



In the face of danger: Exploring the attentional blink to emotional facial expressions in PTSD



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ABSTRACT

There is a wealth of evidence demonstrating an attentional bias to threat-related information in posttraumatic stress disorder (PTSD) and other anxiety disorders. However, there is an ongoing debate whether an enhanced identification of threatening information or rather difficulties to disengage from such signals of danger constitute this bias. The present study used a dual target rapid visual presentation paradigm to examine the temporal allocation of attention to facial expressions of anger and happiness in 16 Palestinian victims of torture with PTSD and 16 control subjects. Findings revealed that signals of threat seem to interfere with already processed information in individuals suffering from PTSD. In contrast, PTSD does not facilitate attention to threatening information. The data provide support for detrimental disengagement as an underlying mechanism of the attentional bias toward threat in PTSD, possibly contributing to symptom development and maintenance.

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1. Introduction

Individuals suffering from posttraumatic stress disorder (PTSD) are well-known to display a symptom pattern consisting of intrusive re-experiencing and hypervigilance toward trauma-associated cues while at the same time making efforts to avoid thoughts and potential reminders of the trauma (situations, places, and people). A wealth of studies has examined putative attentional mechanisms underlying anxiety disorders in general and PTSD symptoms in particular (for review, see [Cisler and Koster, 2010](#)).

Research indicates that PTSD is associated with a hypervigilance toward threat-related stimuli, thus reflecting a generalized hyperactivation or hypersensitivity of the basal fear network (e.g., [Buckley et al., 2000](#); [Moore, 2009](#)). This attentional bias is thought to constitute the main mechanism in maintaining the core symptoms, such as flashbacks and hyperarousal ([Cahill and Foa, 2007](#)). Accordingly, a threat-related bias for trauma-associated words has been repeatedly demonstrated using the emotional Stroop task (for review, see [Williams et al., 1996](#)) and the dot-probe paradigm (e.g., [Bryant and Harvey, 1997](#); [El Khoury-Malhame et al., 2011](#)). While the association with PTSD is well established, there is an ongoing discussion regarding the origin of the attentional bias, namely whether it is a result of an

enhanced identification and more efficient processing of threat-related material (attentional facilitation) or of failures to disengage from it (attentional interference) ([Cisler and Koster, 2010](#)). There is some evidence suggesting disengagement may be the key process in PTSD: in a visual search experiment, attentional facilitation and attentional interference were simultaneously examined by manipulating the trauma-relevance of target and distractor stimuli ([Pineles et al., 2007, 2009](#)). Individuals suffering from PTSD showed difficulties in disengaging from trauma-associated words, whereas no support was found for attentional facilitation.

The above mentioned paradigms are restricted to the measurement of spatial allocation of attention and thereby neglect the role of the temporal components. Hence, effort has been made to examine the temporal distribution of attention toward threatening information using the rapid serial visual paradigm (RSVP), also referred to as the attentional blink (AB) paradigm. This experimental setting is thought to be more comparable to real world situations, in which an individual is faced with a continuous stream of stimuli that compete for cognitive resources. In the AB paradigm, the saliency of visual stimuli is defined as a function of their correct detection following the identification of a preceding target stimulus within a rapidly presented series of distracter stimuli. The underlying assumption is that salient second stimuli break through a usually observable refractory period that occurs between 200 and 500 ms following identification of the first stimulus ([Shapiro et al., 1997](#)). An attenuated AB, i.e., the correct identification of the second target (T2) presented in close temporal proximity following a preceding target (T1),

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has been consistently demonstrated for threatening or emotionally arousing stimulus material (e.g., words, facial expressions, schematic facial expressions) as T2 (Anderson, 2005; de Jong et al., 2009; Keil and Ihssen, 2004; Maratos et al., 2008). In contrast, a threatening T1 has been shown to increase the AB effect as compared to a neutral T1 (de Jong et al., 2010; Mathewson et al., 2008; Schwabe and Wolf, 2010). Interestingly, lower identification rates of T1 when followed by an arousing or threatening T2 have also been observed, an effect coined backward blink (de Jong and Martens, 2007). With reference to the two basal processes outlined before, an attenuated AB may be regarded as attentional facilitation, whereas an increased AB as well as the occurrence of a backward blink indicates attentional interference in the temporal domain.

Preliminary evidence supports the assumption that the magnitude of the AB effect may be modulated by anxiety. While low-anxious individuals reportedly show a relatively strong AB to fearful and happy facial expressions as T2, the AB effects were attenuated for threatening relative to happy facial expressions in high-anxious individuals (Fox et al., 2005), therefore supporting findings representing a hypervigilance of the threat-detection system. A more recent study examined AB effects in high- and low-socially anxious women and found a diminished AB when T2 was a threatening face while the presentation of an angry face as T1 did not lead to a significant increase in the AB effect as compared to a happy T1 (de Jong and Martens, 2007). Interestingly, an angry T2 resulted in a poorer identification of a happy T1, representing a backward blink. However, no evidence was found to suggest that any of the observed effects was especially pronounced in high-socially anxious individuals. Subsequent studies also failed to find altered AB effects in this population (de Jong et al., 2009, 2010). Since the above mentioned findings arise from analog samples of high- or low-anxious students, it remains an unresolved issue whether formally diagnosed patients exhibit different patterns with respect to the AB phenomena.

