical populations, such as Major Depressive Disorder, Bipolar Disorder, and Schizophrenia, experience deficits in one's ability to discriminate between facial expressions of emotions (Phillips et al., 2003). Difficulties in facial expression discrimination among these various clinical populations suggests a need to better understand these difficulties; a better understanding of these deficits could have implications for effective treatment. Although prior research has examined difficulties in facial expression discrimination among children and adolescents who have experienced a traumatic event (Blair, 2003; Masten et al., 2008), research has yet to examine this relationship in adults suffering PTSS.

Participants for the current study consisted of adults experiencing various levels of PTSS. Although participants may not experience levels of impairment indicative of meeting full diagnostic criteria for PTSD, participants did report experiencing subthreshold PTSD (i.e., PTSS). Prior research has shown that individuals experiencing PTSS often experience similar levels of impairments as those individuals meeting diagnostic criteria for PTSD (Carlier & Gersons, 1995; Marshall et al., 2001; Stein et al., 1997). Thus, examining individuals experiencing PTSS will provide insight into how

various levels of PTSS affect individuals' functioning and may provide preliminary implications for how these impairments might affect individuals experiencing PTSD.

Effects of PTSS on Facial Expression Discrimination

Contrary to our hypothesis, findings suggest that individuals' ability to discriminate between various facial expressions of emotions while experiencing high levels of PTSS did not differ from individuals reporting low levels of PTSS. When average performance was compared between the high versus low PTSS groups, no significant differences emerged. However, differences existed within the PTSS groups. A significant relationship was found between high levels of PTSS and a decreased ability to discriminate between happiness compared to anger at low levels of intensity and happiness compared to fear at high levels of intensity. This finding suggests that individuals experiencing high levels of PTSS are identifying facial expressions of emotions in a hypervigilant manner, as they are confusing threatening (i.e., anger and fear) and non-threatening (i.e., happiness) emotions.

Individuals experiencing low levels of PTSS have no difficulty discriminating between non-threatening and threatening expressions. The difficulty exhibited by individuals experiencing high levels of PTSS in discriminating between threatening and non-threatening facial expressions of emotions has important treatment implications. Because individuals experiencing high levels of PTSS display difficulty discriminating between non-threatening and threatening expressions, this difficulty may be related to these individuals' hypervigilant efforts to identify possible threats. This is consistent with prior research finding that individuals with PTSD have an attentional bias to threat-related stimuli (McNally et al., 2000; McNally et al., 1990; Williams et al., 1996). In

efforts to avoid future traumatic events, individuals experiencing PTSS may incorrectly identify non-threatening expressions as threatening.

Additionally, results suggest that individuals reporting high levels of PTSS had more difficulty discriminating between anger compared to fear at low levels of intensity. This suggests that individuals experiencing high levels of PTSS may not process anger and fear in similar ways. Although both expressions could be broadly defined as threatening, individuals experiencing high levels of PTSS may react differently depending on the specific expression. Perhaps expressions of anger are reacted to in a hypervigilant manner in efforts to identify a potential source of future harm. Conversely, fearful expressions may remind individuals of their traumatic experiences and this reminder may create distress; thus, expressions of fear are reacted to with avoidance in efforts to avoid intrusive thoughts that may cause distress. Although these ideas are speculative in nature, prior research does offer support for this argument by suggesting that anxious individuals may direct attention toward threat-related cues early in detection and avoid threat-related cues later in detection (Amir, Foa, & Coles, 1998). Perhaps the avoidance of fearful expressions may explain these individuals' difficulty discriminating between fearful and angry expressions.

