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Temporal Allocation of Attention Toward Threat in Individuals with Posttraumatic Stress Symptoms

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Abstract

Research suggests that individuals with posttraumatic stress disorder (PTSD) selectively attend to threat-relevant information. However, little is known about how initial detection of threat influences the processing of subsequently encountered stimuli. To address this issue, we used a rapid serial visual presentation paradigm (RSVP; Raymond, Sharpiro, & Arnell, 1992) to examine *temporal* allocation of attention to threat-related and neutral stimuli in individuals with PTSD symptoms (PTS), traumatized individuals without PTSD symptoms (TC), and non-anxious controls (NAC). Participants were asked to identify one or two targets in an RSVP stream. Typically processing of the first target decreases accuracy of identifying the second target as a function of the temporal lag between targets. Results revealed that the PTS group was significantly more accurate in detecting a neutral target when it was presented 300 or 500 ms after threat-related stimuli compared to when the target followed neutral stimuli. These results suggest that individuals with PTSD may process trauma-relevant information more rapidly and efficiently than benign information.

Keywords

Posttraumatic stress disorder; attention bias; information processing

Introduction

Posttraumatic stress disorder (PTSD) occurs in response to experiencing or witnessing a traumatic or life-threatening event, and is associated with chronic patterns of avoidance, re-experiencing, and hyperarousal (American Psychiatric Association, 2000). Associated sequelae of the disorder include heightened sensitivity to cues in the environment associated with the traumatic event that may signal potential threat. According to cognitive models of anxiety, the persistence of PTSD can be explained in part by this selective processing bias that automatically favors trauma-relevant information (Brewin & Holmes, 2003; Ehlers & Clark,

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[1]According to Eysenck, Derakshan, Santos, and Calvo (2007), individuals with anxiety may differ on efficiency of processing rather than effectiveness. For the purposes of the current study using the RSVP paradigm, our use of the term efficiency does not specifically refer to that of Eysenck et al.'s Attention Control Theory.

2000; Foa, Huppert, & Cahill, 2006). These theories posit that, following a traumatic event, heightened responsiveness of basic fear systems involved in the processing of emotional information primes threatening representations to become readily accessed by trauma-relevant cues (e.g., McNally, 2006). Thus, preferential processing of threat is thought to reinforce preoccupation with the trauma and contribute to the repeated accessing of trauma-related memories, leading to the maintenance of symptoms such as hyperarousal and intrusive recollections.

In support of cognitive theories, a large body of research suggests that individuals with PTSD selectively attend to threatening stimuli such as reminders of their trauma (Buckley, Blanchard, & Neill, 2000; Constans, 2005; Mathews & MacLeod, 2005). The vast majority of this evidence comes from experimental paradigms that examine the processing of emotional information when stimuli compete for attentional resources. For example, a widely used measure of attention bias in PTSD is the emotional Stroop task. In this task, participants name the color of emotional words while ignoring the meaning of the words (Williams, Mathews, & MacLeod, 1996). Slower response latencies in color-naming threat words compared to color-naming neutral words is thought to reflect difficulty inhibiting the meaning of the threat word, suggesting an attention bias for threat. Across different types of trauma (e.g., combat, rape, accidents), individuals with PTSD tend to take longer to name the color in which trauma-related words are printed than do non-anxious controls, suggesting preferential processing of threatening information (Buckley, Blanchard, & Hickling, 2002; Constans, McCloskey, Vasterling, Brailey, & Mathews, 2004; McNally, Amir, & Lipke, 1996; Paunovic, Lundh, & Ost, 2002; Vrana, Roodman, & Beckman, 1995). More recently, researchers have used probe-detection tasks (Bryant & Harvey, 1997) and visual search tasks (Pineles, Shipherd, Welch, & Yovel, 2007) to explore the nature of spatial orienting of attention toward threatening information in PTSD.

While the above studies suggest that individuals with PTSD are characterized by spatial allocation of attention to trauma-relevant information, those experimental paradigms do not assess the temporal stream of attentional processing. However, in daily experience people encounter a continuous string of stimuli that compete for attentional resources. The extant empirical literature provides little information about how the processing of one type of stimuli influences the processing of subsequently encountered stimuli; that is, the *temporal* allocation of attention. One important, yet unexplored issue in PTSD concerns how the processing of trauma-relevant information influences the processing of subsequent information in one's environment. This information is vital to understanding the way in which attentional processes unfold over time and contribute to cognitive, behavioral and emotional symptoms characteristic of PTSD. On the one hand, previous findings may be interpreted to suggest that selective attention bias in the presence of trauma-relevant information would interfere with subsequent processing of non-emotional information (e.g., emotional Stroop studies). In contrast, other studies have found that repeatedly accessing trauma-relevant cues may make them more readily accessible, as evidenced, for example, by biased implicit memory for trauma-relevant information in individuals with PTSD (Michael, Ehlers, & Halligan, 2005, Amir, Selvig, & Bomyea, *in press*). As a result of this heightened accessibility, one might expect to see greater efficiency in the processing of those cues[2]. This would ostensibly require fewer attentional resources and therefore present less competition among subsequently encountered stimuli. Existing empirical studies in PTSD, however, have not been able to clarify these issues.

