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Treatment sensitivity of implicit threat evaluation, avoidance tendency and visual working memory bias in specific phobia

Andrea Reinecke[a,*], Christian Soltau[b], Jürgen Hoyer[c], Eni S. Becker[d], Mike Rinck[d]

[a] University of Oxford, Oxford, UK
[b] Universitaet Bremen, Bremen, Germany
[c] Technische Universitaet Dresden, Dresden, Germany
[d] Radboud University Nijmegen, Nijmegen, The Netherlands

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ABSTRACT

Cognitive theories of anxiety postulate that negative processing biases play a causal role in the pathogenesis of a disorder, while a normalisation of bias drives recovery. To test these assumptions it is essential to investigate whether biases seen in anxiety are treatment-sensitive, or whether they instead represent enduring vulnerability factors. Twenty-nine spider fearfuls were tested before and after brief cognitive-behaviour therapy (CBT), with half of them additionally being tested before a waiting period to control for retest effects. Using three cognitive bias tasks, we measured implicit threat evaluation (Extrinsic Affective Simon Task), avoidance tendency (Approach-Avoidance Task), and working memory for threat. CBT significantly enhanced negative implicit evaluation and avoidance. This indicates that these cognitive biases are no stable risk factors and provides further evidence for their potential key role in the development and remission of anxiety.

1. Introduction

Cognitive theories of anxiety consider biases in automatic emotional processing as key agents in the pathogenesis and remission of anxiety disorders (e.g. Foa, Huppert, & Cahill, 2006; Williams, Watts, MacLeod, & Mathews, 1997). This assumption is supported by a large number of studies showing an association between heightened states of anxiety and bias, using paradigms that tap into different aspects of information processing: compared to non-anxious controls, anxious individuals show threat-favouring processing biases in attention (for a review, see Mathews & MacLeod, 2005) and visual working memory (VWM; Reinecke, Becker, & Rinck, 2009; Reinecke, Rinck, & Becker, 2006; Reinecke, Rinck, & Becker, 2008), more negative implicit evaluation of fear material (Huijding & de Jong, 2009; Reinecke, Becker, Hoyer, & Rinck, 2010; Teachman, Marker, & Smith-Janik, 2008), and stronger avoidance tendencies in reaction-time based approach-avoidance tasks (Reinecke, Becker, Hoyer, & Rinck, 2010).

Visual working memory bias has recently been studied using a cueing paradigm that allows the experimental manipulation of attention and working memory load (Reinecke et al., 2009; Reinecke et al., 2006). Originally developed in cognitive psychology, this task has been shown to reliably measure VWM storage capacity and serial position effects for neutral stimuli (Wolfe, Reinecke, & Brawn, 2006). However, in the fear bias version of the task (Reinecke et al., 2006), one of the images shows a spider, while all other images are non-threatening. Participants are asked to memorise a subset of images out of a multiple-picture display, and these images are loaded into memory by rapidly being cued one after another. Results show that spider fear is associated with enhanced visual working memory for spider images compared to non-anxious controls. Interestingly, this effect not only occurred for cued spider pictures but also for uncued spiders visible within the display, suggesting that threat stimuli are automatically monitored in VWM (Reinecke et al., 2006).

Furthermore, fear bias has been reliably demonstrated using implicit evaluation or association tasks such as the Extrinsic Affective Simon Task (EAST; De Houwer, 2003). The theoretical concept underlying *implicit evaluation* is that fear is encoded in memory as a network of fear-related situations, fear triggers, and fear responses (Foa et al., 2006; Lang, Cuthbert, & Bradley, 1998). It is assumed that anxiety disorders are underpinned by particularly elaborate or strong connections within this fear network. In the EAST, participants first categorise single valence words as positive or negative, thus implicitly giving a positive versus negative meaning to two response keys. In the main experiment, the same two keys are used to categorise anxiety-relevant stimuli, for instance images of spiders, with respect to a fear-irrelevant dimension, such as the gaze direction of the animal. The implicit fear value of an image can

* Corresponding author at: University of Oxford, Department of Psychiatry, Oxford OX3 7JX, UK.
E-mail address: andrea.reinecke@psych.ox.ac.uk (A. Reinecke).

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be measured by assessing the difference in reaction time with the positive versus with the negative key, as a reaction is faster if the valence of the target matches the valence of the response key (De Houwer, 2003). Recent experimental research has confirmed that compared to healthy controls, patients with anxiety disorders show more negative implicit evaluations of threat stimuli (generalised anxiety disorder: Reinecke, Becker, Hoyer, & Rinck, 2010; panic disorder: Teachman et al., 2008; spider phobia: De Jong, van den Hout, Rietbroek, & Huijding, 2003).

The association of anxiety with processing biases has also been established using an approach-avoidance-task (AAT), which specifically measures *threat avoidance tendencies*. Similarly to implicit evaluation tasks, this paradigm is based on the concept of compatibility versus incompatibility between target stimulus and response. However, this task taps into the behavioural rather than the cognitive component of anxiety (Lang, 1994): in a study addressing bias in spider phobia, participants were required to pull pictures of spiders or butterflies with a joystick whenever a landscape format image was presented, and to push images that were presented in portrait format, or vice versa. To visually support the response movement, pictures shrank in size when pushed and grew when pulled. Participants experience the pushing response as pushing the stimulus away (avoidance), while pulling is experienced as pulling the stimulus closer towards themselves (approach), making it more difficult for spider anxious participants to pull spider images towards them than to push them away (Reinecke, Becker, & Rinck, 2010; Rinck & Becker, 2007).