Attentional Bias Toward Threat-Related Cues

The current study found some evidence to suggest that individuals reporting PTSS exhibited an attentional bias toward threat-related facial expressions of emotions (i.e., anger and fear). Corroborating evidence from the dot-probe task, which measured attentional biases, offers support for this particular hypothesis. Prior research has found evidence suggesting an attentional bias for threat related cues in individuals experiencing

PTSD (McNally et al., 2000; McNally et al., 1990; Williams et al., 1996), generalized anxiety disorder (Mathews & MacLeod, 1985), panic disorder (Ehlers et al., 1988), and social phobia (Watts et al., 1986). Findings of the current study further implicate an attentional bias for threat related cues among individuals experiencing high levels of PTSS. When average performance on the dot-probe task was compared between the high versus low PTSS groups, no differences emerged. However, when excluding those participants who did not report a prior traumatic event, significant correlations emerged. Higher levels of PTSS were correlated with faster reaction times when attending to angry expression, which offers additional support for the hypothesis that individuals experiencing high levels of PTSS have an attentional bias toward threat related cues. However, higher levels of PTSS were correlated with slower reaction times when attending to fearful expressions. This demonstrates that individuals experiencing higher levels of PTSS avoid fearful expression. As previously noted, perhaps these individuals avoid this type of expression because it triggers intrusive thoughts related to their traumatic experience that create distress; although this explanation is plausible, the somewhat inconsistent pattern of results from the current study suggests that more research is needed before a definitive conclusion can be reached.

Relationship Between Comorbid Psychopathology and Discrimination Ability

Interestingly, the present study did not find that increased reports of psychopathology (i.e., PTSS, depression, and anxiety) were correlated with greater deficits in ability to discriminate facial expressions of emotions. However, when those individuals who had not experienced prior traumatic events were excluded from the sample, a significant correlation emerged between high levels of PTSS in conjunction

with anxiety symptoms and a decreased ability to discriminate between happiness and anger at low levels of intensity.

By eliminating those individuals who had not experienced a prior trauma, the sample was made more homogeneous in regards to exposure to traumatic events, which eliminated a possible confounding variable that may have skewed results. If this difficulty in discriminating facial expressions of emotions was due to psychopathology in general, all participants (i.e., those that experienced prior trauma and those that did not) with higher levels of psychopathology would experience difficulties; results did not support this. However, after those participants that did not experience prior traumatic events were excluded from analyses, results suggest that increased reports of psychopathology negatively impact one's ability to discriminate between happiness and anger. This suggests that the deficit in emotion discrimination may be due, in part, to prior traumatic experiences and this deficit is exacerbated by comorbid levels of anxiety. However, this finding should be interpreted with caution due to the small sample size.

Although the results were unexpected, these correlations provide valuable insight into the discrimination ability of those individuals experiencing PTSS. Findings from the current study highlight the importance of examining the severity of PTSS in that a relationship was found between the level of PTSS and one's ability to discriminate between threatening versus non-threatening facial expressions of emotions. Research suggests that hyperarousal symptoms are often exhibited by individuals experiencing PTSS and may impair their psychosocial functioning (Shalev et al., 1998). The current finding that traumatized individuals who are experiencing high levels of PTSS had more difficulty discriminating between threatening versus non-threatening facial expressions of

emotions provides preliminary support for this. This deficit in threatening versus non-threatening facial expressions discrimination can have drastic negative implications for social interactions.

Clinical Implications

Findings from the present study have significant clinical implications and underscore the utility of examining facial expression discrimination in traumatized adults. Individuals experiencing higher levels of PTSS may perceive others as threatening when, in fact, the others are non-threatening. This incorrect perception may lead individuals experiencing higher levels of PTSS to avoid social interactions, which may exacerbate symptoms of psychopathology, as social support has been shown to provide a buffer against these symptoms (Cohen & Willis, 1985). Focusing one's treatment on correcting faulty perceptions could be extremely advantageous. Additionally, the biased tendency of individuals experiencing higher levels of PTSS toward identifying threatening expressions could play a role in perpetuating their PTSD. Incorrectly identifying expressions as threatening may lead to social isolation, as individuals may not interact with others misidentified as threatening. Previous research has identified many negative consequences associated with social isolation (Twenge et al., 2002), including self-defeating behaviors. Negative consequences, such as self-defeating behaviors, may play a role in maintaining PTSS. In the clinical setting, the clinician could focus treatment on teaching these individuals how to correctly identify facial expressions of emotions, which could help foster more positive social interactions.