[2]Analyses on our main dependent variable, i.e., T2 accuracy, were also conducted including all five neutral words. These analyses revealed the same pattern of results compared to our primary analyses where the two T1 neutral words with poor accuracy were removed. Specifically, in the dual task condition, participants in the PTS group displayed better accuracy at detecting T2 when T1 was a threat word versus a neutral word at lags 3 and 5, $t(14) = 2.9, 2.7$ respectively, both $p < .02$.

To examine the temporal allocation of attention to emotional stimuli in anxiety, researchers have adapted the rapid serial visual presentation (RSVP) task, a well-established attention paradigm in cognitive psychology (Raymond, Shapiro, & Arnell, 1992; Shapiro & Raymond, 1994; Shapiro, 2001). In the traditional RSVP paradigm, participants see a rapid serial presentation of stimuli (e.g., letters) with a target stimulus (T1; e.g., the letter “A” in white font) embedded within a series of distracters that appears in black font. On 50% of trials, a second target (T2) is presented in black font (e.g., the letter “X”). In the baseline (single-task) condition, participants are instructed only to detect the presence of T2. In the experimental (dual-task) condition, participants must identify T1 as well as determine whether T2 was presented. Although participants are generally very accurate at detecting T1, the processing of T1 typically produces a deficit in the accuracy of detecting T2 (Chun & Potter, 1995; Raymond et al., 1992; Shapiro, Arnell, & Raymond, 1997). This deficit is often depicted as a U-shaped function of temporal lag (i.e., number of distracters) between T1 and T2. If T2 follows the presentation of T1 within approximately 100 ms (i.e., lag 1), accuracy for detecting T2 is relatively high (e.g., 85%; Raymond et al., 1992). However, accuracy of T2 detection decreases when it is presented 2–5 serial positions after T1 (i.e., approximately 200–500 ms). As the temporal lag increases past this critical period, so does accuracy in detecting T2. Reduction in accuracy of T2 detection has been termed the *attentional blink* (AB) effect (Raymond et al., 1992). The RSVP task and subsequent magnitude of the AB are thought to provide an index of the speed and efficiency with which particular stimuli are processed.

Cognitive models developed to account for the AB phenomenon posit a two-stage processing account of stimulus encoding (Chun & Potter, 1995; Arnell & Jolicoeur, 1999). A brief and complete activation of stimulus information occurs in the first stage. Representations formed in this stage are subject to rapid decay or overwriting by subsequent information unless they are selected for second-stage elaborative processing. However, this second strategic stage is effortful and capacity limited; transference of new information in the serial presentation from stage one to stage two cannot proceed until processing resources finish consolidation of prior stimuli. Thus, an attentional “bottleneck” occurs, creating the AB effect. Accordingly, the RSVP task seems well suited to clarify the above issues regarding temporal attentional processing in PTSD, namely whether threatening information is detected and processed rapidly and efficiently, or whether the processing of threatening information consumes attentional resources and therefore interferences with the processing of subsequently encountered stimuli.

Despite the potential utility of this task in exploring questions related to the initial processing and consolidation of information in the attentional stream, relatively few studies have used the RSVP paradigm to investigate the temporal processing of emotional stimuli in anxiety. However, researchers have begun to adapt this paradigm to explore at least two questions regarding the effects of processing emotional stimuli on the AB effect. First, researchers have manipulated the emotionality of T2 to determine whether emotionally salient stimuli can overcome the processing deficits seen in the AB. Results of these studies generally converge in finding that the AB effect is reduced in non-anxious individuals when T2 is a threatening or arousing stimulus in non-anxious individuals (Anderson, 2005; Keil & Ihssen, 2004; Reinecke, Rinck, & Becker, 2008; Trippe, Hewig, Heydel, Hecht, & Miltner, 2007), and that this reduction is particularly pronounced for anxious individuals (Fox, Russo, & Georgiou, 2005; Reinecke et al., 2008, study 2; Trippe et al., 2007).

A second relatively less explored question regarding the study of temporal allocation of attention is the effect of encountering emotional stimuli (at T1) on the processing of subsequent non-threat information (T2). Such paradigms provide information regarding the speed and efficiency with which emotional information is encoded, as well as its effect on the processing of subsequent neutral information. Studies using *arousing* stimuli such as sexually explicit or taboo words (Mathewson et al., 2008), or images conditioned using an aversive sound as T1 stimuli (Smith, Most, Newsome, & Zald, 2006) have found evidence for an increased AB, suggesting that these stimuli required more attentional resources to process than neutral or other emotional information. Moreover, Huang, Baddeley, and Young (2008) manipulated the level of processing of words presented at T1, and found that emotional information lead to an increased AB, but only when words were processed semantically (not perceptually or phonetically). One interpretation of these findings is that emotional stimuli consume greater attentional resources in non-anxious individuals only when those stimuli require elaborative processing, either because of explicit instructions to process them semantically or because of the highly arousing nature of the stimuli.

To date, only two studies have explored the effect of emotional stimuli presented at T1 on the processing of subsequent non-threat information (T2) in anxious individuals. Arend and Botella (2002) found that high trait-anxious participants showed a reduction in the magnitude of the AB effect for targets following emotional T1 words relative to those following neutral words at T1. Similarly, Cisler, Ries, and Widner (2007) found that the length of the AB was reduced in individuals with high levels of spider phobia symptoms as compared to those with low levels when presented with spider-related words at T1. Considered together, these studies suggest that anxious individuals may require fewer attentional resources to process emotional stimuli, thereby allowing them to more rapidly process subsequent incoming stimuli. In contrast, emotional information appears to require greater attentional resources relative to neutral information in non-anxious individuals, but only when that information is arousing or processed semantically.

