



Review

Modification of cognitive biases related to posttraumatic stress: A systematic review and research agenda



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ABSTRACT

Cognitive models of Posttraumatic Stress Disorder (PTSD) postulate that cognitive biases in attention, interpretation, and memory represent key factors involved in the onset and maintenance of PTSD. Developments in experimental research demonstrate that it may be possible to manipulate such biases by means of Cognitive Bias Modification (CBM). In the present paper, we summarize studies assessing cognitive biases in posttraumatic stress to serve as a theoretical and methodological background. However, our main aim was to provide an overview of the scientific literature on CBM in (analogue) posttraumatic stress. Results of our systematic literature review showed that most CBM studies targeted attentional and interpretation biases (attention: five studies; interpretation: three studies), and one study modified memory biases. Overall, results showed that CBM can indeed modify cognitive biases and affect (analog) trauma symptoms in a training congruent manner. Interpretation bias procedures seemed effective in analog samples, and memory bias training proved preliminary success in a clinical PTSD sample. Studies of attention bias modification provided more mixed results. This heterogeneous picture may be explained by differences in the type of population or variations in the CBM procedure. Therefore, we sketched a detailed research agenda targeting the challenges for CBM in posttraumatic stress.

Posttraumatic Stress Disorder (PTSD) is a psychological reaction following one or several traumatic events. According to the Diagnostic and Statistical Manual of Mental Disorders-5th edition (DSM 5, 2013), PTSD is characterized by four symptom groups: (a) involuntary memories of the trauma such as intrusions or nightmares; (b) persistent avoidance of stimuli associated with the traumatic event; (c) negative alterations in cognitions and mood that are associated with the trauma; and (d) alterations in arousal and reactivity that are associated with the trauma. Research suggests that most victims recover spontaneously (e.g., Foa & Riggs, 1995). However, for 10–15% of the victims, the symptoms persist (e.g., Foa & Rothbaum, 1998; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), depending on various external (e.g., the type of trauma) and intrapersonal factors (e.g., emotion regulation skills, cognitive biases). If the symptoms persist for more than a month, the diagnosis of PTSD can be given.

To elucidate the specific contribution of cognitive factors to the development and maintenance of PTSD, several information processing theories have been proposed in the past 30 years (e.g., Brewin, Dalgleish, & Joseph, 1996; Dalgleish, 2004; Ehlers & Clark, 2000; Foa, Steketee, & Rothbaum, 1989). These theories converge on the idea that

PTSD symptoms can be explained best by alterations or dysfunctions in cognitive processing. Three specific cognitive biases have been identified in emotional disorders (for reviews, see e.g., Barry, Vervliet, & Hermans, 2015; Hirsch, Meeten, Krahé, & Reeder, 2016; Mathews & MacLeod, 2005), which can be also found in the context of PTSD (for review, see e.g., Buckley, Blanchard, & Neill, 2000; Johnson, Bomyea, & Lang, 2017): attention, interpretation, and memory biases. According to the cognitive model of Ehlers and Clark (2000), cognitive biases for trauma-relevant information contribute to a sense of ‘current threat’, which (partly) determines the degree to which an individual will spontaneously recover from the traumatic experience.

Current research shows that cognitive biases are correlated with PTSD symptomatology. However, it remains unclear whether cognitive biases causally contribute to PTSD (Kraemer et al., 1997). Developments within experimental research demonstrate that cognitive biases may be manipulated by means of Cognitive Bias Modification (CBM; cf.: Koster, Fox, & MacLeod, 2009; Woud & Becker, 2014). There is a substantial and promising body of research on CBM in emotional disorders which is summarized in various reviews and meta-analyses (e.g., Cristea, Kok, & Cuijpers, 2015; Hallion & Ruscio, 2011;

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MacLeod & Mathews, 2012). Importantly, there is also a growing body of CBM research in the field of psychological trauma. To the best of our knowledge, this evidence has not previously been reviewed. Hence, the main aim of the present review is to provide a systematic overview of CBM research in the field of PTSD and (analogue) trauma. Before presenting these results we will first provide an illustrative overview of exemplary studies assessing cognitive biases in psychological trauma. This overview defines the type of cognitive biases we are interested in to serve as a background for the reader.

1. Current evidence for cognitive biases in PTSD

1.1. Attention

This section summarizes studies assessing biased attention in PTSD, structured according to the paradigms commonly used to measure attentional processes.

1.1.1. Emotional Stroop task

In the emotional Stroop task (ES; Cisler et al., 2011; Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007), participants are exposed to printed color words that may or may not be related to their traumatic experience. Participants are instructed to ignore the words' meaning and instead name the words' print color. Longer response latencies for trauma-related or anxiety-related versus other color words reflect trauma-specific and general-threat-related attentional bias, respectively. Literature reviews on ES effects reveal different conclusions. Based on a qualitative review in dissertation abstracts (Kimble, Frueh, & Marks, 2009) and a meta-analysis (Cisler & Koster, 2010), evidence for trauma-specific attentional bias in PTSD appears to be scarce. As reported by Cisler and Koster (2010), evidence generally shows biased responding for trauma-relevant words both in PTSD patients and trauma-exposed controls when these groups are compared with healthy controls. An interim summary of research revealed that interference effects for trauma-relevant words can be best explained by trauma-exposure alone (Cisler & Koster, 2010; Van Bockstaele et al., 2014). To conclude: various studies suggest that the ES paradigm as index of attention bias is unable to detect enhanced processing of trauma-related or general threat-related information in PTSD.