In addition to focusing treatment on correcting this difficulty, clinicians could use these behavioral measures (i.e., facial expression discrimination task and dot-probe

attention task) as an assessment to measure treatment effectiveness. At baseline, individuals experiencing high levels of PTSS should exhibit difficulty discriminating between anger and fear, but as effective treatment progresses this difficulty should diminish. The performance of individuals experiencing PTSS on these behavioral measures should improve from baseline to post-treatment.

Limitations and Future Research

The current study was not without limitations. First, the present study consisted of college students and may not generalize to other populations. Future research is needed examining the relationship between levels of PTSS and one's ability to accurately discriminate between various facial expressions of emotions in other samples such as older adults, combat veterans, victims of natural disasters, and victims of interpersonal violence. Additionally, the present study's sample was fairly homogeneous in terms of ethnicity, with 80.9% of participants identifying as Caucasian. Individuals from various other ethnicities may behave differently when compared to the behavior of Caucasians. Future research should address this limitation by recruiting a sample more diverse in terms of ethnicity.

Moreover, the current sample was composed primarily of female participants (80.9%). The sample was so heavily composed of female participants that the fourth hypothesis could not be analyzed because of the low statistical power due to unequal groups. Further, the large proportion of female participants may have skewed results. Prior research has suggested that women are better than men in recognizing facial expressions (Montagne et al., 2005). If women are better at emotion discrimination, then perhaps the current findings would be different (e.g., more significant differences or

correlations) if men were more equally represented in the sample. Future research could examine these hypotheses by collecting a sample of participants more equally distributed in terms of gender. In addition to these limitations, many of the conclusions drawn were based on correlational results. As such, the current findings are not indicative of a causal relationship. Future research should focus on identifying specific causal factors such as the type of trauma experienced, level of traumatic severity, or history of exposure to traumatic events.

Despite these limitations, findings from the present study provide valuable knowledge regarding the impact of PTSS on adults' ability to accurately discriminate between various facial expressions of emotions. Moreover, findings suggest higher levels of PTSS are related to a decreased ability to discriminate between threatening and non-threatening facial expressions of emotions, which offer significant clinical implications. Additionally, this study offers valuable knowledge concerning attentional biases among individuals experiencing PTSS. The knowledge provided by this study could greatly benefit both development and implementation of effective treatment aimed at decreasing the negative effects experienced by individuals reporting PTSS.

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APPENDIX A

Demographics

Age: _____

Gender: Female____ Male____ Prefer not to respond____

Current GPA: _____

Do you have any vision impairments not corrected? _____

Do you have any hearing impairments not corrected? _____

How much do your symptoms affect your physical health?