In the current study we examined temporal allocation of attention in PTSD using a modified version of the RSVP task. Our task assessed the effect of initial processing of trauma-relevant information on subsequent stimuli in individuals with symptoms of PTSD, individuals reporting prior trauma exposure without current symptoms of PTSD, and a non-anxious control group without prior trauma exposure. More specifically, we manipulated the emotionality of T1 by presenting either neutral or a trauma-related word, and examined its effect on the accuracy of detecting a neutral target at T2. In keeping with prior research suggesting the importance of semantic processing of emotional information in the RSVP task (Huang et al., 2008), participants were required to make a categorical judgment about both emotional and neutral stimuli presented at T1. In line with prior work in this area (i.e., Arend & Botella, 2002), we hypothesized that individuals in the PTS group would demonstrate a reduction in the magnitude of the AB effect when T1 was trauma-related compared to when T1 was neutral.

Method

Participants

Individuals were selected from a large pool of undergraduate psychology students and participated for research credit. Students were screened for prior trauma exposure and symptoms of PTSD using the Posttraumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997).The PDS is a 49-item self-report measure designed to quantify the severity of PTSD symptoms as reported in the *Diagnostic and Statistical Manual of Mental Disorders – 4th Edition* (DSM-IV-TR; American Psychiatric Association, 2000). Items assess the type of trauma experienced as well as symptom severity over the past month, and are scored on a zero to three scale. The PDS has satisfactory agreement with the Structured Clinical Interview for DSM-III-R (Spitzer, Williams, Gibbon, & First, 1990; kappa=0.65, agreement=82%, sensitivity=0.89, specificity=0.75; Foa et al., 1997) and has been used to select PTSD diagnostic groups in student samples (Twamley, Hami, & Stein, 2004).

Based on results of this screening, we created three groups of individuals. Participants were included in the PTS group (n = 15) if they (a) reported a DSM-IV criterion trauma, (b) scored

11 or higher on the PDS, which reflects at least a moderate degree of PTSD symptom severity (Foa et al., 1997), and (c) endorsed at least a “one” on the four-point frequency scale for a minimum of one intrusion, three avoidance, and two arousal symptoms. The mean PDS score for this group (M = 24.2, SD = 9.7) was comparable to those reported in previous research in student samples (Twamley et al., 2004). The trauma control group (TC; n = 14) included individuals who (a) reported at least one DSM-IV Criterion (A) trauma and (b) scored less than a 5 on the PDS (M = 0.3, SD = 0.6). See Table 1 for trauma types endorsed in the PTS and TC groups. If participants endorsed multiple traumas, they were instructed to fill out the PDS by reflecting on the traumatic event that bothered them the most. Finally, the non-anxious control group (NAC; n = 15) comprised individuals who did not endorse a trauma or symptoms associated with PTSD. Participants also completed the Beck Depression Inventory II (BDI-II; Beck & Steer, 1987) and the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch,Lushene, Vagg, & Jacobs, 1983) to assess depressive and anxiety-related symptomatology, respectively.

Materials

The stimulus set used in this study comprised 5 trauma-relevant words (flashback, attack, numb, helpless, nightmare), 5 neutral words (carpet, desk, chaise, painting, dustbin), and 25 neutral distracter words (i.e., names of countries). Neutral words represented household items and were taken from a set used in previous information processing studies, and threat words were selected from a larger list piloted at two trauma treatment centers. The word types were matched on word length and frequency of use (Francis & Kucera, 1982).

Procedure

Participants completed an informed consent form, self report measures, and then the RSVP computer task individually in the laboratory. They were seated 30 cm away from the computer screen and words appeared in the center of the screen. The experimental session was divided into two blocks of trials, one for the single task condition and one for the dual task condition. In the single task condition, participants were instructed only to indicate whether or not T2 (the word “water”) was presented on any trial. In the dual task condition, participants were required to first identify the category of T1 (Threat, Neutral) and then to indicate whether T2 was presented in each trial. Order of the block presentation was counterbalanced across subjects such that in each group half of the participants completed the single task condition first and the other half completed the dual task condition first. Each block consisted of 160 trials.

Each trial began with a fixation point (+) presented in the center of the screen for 500 ms. A series of distracter words (country names, e.g., sweden) then appeared in black font in the center of the computer screen one after the other. After three to five distracter words, a target word (T1) was embedded within the string. This word was presented in red font, and was either a neutral (e.g., carpet) or threat (e.g., flashback) word. On half of the trials a second target (T2, the word “water”) was also presented. On trials where T2 was present, the interval between the presentation of T1 and T2 varied from 0, 1, 2, 3, 4 or 7 distracters, i.e., lags 1 to 5 and 8 (Mathewson et al., 2008), with three to five distracter words presented before T1 and five to seven distracters after T2. Each word was presented for 85 ms, and the inter stimuli interval (ISI) was 15 ms, so that the stimulus onset asynchrony (SOA) was 100 ms. All words were presented in lowercase in 12-point Arial font. Figure 1 presents an example trial.