Taken together, such results to some degree do support cognitive models of anxiety which assume that changes in cognitive bias drive the development of and recovery from a disorder (e.g. Williams et al., 1997). However, while these comparative, cross-sectional studies allow conclusions as to whether anxiety is correlated with a certain bias, they leave open whether fluctuations in bias are in fact associated with fluctuations in anxiety states, or whether the bias instead represents an enduring vulnerability factor. To further test current theoretical assumptions regarding the functional relationship between cognitive bias and pathological states, it is essential to investigate whether the bias is susceptible to treatment. To date, the few studies that have investigated the impact of CBT on emotional information processing provide mixed evidence. While some studies do report treatment sensitivity of attention bias (generalised anxiety disorder: Mogg, Bradley, Millar, & White, 1995; spider phobia: Van den Hout, Tenney, Huygens, & de Jong, 1997) and implicit evaluation bias (spider phobia: Teachman & Woody, 2003; panic disorder: Teachman et al., 2008), no patient waiting groups had been included in these study designs, making it difficult to disentangle real treatment effects from mere test–retest effects. Another study including such a patient waiting group failed to find an effect of a single-block session of CBT on implicit bias over and above retest effects (Huijding & de Jong, 2009). Experimental post-assessment, however, took place immediately after a single session of treatment, although bias change might require a more thorough consolidation of treatment effects. Furthermore, research has not addressed yet whether visual working memory biases and automatic avoidance tendencies that have recently been associated with anxiety (Reinecke et al., 2006; Rinck & Becker, 2007) are sensitive to treatment, leaving it open what role these biases play in the development of a disorder.

The present study investigated the impact of brief CBT (Öst, 1996) on a range of emotional processing parameters in a sample of patients with spider anxiety, while taking the methodological limitations described above into account. Cognitive bias was measured using the EAST and AAT (Reinecke, Becker, & Rinck, 2010) previously shown to reliably assess implicit threat associations and automatic threat avoidance tendencies in spider anxiety, and the previously developed visual working memory task (VWMT; Reinecke et al., 2006) to assess monitoring of threat in working memory. All participants were tested three times, with two weeks between assessments. However, they were randomly allocated to a treatment group versus a waiting group: the waiting group received CBT after the second assessment to control for test–retest effects, while the treatment group received treatment between the first two assessments. The following hypotheses, derived from the assumptions made by cognitive models of anxiety (Foa et al., 2006; Williams et al., 1997), were tested: (i) CBT affects self-report, behavioural and cognitive bias measures of anxiety over and above mere practise effects, resulting in stronger reduction on these measures in the treatment group than the waiting group from the first to the second test, (ii) compared to the treatment group, bias reduction will be stronger in waiting group patients, who by this point have received CBT as well, between the second to the third test.

2. Materials and methods

2.1. Participants

Twenty-nine spider-fearful participants were recruited into the study through advertisements in Dresden University of Technology lectures and local newspapers. Exclusion criteria were panic disorder, depression, psychosis, and alcohol or drug abuse. Participants were screened for mental disorders, using the International Diagnosis Checklist for DSM-IV (ICDL; Hiller, Zaudig, & Mombour, 1997). Screenings were applied by trained interviewers, and diagnostic decisions were supervised (ESB) based on written records. To be eligible for the study, participants had to at least fulfil the DSM-IV criteria A to D for specific phobia. As it is fairly easy to avoid spiders in Northern Europe, criterion E, which requires significant impairment in everyday life, was not required to be fulfilled. A specific phobia was diagnosed for 15 of the participants, who were equally represented in the two groups (TG: 6/14, WG: 9/15, $\chi^2(1) = 1.29$, $p = .256$).

2.2. Materials and apparatus

2.2.1. Self-report questionnaires

Subjective spider anxiety was measured using the Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995, German version: Rinck et al., 2002). In addition, the Body Sensations Questionnaire (BSQ; Chambless, Caputo, Bright, & Gallagher, 1984; German version: Ehlers, Margraf, & Chambless, 1993) was used to assess fear of physical symptoms commonly associated with anxiety.

2.2.2. Behavioural challenge tests (BT)

Passive BT. Heartbeat per minute was measured with an ear clip device during four experimental phases: (1) during a baseline phase while completing the Beck Depression Inventory (BDI; Beck & Steer, 1987), (2) during an anticipatory phase while looking at the picture of a tarantula, after having been instructed about the imminent confrontation, (3) during an exposure phase in which the experimenter quickly approached the participant with the carapace of a tarantula, and (4) during a rebound phase while completing the BSQ. Outcome measures were pulse scores during anticipation, exposure and rebound, minus baseline pulse.

Active BT. Patients were instructed to enter a room where a cage with a living tarantula was kept on the windowsill, and they were asked to approach the cage as quickly and as closely as they felt comfortable with. Outcome parameters were speed in approaching the tarantula and final distance to the cage in cm. Recent research suggests high 1-week test–retest reliability of this test ($r = .84$, $p < .001$; Reinecke, Becker, & Rinck, 2010).