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The effects of attentional bias modification on emotion regulation

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ABSTRACT

Background and objectives: In two experiments, we investigated the effects of Attentional Bias Modification (ABM) on emotion regulation, i.e. the manner in which people influence emotional experiences. We hypothesized that decreases in attentional bias to threat would impair upregulation and improve downregulation of negative emotions, while increases in attentional bias to threat would improve upregulation and impair downregulation of negative emotions.
Methods: Using the emotion-in-motion paradigm (Experiment 1, N = 60) and the visual search task (Experiment 2, N = 58), we trained participants to attend to either threatening or positive stimuli and we assessed emotion intensity while observing, upregulating, and downregulating emotions in response to grids of mixed emotional pictures.
Results: In Experiment 1, the attend positive group reported more positive emotions while merely watching grids of training pictures and the attend threat group showed impaired upregulation of negative affect. In Experiment 2, the attend threat group reported intensified negative emotions for all three instructions, while the attend positive group remained largely stable over time.
Limitations: We cannot unequivocally attribute these changes in emotion regulation to changes in attentional bias, as neither of the experiments yielded significant changes in attentional bias to threat.
Conclusions: By showing that attentional bias modification procedures affect the manner in which people deal with emotions, we add empirical weight to the conceptual overlap between attentional bias modification and emotion regulation.

1. Introduction

Prominent cognitive theories propose that biased cognitive processes play a prominent role in anxiety problems (e.g. Mogg & Bradley, 1998; Williams, Watts, MacLeod, & Mathews, 1997). Compared to non-anxious individuals, anxious individuals are thought to attend more to threatening stimuli in their environment, a finding commonly termed attentional bias. There is now a wealth of empirical evidence for the link between anxiety and attentional bias (for a review, see Bar-Haim, Lamy, Pergamin, Bakermans- Kranenburg, & van IJzendoorn, 2007). In more recent years, research has focussed on the hypothesis that attentional bias causally contributes to the development, maintenance, and/or exacerbation of anxiety (Van Bockstaele et al., 2014). Such a causal relation implies that experimentally induced changes in attentional bias should lead to clinically relevant changes in anxiety.

In a seminal paper, MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) used an adaptation of the visual probe task to train participants to either avoid or attend to threat. In the assessment version of this task, two task-irrelevant cue pictures – typically one threatening and one neutral picture – are shown on opposite locations of the computer screen. After these cues disappear, a target stimulus is presented on either the location of the threatening picture (threat congruent trials) or on the location of the neutral picture (threat incongruent trials). Attentional bias is derived from slower reaction times

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on threat incongruent trials compared to threat congruent trials. MacLeod et al. modified the assessment version of the task by presenting either a majority of threat congruent or a majority of threat incongruent trials. In this manner, they trained one group of participants to attend to the threatening cues, while another group was trained to avoid threat. This attentional bias modification (ABM) procedure resulted not only in changes in attentional bias, but also in changes in anxiety vulnerability: During a stress-inducing task, participants in the avoid threat group reported an attenuated increase in feelings of anxiety and depression as compared to participants in the attend threat group, thus demonstrating the causal effect of attentional bias on stress vulnerability.

ABM has since then been applied in a variety of clinical settings and samples (for reviews, see Clarke, Notebaert, & MacLeod, 2014; Cristea, Kok, & Cuijpers, 2015; Van Bockstaele et al., 2014). Although most early ABM studies in the anxiety domain were successful in reducing both attentional bias and anxiety, more recent studies have struggled to replicate these findings, illustrating that the transfer of changes in bias to changes in anxiety ("far transfer", see e.g. Hertel & Mathews, 2011) is subject to certain boundary conditions. In order to better understand these boundary conditions, a thorough understanding of the mechanisms underlying the transfer of ABM to anxiety is crucial. At present, however, very few studies have investigated how changes in attentional bias lead to changes in anxiety.

One way ABM may reduce anxiety is by improving emotion regulation. Emotion regulation is commonly defined as "the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998, p. 275). Emotion regulation is thus not limited to identifying the emotions one feels at a certain point in time, or even the emotional reactions to a specific event, which is what assessments of anxiety vulnerability after ABM procedures have almost exclusively focused on thus far. Emotion regulation also involves the extent to which people are able to increase or decrease emotional responses according to their goals or needs in a given situation. Dysfunctional emotion regulation has been linked to difficulties to cope with stressful or anxiety provoking events and to the development and maintenance of anxiety disorders (Cisler & Olatunji, 2012; Sheppes, Suri, & Gross, 2015). Some studies have shown that ABM can reduce the frequency of what are typically considered maladaptive emotion regulation strategies, like worry (e.g., Hayes, Hirsch, & Mathews, 2010) and rumination (e.g., Yang, Ding, Dai, Peng, & Zhang, 2015). However, these studies only assessed the frequency of worry and rumination as symptoms of generalized anxiety or depression, and did not specifically examine whether ABM influenced the strength and expression of emotions through its impact on these emotion regulation strategies. According to influential accounts of emotion regulation (e.g. Gross, 1998; Koole, 2009), redirecting attention either towards or away from emotion-provoking aspects of a situation enables people to increase or decrease the intensity of emotions (e.g. Sanchez, Vazquez, Gomez, & Joormann, 2014; van Reekum et al., 2007).