Design

As the AB effect has been shown to occur between 100 and 500 ms after the presentation of T1 (Chun & Potter, 1995; Raymond et al., 1992; Shapiro et al., 1994), lags 1–5 represent the expected times for the AB effect to occur. Lag 8, as the farthest from the presentation of T1, represents an estimated baseline measure of dual task performance (Mathewson et al., 2008).

Therefore, the design was a 3 × 2 × 2 × 6 between-within ANOVA with repeated measurement on the last three factors.

Results

Demographics

Groups did not differ in age or years of education (both $p > .05$). As was expected, groups differed on depression and anxiety scores (both $p < .05$). Follow-up Post hoc analyses using Tukey's honestly significant difference (HSD) procedure revealed that the PTS group was more anxious (state and trait) and dysphoric than the TC and NAC groups. The TC and NAC groups did not differ on anxiety and depression. Also, the proportion of females was higher in the PTS group than the NAC group, but there were no differences between the PTS and TC or the TC and NAC groups. This finding is consistent with research demonstrating that higher rates of PTS are observed in women than in men (Tolin & Foa, 2006). See Table 2 for demographic and clinical characteristics.

T1 Performance

Analysis of T1 accuracy rates for each group was conducted for threat and neutral words in the dual-task condition. This analysis indicated accuracy rates ranging from 63% to 94%. Accuracy for two of the neutral words was below average (chaise = 63%; dustbin = 78%) in relation to other words presented at T1 as well as previous research (e.g., 94%; Rokke, Arnell, Koch, & Andrews, 2002). Given that T2 performance was conditional upon correct identification of T1, trials comprising either of these neutral words at T1 were excluded from the analyses. For the remaining trials, participants' accuracy in identifying T1 ranged from 88% to 94%, with an average of 92%. This finding is consistent with previous research using the RSVP task (Rokke et al., 2002). Accuracy rates were submitted to a 3 (Group: PTS, TC, NAC) × 2 (Word type: threat, neutral) factorial analysis of variance (ANOVA) with repeated measurement on the last two factors. Results revealed no significant effects (*ps* > .1).

T2 Performance

Mean percentage accuracy for T2 was calculated for trials where T1 was identified correctly (Fox et al., 2005; Rokke et al., 2002). We then submitted these data to a 3 (Group: PTS, TC, NAC) × 2 (Task type: single, dual) × 2 (Word type: threat, neutral) × 6 (Lag: 1, 2, 3, 4, 5, 8) factorial analysis of variance (ANOVA) with repeated measurement on the last three factors. Results revealed significant main effects of Task, $F(1, 41) = 82.5$, $p < .001$, and Lag, $F(1, 41) = 11.5$, $p < .001$, that were modified by interactions of Task type × Lag, $F(5, 205) = 9.8$, $p < .001$, Group × Task type × Word type, $F(2, 41) = 4.2$, $p < .03$, and Group × Task type × Word type × Lag, $F(10, 205) = 2.14$, $p < .03$. None of the other effects were significant (*ps* > .1)

To follow-up the four-way interaction, we conducted separate 3 (Group) × 2 (Word type) × 6 (Lag) mixed ANOVAs with repeated measurement on the last two factors within each Task type. In the single task condition this analysis revealed a significant main effect of Lag, $F(5, 205) = 12.01$, $p < .001$, that was modified by a Word Type × Lag interaction, $F(5, 205) = 3.06$, $p = .01$. No other effects were reached significance (*ps* > .05). Because none of the effects including the group factor were significant we did not conduct further analyses for the single task condition.

Analysis of the dual task condition revealed a significant main effect of Lag, $F(5, 205) = 10.43$, $p < .001$, that was modified by a significant Word type × Lag × Group interaction, $F(10, 205) = 1.99$, $p < .04$. None of the other effects were significant (*ps* > .05). To examine the three-way interaction further, we conducted separate 2 (Word type) × 6 (Lag) repeated measures ANOVAs for each of the three groups. For the PTS group, this analysis revealed significant main effects of Word type, $F(1, 14) = 8.10$, $p < .02$ and Lag, $F(5, 70) = 2.89$, $p = .02$, that were modified by an interaction of Word type × Lag, $F(5, 70) = 2.35$ $p < .05$. Simple effects analysis revealed that participants in the PTS group were significantly more accurate at detecting T2 when T1 was a threat word versus a neutral word at lags 3 and 5, $t(14) = 2.34$, 2.79 respectively, both $p < .05$. No differences emerged for T2 accuracy following threat relative to neutral words at all other lags (all $p > .10$). For the TC and NAC groups, the 2 (Word type) × 6 (Lag) ANOVA revealed a significant main effect of Lag, $F(5,70) = 6.42$, 3.74, respectively, both $p < .05$. No other main effects or interactions were significant. Figure 2, Figure 3, and Figure 4 depict the pattern of AB in each group[2].

Discussion

Results of the present study demonstrate that individuals with high levels of PTSD symptoms were more accurate at detecting a neutral T2 stimulus at lags 3 (300 ms) and 5 (500 ms) following presentation of a trauma-related word at T1 compared to when T1 was neutral. In contrast, individuals with prior trauma exposure without symptoms of PTSD, and non-trauma exposed non-anxious controls did not differ in patterns of temporal processing for threat versus neutral stimuli. Current results suggest that individuals with PTSD symptoms may process trauma-relevant stimuli more rapidly and efficiently than neutral information, resulting in faster recovery of attention resources after encountering threatening information. These findings are consistent with earlier studies examining temporal processing of emotional information in anxiety (Arend & Botella, 2002; Cisler et al., 2007) as well as research indicating biased attentional processing of threat-relevant information in PTSD (see Buckley et al., 2000; Constans, 2005; Mathews & MacLeod, 2005). However, this serves as the first study to specifically examine the temporal sequence of attentional processing in PTSD with the RSVP paradigm.

