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Attentional bias for affective visual stimuli in posttraumatic stress disorder and the role of depression

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ABSTRACT

An attentional bias for trauma-related verbal cues was frequently demonstrated in posttraumatic stress disorder (PTSD) using variants of the emotional Stroop task (EST). However, the mechanisms underlying the Stroop-effect are ill-defined and it is yet unclear how the findings apply to different paradigms and stimulus modalities. To address these open questions, for the first time a spatial-cuing task with pictorial cues of different emotional valence was administered to trauma-exposed individuals with and without PTSD, and non-trauma-exposed controls. Groups did not show different response profiles across affective conditions. However, a group effect was evident when comparing depressed with non-depressed individuals: Those with depression showed delayed attending towards trauma-related cues and faster attending away from negative cues. In correlational analyses, attentional avoidance was associated with both depression and PTSD symptom severity. These findings highlight the need for research on trauma populations and anxiety in general to pay closer attention to depression as an important confound in the study of emotional information processing.

1. Theoretical background

Attentional biases have been ascribed a prominent role in cognitive accounts of posttraumatic stress disorder (PTSD; e.g., Foa et al., 1989; Ehlers and Clark, 2000; Brewin, 2001), empirically supported by a large number of studies demonstrating attentional bias for trauma-related stimuli (for reviews see Buckley et al. (2000), Constans (2005); but see also Kimble et al. (2009)). According to long-held assumptions (e.g., fear network model, Foa et al. (1989)) the attentional bias in PTSD reflects a preferential encoding of (i.e., facilitated attention towards) trauma-related information, corresponding to symptoms of hypervigilance (Constans, 2005) which represent a core feature of PTSD (DSM-IV, American Psychiatric Association, 1994).

However, despite a vast gain of insight from numerous studies in this field, results are not fully consistent and the exact profile of the observed attentional bias has not yet been entirely pinpointed. In part, this is owing to the fact that the vast majority of studies used emotional variants of the "Stroop task" (Stroop, 1935; for reviews see Buckley et al. (2000), Constans (2005), Yiend (2010)) which does not allow for disentangling different components involved in the effect (e.g., Fox et al., 2001; Derryberry and Reed, 2002). More specifically, results generated with the Emotional Stroop task (EST) remain silent about whether the observed attentional bias reflects "attentional facilitation" (i.e., faster detection of trauma-related compared to neutral stimuli), "attentional interference" (i.e., impaired ability to disengage from a trauma-related stimulus), or "attentional avoidance" (i.e., allocating attention towards locations opposite to a trauma-related stimulus) (Cisler and Koster, 2010). These three attentional bias components, however, are each likely to play a distinct role in the etiology and maintenance of PTSD symptomatology (Shipherd and Salters-Pedneault, 2008; Pineles et al., 2009). For example, attentional interference may lead to an over-evaluation of trauma-related information, whereas attentional avoidance of these stimuli is likely to increase and prolong the distress experienced when encountering a trauma reminder in the long run. Facilitation could be associated with hypervigilance symptoms (Pineles et al., 2009).

Only more recent studies have employed different paradigms to test whether attentional bias in PTSD replicates across different methodologies. Moreover, these newer paradigms aim to disambiguate attentional bias components which may be effective in PTSD.

1.1. Dot-probe and visual search tasks in attentional bias research in PTSD

Newer studies have used "dot-probe" (MacLeod et al., 1986) or "visual search tasks" (VST; for a review see Ohman et al. (2001)) to investigate attentional biases in PTSD. In dot-probe tasks,

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participants simultaneously view a threatening and a neutral stimulus. After a set time, a probe substitutes one of the two stimuli, to which participants are requested to respond. Attentional facilitation is inferred from faster reaction times and attentional avoidance from longer reaction times to those probes that appear at the location of the threatening relative to the neutral stimulus. Studies yielded mixed results: Bryant and Harvey (1997) demonstrated attentional facilitation for mild but not for strong threat words in PTSD, whereas Dalgleish et al. (2003) did not find attentional facilitation for general threat words but an attention bias away from depression-related words. In a study by Elsesser et al. (2004), PTSD patients and recent trauma victims did not show different response latencies for neutral and trauma-relevant pictorial cues relative to nontraumatized controls. Recent studies (Bar-Haim et al., 2010; Wald et al., 2011a, 2011b) examining attentional bias under (life-) threatening conditions (e.g., rocket attacks) demonstrated attentional avoidance of threat-related words to be associated with acute proximal stress and stress-related psychopathology (PTSD and depression symptoms). In a longitudinal approach (Wald et al., 2011b) attentional avoidance during threat predicted higher rates of PTSD symptoms at 1-year follow-up.