0=Does not affect

1=Slightly affects

2=Neutral

3=Somewhat affects

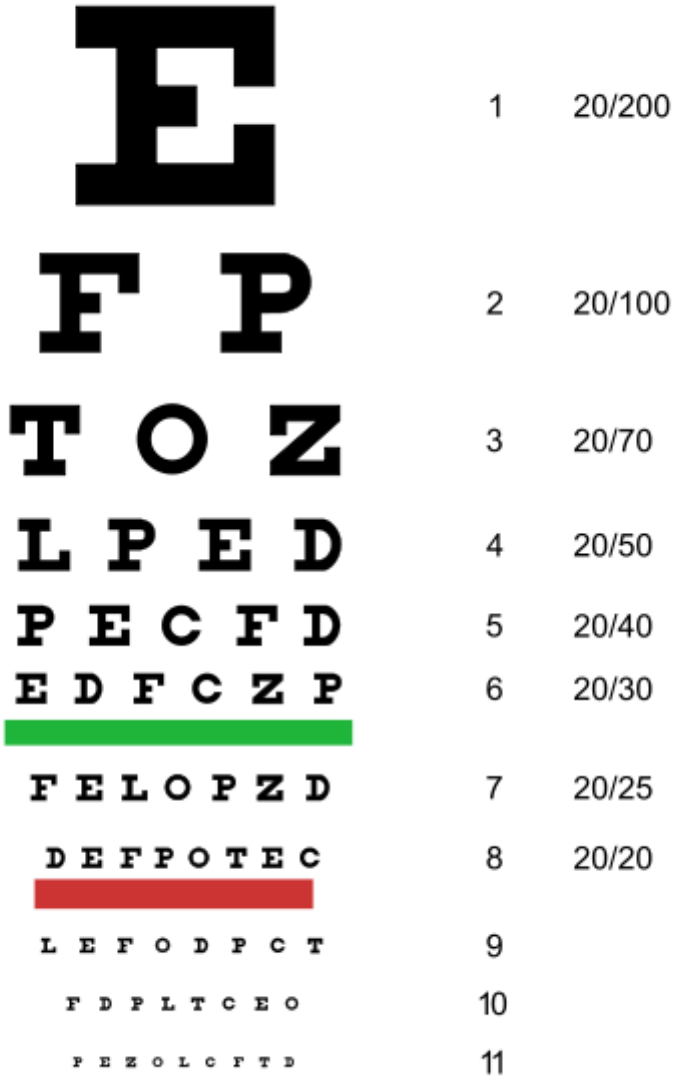
4=Strongly affects

Are you currently taking any medications? _____

If yes, please list all medications _____

APPENDIX B

Snellen Visual Acuity Test



APPENDIX C

Traumatic Stress Schedule

Directions: The following questions are about events that people may experience in their lifetime. For each event listed below, please indicate whether you have experienced it. If yes, please answer questions A-E for each event you have experienced.

Events	Answer
1. Did anyone ever take something from you by force or threat of force such as in a robbery, mugging, or hold up?	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
2. Did anyone ever beat you up or attack you?	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
3. Did anyone ever make you have sex by using force or threatening to harm you? This includes any type of unwanted sexual activity.	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	

C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
4. Did a close friend or family member ever die because of an accident, homicide, or suicide?	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
5. Did you ever suffer injury or property damage because of fire?	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
6. Did you ever suffer injury or property damage because of severe weather or either a natural or human-made disaster?	YES NO

A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
7. Were you ever in a motor vehicle accident serious enough to cause injury to one or more people?	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
8. Have you ever seen someone seriously injured or killed?	YES NO
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
9. Have you ever suffered serious physical injury as a result of a non motor vehicle related accident?	YES NO
A. How many times has this happened to you?	

B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
10. Did you ever have some other terrifying or shocking experience that is not covered above?	YES NO
If so, please describe briefly what happened:	
A. How many times has this happened to you?	
B. How old were you the first time this happened?	
C. On a scale from 1 to 7, to what extent did you fear for your life during this event? (Please circle one)	1 2 3 4 5 6 7 Not at all Neutral Extremely
D. To what extent were you physically injured during the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely
E. To what extent were you distressed by the event?	1 2 3 4 5 6 7 Not at all Neutral Extremely

APPENDIX D

Impact of Event Scale-Revised

Below is a list of comments made by people after stressful life events. Please check each item, indicating how frequently these comments were true for you **SINCE THE IDENTIFIED STRESSFUL EVENT.** If they did not occur during that time, please mark the "not at all" column

Please think of your stressful event when filling out this questionnaire

	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Any reminder brought back feelings about it	0	1	2	3	4
2. I had trouble staying asleep	0	1	2	3	4
3. Other things kept making me think about it	0	1	2	3	4
4. I felt irritable and angry	0	1	2	3	4
5. I avoided letting myself get upset when I thought about it or was reminded of it	0	1	2	3	4
6. I thought about it when I didn't mean to	0	1	2	3	4
7. I felt as if it hadn't happened or wasn't real	0	1	2	3	4
8. I stayed away from reminders about it	0	1	2	3	4
9. Pictures about it popped into my mind	0	1	2	3	4
10. I was jumpy and easily startled	0	1	2	3	4
11. I tried not to think about it	0	1	2	3	4
12. I was aware that I still had a lot of feelings about it, but I didn't deal with them	0	1	2	3	4
13. My feelings about it were kind of numb	0	1	2	3	4
14. I found myself acting or feeling like I was back at that time	0	1	2	3	4
	Not at all	A little bit	Moderately	Quite a bit	Extremely
15. I had trouble falling asleep	0	1	2	3	4
16. I had waves of strong feelings	0	1	2	3	4