Current findings suggest that one associated feature of PTSD may be heightened efficiency of basic cognitive systems involved in initial detection and identification of threatening environmental stimuli. Cognitive theorists posit that following exposure to a traumatic event some individuals demonstrate biased information processing that lead cues associated with the initial trauma to become readily accessed and assimilated into existing memory structures (Foa et al., 2006; McNally, 2006). This preferential processing of threat is hypothesized to reinforce preoccupation with the trauma and contribute to priming of emotional information (Michael et al., 2005), increasing the speed and strength with which semantic representations of trauma-relevant stimuli become activated. Thus, rapid identification and appraisal of threat-relevant stimuli occurring repeatedly in the aftermath of trauma may increase efficiency of threat detection and evaluation. However, future studies should examine whether processes specific to PTSD, rather than to heightened state anxiety, are responsible for the current results.

Experimental paradigms measuring spatial versus temporal attention processes in PTSD may reflect different components of an underlying cognitive hypervigilance construct. Hypervigilance comprises at least two subcomponents of attentional processing: the initial correct *detection* of threat-relevant stimuli and the subsequent *processing* of those stimuli once attended. Previous research examining the spatial orientation of attention in PTSD primarily addresses the detection of threat in one's environment relative to other stimuli. However, these task do not address the second subcomponent, namely how threat is processed once identified.The results from the RSVP paradigm allowed us to disambiguate the early detection of threat and the efficiency of threat processing, and suggest that trauma-relevant cues are processed more efficiently in individuals with symptoms of PTSD relative to neutral stimuli. That is, threat information appears to be identified rapidly, such that information following approximately 300–500 ms after the threat can also be processed. One implication of these findings is that the speeded processing of threatening information characteristic of individuals with PTSD may interfere with their ability to effectively reappraise the meaning associated with trauma-relevant stimuli in a more benign manner.

In contrast to the PTS group, the TC and NAC groups did not differ in their processing efficiency of T2 stimuli following emotional versus neutral stimuli at T1. Although these findings may appear to stand in contrast to recent research that found evidence of an increased AB effect for emotional stimuli at T1 that was processed semantically (Huang et al., 2008), methodological differences between these studies may account for the different results. Huang et al. required semantic processing for both T1 and T2, such that participants were required to process every word in the RSVP stream in order to detect he appropriate target (i.e., the word that represented a fruit category). In contrast, the current study only required that participants categorize T1, while requiring simple detection of T2. Future research should examine the effect of manipulating semantic processing of emotional and neutral information at T1 versus T2 in the RSVP task in non-anxious individuals.

Our study has limitations. First, the PTS group in the current sample comprised undergraduate students endorsing high levels of PTSD symptoms on a self-report measure. Although the PDS demonstrates satisfactory agreement with DSM diagnostic criteria (Foa et al., 1997), given that diagnostic status was not assessed with a clinical interview, extrapolation to individuals with diagnosis of PTSD remains to be established. In addition, participants reported exposure to varying types of traumatic events. It is unclear whether the type of trauma experienced by participants influenced the current findings, and how the specific stimuli used in this paradigm might impact performance on the task differentially for individuals depending upon the specific type of trauma experienced. For example, individuals in the PTS group may have had more severe trauma, given that trauma severity is associated with greater risk of PTSD development (Brewin, Andrews, & Valentine, 2000). Future studies using this paradigm might consider matching trauma histories. Furthermore, the PTS group differed from the TC and NAC groups on self-reported state anxiety and dysphoria. Given that we did not include other control groups (e.g., depressed individuals) in this study, we cannot speak to the specificity of the findings to PTSD versus other types of psychopathology. The limited information collected on comorbid conditions precludes an examination of how such co-occurring conditions may influence responses in this paradigm. Finally, the sample used in the present study is relatively small. This may have influenced the findings, particularly the lack of a significant difference between neutral and threat stimuli at time point four in the PTS group. Future studies should be conducted to replicate these findings.

In summary, our results are consistent with that of earlier research implicating the role of attention bias for threat in the pathophysiology of PTSD. The current study extends the extant literature, however, by serving as the first study to examine the temporal stream of attentional processing in the context of trauma-relevant information in PTSD. In doing so, we found evidence pointing to the rapid and efficient processing of threat-relevant cues in individuals with symptoms of PTSD, a cognitive pattern not found in traumatized individuals without symptoms of PTSD, as well as non-traumatized, non-anxious controls. Present findings are consistent with cognitive theories of anxiety that implicate preferential processing of trauma-relevant information in the persistence PTSD (Brewin & Holmes, 2003; Ehlers & Clark, 2000; Foa et al., 2006).