More recently, a study employed the AB paradigm to explore the temporal allocation of attention to threatening stimuli in PTSD by manipulating the emotional content of the T1 instead of the T2 stimulus (Amir et al., 2009). The authors reported that the AB effect was significantly attenuated when a threatening T1 was followed by a neutral T2 as compared to a neutral T1 in the PTSD group. The results led the authors to suggest that subjects suffering from PTSD may process trauma-associated stimuli more rapidly than benign stimulus material, thus showing facilitated disengagement. However, there are some methodological weaknesses that may challenge these conclusions. For one, the sample consisted of undergraduate students endorsing high or low PTSD symptoms on a self-report measure, which makes an extrapolation to clinical populations questionable. In addition, the authors used nonspecific trauma-related words as T1 (e.g., nightmare, helpless), and approach that can be equivocal in its individual association to the traumatic experience.

In summary, there is evidence for the assumption that threatening stimuli are preferentially processed in certain temporal windows, thus deflecting attentional resources at the expense of previously or subsequently appearing information. However, the evidence for pronounced effects in individuals prone to threat cues is less conclusive. Therefore, the major aim of this study was to explore whether clinically diagnosed patients with PTSD would show an altered pattern of attention allocation to facial expressions of threat in the AB paradigm. For this purpose, we recruited a homogeneous sample of man-made repetitive type II traumatized individuals suffering from severe PTSD symptoms. Emotional faces were used as stimuli, assuming that angry facial expressions would represent threatening trauma-related cues for the addressed PTSD sample. It was expected that symptoms of hyperarousal and hypervigilance caused by interpersonal trauma should lead to a pronounced attentional bias toward angry faces. Another objective of the present study

was to shed light on the basal processes that maintain the clinical symptoms of PTSD and to clarify whether attentional facilitation or disengagement underlies the attentional bias. In other words: are PTSD patients always and generally primed to quickly process threatening stimuli in an environment regarded as potentially dangerous (facilitation) and/or do threat-related stimuli capture and hold attention by means of triggering flashbacks and reminders of the traumatic event (disengagement)? On the basis of the above mentioned literature, we expected an attenuated AB to occur, indicating that angry T2s are more easily detected than happy T2s. With regard to the findings stemming from the visual search task showing no attentional facilitation in PTSD, we did not expect the attenuated AB to be more pronounced in PTSD patients compared to healthy controls. In contrast, we assumed that angry T1s should induce a relatively stronger AB in the PTSD group than happy T1s (i.e., lower identification rates for T2). In addition, we expected a more pronounced backward blink in the PTSD group, i.e., more correct answers to T1 when followed by a happy compared to an angry T2. Both effects are indicative of difficulties in disengagement from threat.

2. Methods

2.1. Participants

The experimental group subjects ($n=16$) were male patients seeking psychological treatment at the Treatment and Rehabilitation Center for Victims of Torture in the West Bank, Palestine. All subjects (>18 years) had been repeatedly tortured during their imprisonment after the beginning of the second Intifada in 2000. Participants were diagnosed with severe PTSD by the attending psychiatrists, had no comorbid diagnosis of schizophrenia or bipolar disorder and were not medicated. Individuals were informed about the present study by their therapist. After the subjects indicated willingness to participate, they were approached by a member of the research team (T.A.), who explained study aims and procedure to all participants and carried out the study protocol. The validity of clinical diagnosis was verified with the Harvard Trauma Questionnaire (parts A & B; Mollica et al., 1992), as well as through an oral assessment of the relevant DSM-IV criteria for PTSD. The initially planned non-help-seeking control group of ex-detainees without PTSD was to be recruited via the Palestinian Prisoners Club. However, this control group was not included in our design due to the lack of individuals free of substantial PTSD symptoms. Therefore, we recruited a sample of 16 healthy German individuals with no traumatic experiences. The control group was recruited through advertisements at the university campus. Male volunteers were chosen to match age and education level of the clinical participants. After being screened for the presence of a (life-time) psychiatric disorder, healthy participants were tested immediately (M.S. & T.A.). All participants from both groups were university students or had recently graduated. Both groups completed a short version of the Symptom Checklist-90 (SCL-10R; Rosen et al., 2000) and the Beck Depression Inventory (BDI; Beck and Steer, 1987). The PTSD group exhibited significantly higher psychological distress and increased depression scores compared to the healthy controls (see Table 1). This research was approved by the university's Ethics Committee and all participants provided written informed consent. All subjects received monetary compensation (5 Euro).

2.2. Stimuli

Digitized color photographs were selected from the Karolinska Directed Emotional Faces database (Lundqvist et al., 1998). We used six male faces (M08, M10, M13, M17, M30, M31) and included angry, happy (as T1 and/or T2s) and neutral expressions (as distracters) for the experimental trials. Sad, disgusted and surprised facial expressions were used for practice trials. Expression accuracy rates were $>90\%$ for all selected models (Calvo and Lundqvist, 2008). With reference to the finding that exposed teeth are especially likely to attract attention and might facilitate detection (Calvo and Nummenmaa, 2008), we only selected models with visible teeth in the happy and

Table 1
Demographic and clinical characteristics.

Variable	PTSD	Controls	Statistics
Age, mean (SD)	25.25 (2.44)	24.06 (2.67)	$t(30)=1.31, p=0.199$
BDI	24.75 (15.62)	2.06 (2.77)	$t(30)=5.72, p<0.001$
SCL-10R	19.19 (8.11)	2.88 (3.67)	$t(30)=7.33, p<0.001$

Note. BDI=Beck Depression Inventory; SCL-10R=Symptom Checklist 10-Revised.

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