17. I tried to remove it from my memory	0	1	2	3	4
18. I had trouble concentrating	0	1	2	3	4
19. Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart	0	1	2	3	4
20. I had dreams about it	0	1	2	3	4
21. I felt watchful and on-guard	0	1	2	3	4
22. I tried not to talk about it	0	1	2	3	4

APPENDIX E

Center for Epidemiological Studies Depression Scale

Circle the number for each statement which best describes how often you felt or behaved this way – ***DURING THE PAST WEEK***

DURING THE PAST WEEK:	Rarely or None of the Time (< 1 Day)	Some or a Little of the Time (1-2 Days)	Occasionally or a Moderate Amount of the Time (3-4 Days)	Most or All of the Time (5-7 Days)
1. I was bothered by things that usually don't bother me	0	1	2	3
2. I did not feel like eating; my appetite was poor	0	1	2	3
3. I felt that I could not shake off the blues even with help from my friends or family	0	1	2	3
4. I felt that I was just as good as other people	0	1	2	3
5. I had trouble keeping my mind on what I was doing	0	1	2	3
6. I felt depressed	0	1	2	3
7. I felt that everything I did was an effort	0	1	2	3
8. I felt hopeful about the future	0	1	2	3
9. I thought my life had been a failure	0	1	2	3
10. I felt fearful	0	1	2	3
11. My sleep was restless	0	1	2	3
12. I was happy	0	1	2	3
13. I talked less than usual	0	1	2	3
14. I felt lonely	0	1	2	3
15. People were unfriendly	0	1	2	3
16. I enjoyed life	0	1	2	3
17. I had crying spells	0	1	2	3
18. I felt sad	0	1	2	3

19. I felt that people disliked me	0	1	2	3
20. I could not get “going”	0	1	2	3

APPENDIX F

Depression Anxiety Stress Scales

DASS *Name:* *Date:*

Please read each statement and circle a number 0, 1, 2, or 3 that indicates how much the statement applied to you *over the past week.* There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found myself getting upset by quite trivial things	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I just couldn't seem to get going	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I had a feeling of shakiness (eg, legs going to give way)	0	1	2	3
8	I found it difficult to relax	0	1	2	3
9	I found myself in situations that made me so anxious I was most relieved when they ended	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting upset rather easily	0	1	2	3
12	I felt that I was using a lot of nervous energy	0	1	2	3
13	I felt sad and depressed	0	1	2	3
14	I found myself getting impatient when I was delayed in any way (eg, elevators, traffic lights, being kept waiting)	0	1	2	3
15	I had a feeling of faintness	0	1	2	3

16	I felt that I had lost interest in just about everything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life wasn't worthwhile	0	1	2	3
22	I found it hard to wind down	0	1	2	3
23	I had difficulty in swallowing	0	1	2	3
24	I couldn't seem to get any enjoyment out of the things I did	0	1	2	3
25	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3

Please turn the page

Reminder of rating scale:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

26	I felt down-hearted and blue	0	1	2	3
27	I found that I was very irritable	0	1	2	3
28	I felt I was close to panic	0	1	2	3
29	I found it hard to calm down after something upset me	0	1	2	3
30	I feared that I would be "thrown" by some trivial but unfamiliar task	0	1	2	3
31	I was unable to become enthusiastic about anything	0	1	2	3
32	I found it difficult to tolerate interruptions to what I was doing	0	1	2	3
33	I was in a state of nervous tension	0	1	2	3
34	I felt I was pretty worthless	0	1	2	3
35	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
36	I felt terrified	0	1	2	3
37	I could see nothing in the future to be hopeful about	0	1	2	3
38	I felt that life was meaningless	0	1	2	3
39	I found myself getting agitated	0	1	2	3
40	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
41	I experienced trembling (eg, in the hands)	0	1	2	3
42	I found it difficult to work up the initiative to do things	0	1	2	3