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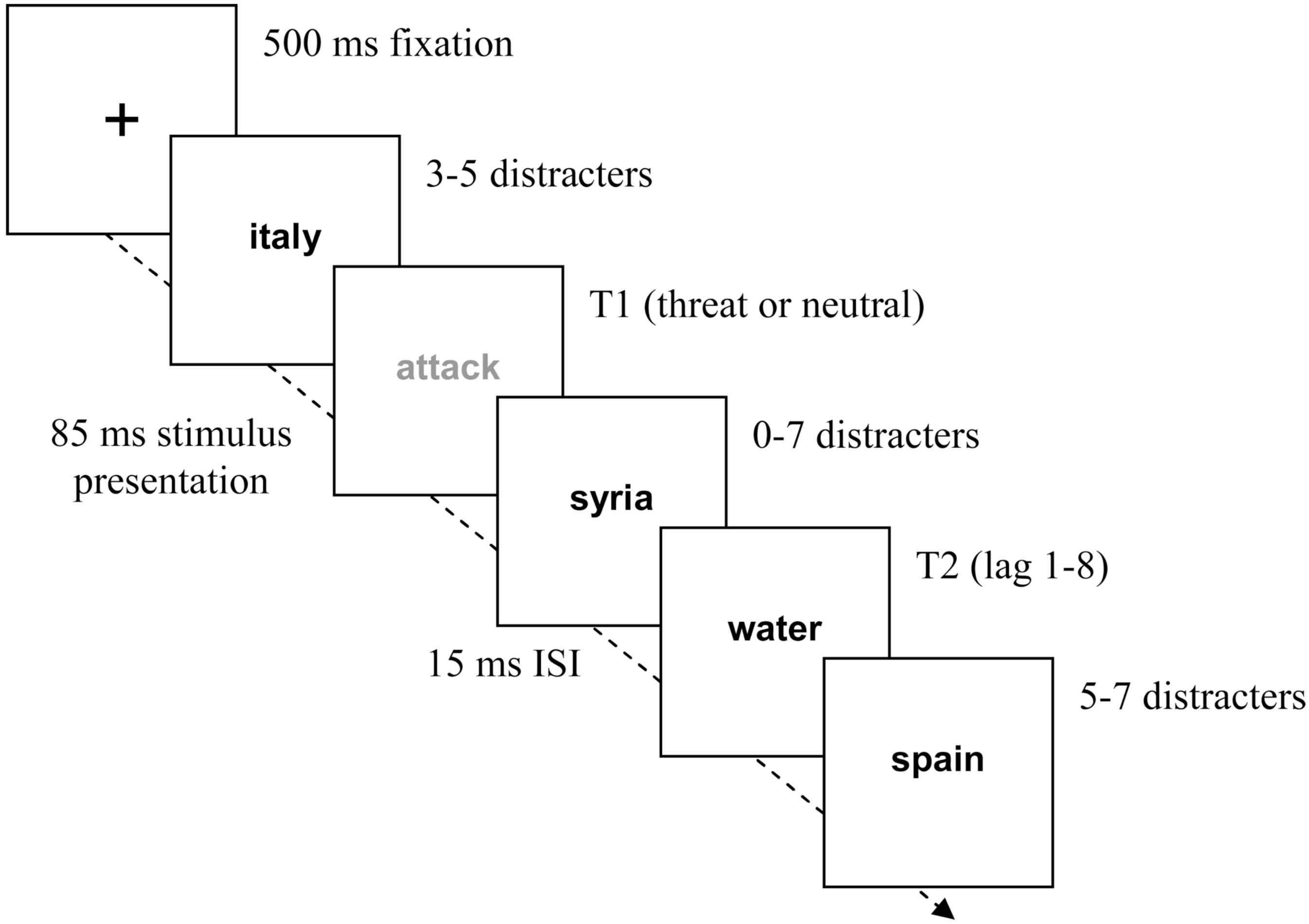

Figure 1.
The order of stimuli presentation within each trial.