1.1.2. Dot probe task

In the dot probe task (MacLeod, Mathews, & Tata, 1986), a fixation cross is presented in the middle of a computer screen. Subsequently, two cues appear simultaneously left and right or top and bottom of the fixation cross. One of the cues is trauma- or threat-related, the other neutral. After a short presentation (e.g., 500 ms, 1000 ms), one of the cues is replaced by a target stimulus. Participants are instructed to respond to this target as fast as possible. Hence, an attentional bias is inferred from faster reaction times on trials where a target replaces a trauma cue (congruent trials) compared to trials where the target appears at the opposite location (incongruent trials) (Van Bockstaele et al., 2014). For instance, Naim et al. (2014) tested a sample of motor vehicle accident survivors within 24 h of hospital admission. A dot probe task was used including threat-neutral word pair combinations. Strength of the cueing effect (the difference in reaction times of congruent minus incongruent trials) as an index of attentional bias towards threat predicted PTSD three months later. This example follows the general pattern of evidence presented in earlier reviews (Bar-Haim et al., 2007; Van Bockstaele et al., 2014), suggesting that the majority of studies do find that attention bias as measured with the dot probe is correlated with PTSD. Yet, with this paradigm, it is difficult to disentangle whether attention bias effects in PTSD reflect a difficulty in disengaging from threat, avoidance from threat, or facilitated attention towards threat. Furthermore, few studies have tested PTSD-related attention bias using trauma-specific stimuli.

1.1.3. Visual search paradigm

In a lexical decision variant of the visual search paradigm, participants are presented with arrays of distracters consisting of several trauma-related or neutral stimuli and a single target stimulus (trauma-related or neutral) that has to be detected and identified. Facilitated engagement of attention is inferred by speeded responding to trauma-related targets compared to non-trauma related targets. Delayed disengagement is measured by comparing trials where a non-trauma target has to be detected in arrays with several trauma-related distracters with trials in which trauma-related targets have to be searched for in arrays of non-trauma distracters. Pineles, Shipherd, Welch, and Yovel (2007), and Pineles, Shipherd, Mostoufi, Abramovitz, and Yovel (2009) compared sexual trauma victims high and low on PTSD symptoms (2009) and Vietnam-era veterans with high and low scores on PTSD symptoms (2007) on attention facilitation and delayed disengagement. Results of both studies showed that the PTSD participants were characterized by delayed disengagement from trauma-related stimuli compared to trauma-exposed controls. No evidence was found for PTSD-related facilitated engagement with trauma stimuli. In the second study, it was found that group differences in attentional bias were specific for trauma-related words: individuals with PTSD and trauma-exposed controls did not show different patterns of responding for general threat words and neutral words. As no other empirical studies have been conducted apart from the ones described here, it is possible to tentatively conclude that the visual search paradigm is able to detect a correlation between attention bias and having a PTSD diagnosis. This evidence points towards a PTSD-related difficulty to disengage attention from trauma-related word stimuli. No evidence was found for facilitated engagement within PTSD groups.

1.1.4. RSVP task

In the rapid serial visual presentation (RSVP) temporal attentional bias can be assessed by comparing the capacity of trauma-related, general anxiety-related and neutral stimuli to impair subsequent target processing. In a recent study (Olatunji, Armstrong, McHugo, & Zald, 2013), veterans with PTSD, trauma-exposed veterans without PTSD, and healthy controls were instructed to identify the rotation of neutral target image as quickly as possible. Distracters preceded the target and consisted of combat-related, disgust, positive, or neutral images. Results showed impaired target detection in the veterans with PTSD after combat-related distracters were presented shortly (200 ms) before the target stimulus. The PTSD group did not differ from the trauma-exposed control group and the healthy controls on trials with disgust, positive and neutral distracters. In summary, although evidence using this paradigm is still scarce (i.e., Olatunji et al., 2013; see also Amir, Leiner, & Bomyea, 2010), results are in line with the studies presented for the dot probe and visual search paradigms showing a specific relationship between attention bias and PTSD.

1.1.5. Brief summary

Taken together, several studies investigating the role of trauma-related and general-threat related attention bias in PTSD using the dot probe, visual search, and RSVP paradigms generally support the idea that long-term persistence of PTSD symptoms after trauma exposure can be explained in part by alterations or dysfunctions in cognitive processing. The ES paradigm has been shown to differentiate between trauma-exposed individuals (both PTSD and non-PTSD) and healthy control participants, but could not detect specific information processing abnormalities related to PTSD.

1.2. Interpretation

This section will first summarize findings obtained via the Post Traumatic Cognitions Inventory (PTCI; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999), and then present studies assessing biased interpretations in PTSD, structured according to the paradigms com-

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