Only two studies by Pineles and colleagues (2007, 2009) used VSTs, in which participants were asked to identify a discrepant target (threatening, e.g., "rape") in an array of identical stimuli (neutral, e.g., "trrl"). Slower reactions to neutral target words within arrays of threat words as compared to arrays of neutral words were interpreted to reflect attentional interference. Attentional facilitation was assumed when participants responded faster to threat targets in arrays of neutral words as compared to neutral targets within arrays of neutral words. Pineles and colleagues did not find attentional facilitation but instead, PTSD was linked with attentional interference from trauma-related relative to neutral (Pineles et al., 2007, 2009) as well as to general threat-related words (Pineles et al., 2009). They proposed that attentional interference could be an important factor contributing to the maintenance of PTSD whereas attentional facilitation may be a relatively weak or even non-existing phenomenon in PTSD (Pineles et al., 2009).

Still, a number of questions has remained unsolved in research on attentional bias in PTSD. Despite methodological advantages over the emotional EST paradigm, dot-probe and VST are not free of interpretational problems either. For example, the simultaneous presentation of emotional and neutral words in both tasks may cause difficulties in isolating attentional effects for the targets from those of the distracters (Yiend, 2010). Also, in VST reaction times depend on the number and location of distracters which further burdens the interpretation and comparability of the results (e.g., Ohman et al., 2001). Second, evidence is yet inconclusive with regard to the specificity of attentional bias components in PTSD (e.g., Fleurkens et al., 2011). On the one hand, it remains unclear, to which extent each attentional bias component is specific for trauma-related cues ("pathology congruent", for a review see Williams et al. (1997)) or generalizes to other emotional material (e.g., general threat-, depression- related, i.e., "stimulus specifity"). On the other hand, little is known about the degree to which attentional biases are specific for PTSD (i.e., "psychopathology specifity") or related to secondary factors, such as depressive symptomatology, which has been shown to be an important confound in other studies (Burt et al., 1995; Moritz et al., 2003) and associated with attentional biases both in trauma-exposed (e.g., Bar-Haim, 2010) and non-exposed individuals (see meta-analysis by Peckham et al. (2010)). Third, with only one exception (Elsesser et al., 2004), attentional bias research in PTSD has primarily employed verbal stimuli, though, it has been argued that investigation of verbal information processing may not provide a sufficient test of processing biases with regard to trauma-related information (e.g., Constans, 2005). Pictorial stimuli are thought to possess a greater ecologic validity than verbal material (Mogg et al., 2004; Moritz et al., 2008). Thus, in view of these open questions, studies using different paradigms and stimulus modalities (i.e., pictorial) are required before further conclusions can be drawn.

1.2. Emotional spatial-cuing paradigm

A paradigm suited for the simultaneous investigation of attentional facilitation, interference, and avoidance is the "spatial-cuing paradigm" (Posner, 1980), in which participants are demanded to detect a visual target presented at the left or right side of a fixation point. In some of the trials, a cue precedes the target at the same location ("valid trials"), whereas in the other trials the cue is presented on the opposite side to the target ("invalid trials"). In emotional variants of the cuing paradigm, the cue may be varied with regard to its emotional valence (e.g., threat vs. neutral). Attending towards a cue "attentional engagement" (i.e., faster=facilitation and slower=avoidance, respectively) is reflected by RTs in *valid* trials with threat compared to neutral cues, whereas attending away "attentional disengagement" (i.e., faster=avoidance and slower=interference, respectively) is indicated by RTs for threat compared with neutral cues in *invalid* trials. The duration of the cue-target intervals (stimulus onset asynchrony, SOA; e.g., Moritz et al. (2009)) may be varied between long and short SOAs. The use of long and short SOAs has been suggested by Yiend (2010) in order to gain a more complete picture of attention allocation over time.

Whereas emotional variants of the spatial-cuing paradigm have been increasingly used to investigate attentional bias components in different anxious populations, such as individuals with high trait anxiety (Koster et al., 2006), social phobia (e.g., Amir et al., 2003), or obsessive-compulsive disorder (Moritz et al., 2009; Cisler and Olatunji, 2010), to the best of our knowledge, it has not yet been employed to examine attentional bias in PTSD.

In summary, an attentional bias in PTSD has frequently been demonstrated using variants of the EST. However, the components of attentional bias underlying the Stroop-effect are unclear and relatively few studies investigated whether attentional bias in PTSD translates to different paradigms. More recent studies using VST or dot-probe tasks found stimulus avoidance (e.g., Bar-Haim et al., 2010; Wald et al., 2011b) or interference (e.g., Pineles et al., 2007, 2009) in PTSD. Still, evidence is scarce and it remains unclear whether these findings replicate across different paradigms (i.e., spatial-cuing tasks) and stimulus modalities (i.e., visual).

1.3. The present study

The primary aim of the present study was to replicate and extend previous findings of attentional bias in PTSD by investigating presence and specificity of attentional facilitation, interference, and avoidance for visual stimuli of varying emotional valence in PTSD. We further aimed to control for the effect of depression as a common posttraumatic (comorbid) condition (American Psychiatric Association, 1994), likewise associated with attentional biases which – when overlooked – could be misattributed to the primary condition.

To meet this purpose, for the first time, we used a newly developed emotional cuing paradigm with neutral, general threat-related, negative event-related, and trauma-related pictorial cues. The paradigm was presented to individuals who had experienced trauma of interpersonal violence with and without PTSD, as well as to non-trauma-exposed controls. Both, a diagnosis and severity of