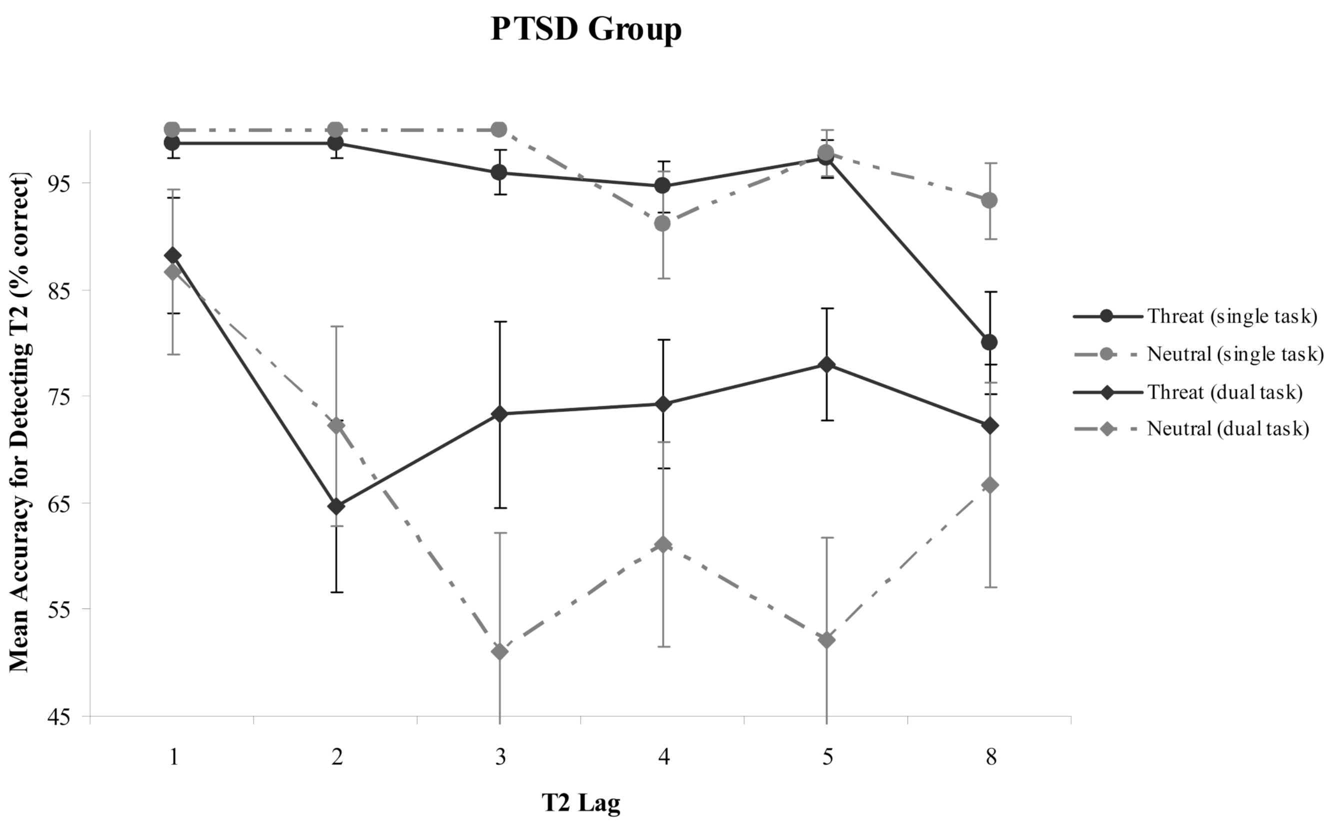

Figure 2.
Pattern of attentional blink for PTSD group.

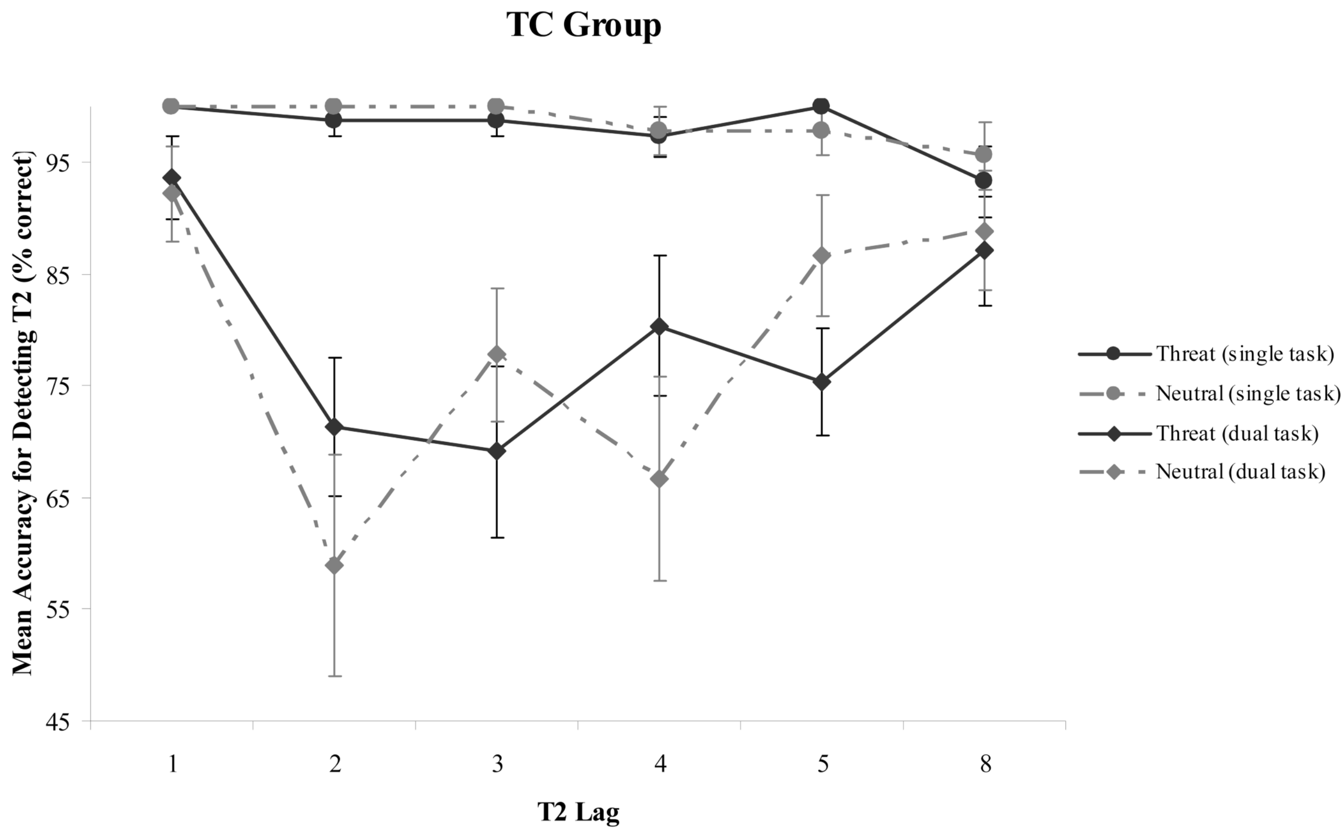

Figure 3.
Pattern of attentional blink for TC group.

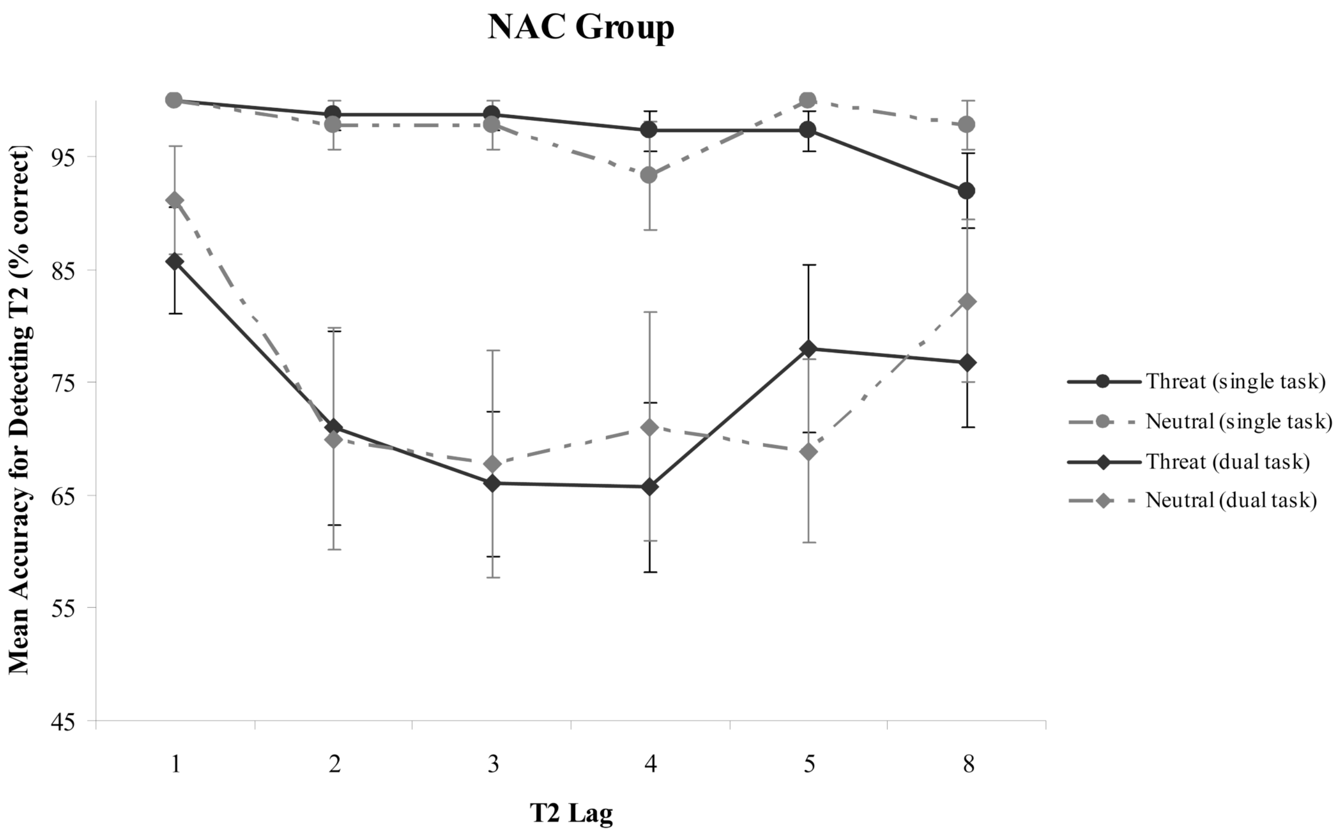

Figure 4.
Pattern of attentional blink for NAC group.

Table 1

Trauma Type Endorsement.

	PTSD*	TC*
Accident	4	4
Natural disaster	0	4
Non-sexual assault by a stranger	0	1
Sexual assault by a family member or someone known	3	1
Sexual assault by a stranger	1	1
Life-threatening illness	3	3
Other	2	0
Single Trauma	4	5
Multiple Traumas	11	10

Note. Three participants with multiple traumas failed to identify a primary trauma (2 PTSD, 1 TC). Of the two participants endorsing “other,” one reported a traumatic hospitalization experience, and the other reported almost drowning.

Table 2

Demographic and clinical characteristics.

	PTSD	TC	NAC	*F*
	M (SD)	M (SD)	M (SD)	
Age	19.3 (1.5)	19.3 (1.0)	19.3 (1.5)	0.00
Education (years)	13.5 (1.3)	13.5 (1.2)	13.5 (0.9)	0.00
Gender	13 female	7 female	6 female	7.5*
PDS	24.2 (9.7)	0.3 (0.6)	-- (--)	95.01**
BDI	19.1 (11.5)	4.4 (2.5)	5.9 (4.5)	18.23**
STAI-S	44.0 (12.2)	31.2 (8.2)	32.6 (9.6)	7.00*
STAI-T	50.8 (12.4)	33.4 (7.0)	35.8 (9.0)	13.43**

* $p < .05$

** $p <. 001$