There is a clear conceptual overlap between ABM as a means to reduce anxiety (training people to attend less to threat leads to reduced anxiety vulnerability) on the one hand, and attention deployment as an emotion regulation strategy (attending to positive aspects of a situation helps to reduce the intensity of negative emotions) on the other hand. Although several researchers have noticed this conceptual overlap (e.g. MacLeod & Bucks, 2011; Todd, Cunningham, Anderson, & Thompson, 2012; Wadlinger & Isaacowitz, 2011), the link between ABM and improved emotion regulation skills has thus far remained largely theoretical. In a recent study, Sanchez, Everaert, and Koster (2016) compared the effects of a combination of ABM and interpretation bias training with a no-training control group. They found that larger reductions in attentional bias following the training predicted better instructed downregulation of negative emotions using reappraisal.

In our present two experiments, we aimed to add to this research. We investigated whether ABM training procedures would result in changes in a widely used emotion regulation paradigm in which participants are asked to increase or decrease their emotions (Jackson, Malmstadt, Larson, & Davidson, 2000). In Experiment 1, we used the Emotion-In-Motion paradigm developed by Notebaert et al. (in press) to train people to either attend to threat or attend to positive stimuli. Before and after the training, we assessed attentional bias using the assessment version of the visual probe task and we measured the intensity of negative emotions while watching grids of mixed positive and negative pictures, as well as how well participants were able to increase and decrease the intensity of negative emotions in response to these grids of pictures. If improved emotion regulation is indeed implicated in the emotional effects of ABM, then we expected those in the attend threat group to become better at increasing but worse at reducing their anxiety. Inversely, we expected those in the attend positive group to become worse at increasing but better at reducing their anxiety.

2. Experiment 1

2.1. Method

2.1.1. Participants

Sixty-one students (46 women, *M* age = 23.90, *SD* = 7.47, range 18–65) participated in this study in exchange for course credits or €15. Students were screened on trait anxiety using the trait version of the State and Trait Anxiety Inventory (STAI-T: van der Ploeg, Defares, & Spielberger, 1980). Because training anxious people to give more attention to threat could have harmful consequences, we excluded extremely high (score > 51) and low (score < 28) trait anxious participants from participating (246 of 309 screened students met this inclusion criterion and were invited to participate). All participants were informed about the general nature of the tasks and stimuli prior to signing an informed consent form. The entire procedure was approved by the ethical committee of the University of Amsterdam.

2.1.2. Materials

We selected a total of 96 threatening and 96 positive pictures from the International Affective Picture System (IAPS: Lang, Bradley, & Cuthbert, 2008). To test generalization across different stimuli and tasks, both threatening and positive pictures were divided in three subsets of 32 pictures each.[1] The first subset was used in the emotion regulation task, the attentional bias assessment task, and the ABM procedure; the second subset was used only in the ABM procedure; the third subset was used only in the emotion regulation task and the attentional bias assessment task. All pictures were cropped and resized to 235 × 235 pixels. For the practice phase of the visual probe task, we selected six neutral pictures from the IAPS, depicting random household objects. For the practice phase of the Emotion-In-Motion task, we used pictures of faces with neutral expressions, including eight male and eight female actors, selected from the Karolinska Directed Emotional Faces database (KDEF; Lundqvist, Flykt, & Öhman, 1998).

2.1.3. Questionnaires

We used the Dutch translation of the State and Trait Anxiety Inventory (STAI-S and STAI-T: van der Ploeg et al., 1980) to measure state and trait anxiety respectively. Both questionnaires consist of 20 4-point Likert items. The STAI-S assesses current levels of anxiety, while

[1] Picture sets were created such that based on the IAPS normative ratings, there were no significant differences between the three threatening subsets on either valence (Set 1: $M = 2.19$, $SD = 0.51$; Set 2: $M = 2.29$, $SD = 0.50$; Set 3: $M = 2.38$, $SD = 0.52$; $F(2, 93) = 1.13$, $p = .33$) or arousal (Set 1: $M = 6.25$, $SD = 0.62$; Set 2: $M = 6.08$, $SD = 0.56$; Set 3: $M = 6.19$, $SD = 0.65$; $F < 1$), nor were there significant differences between the three positive subsets on valence (Set 1: $M = 7.49$, $SD = 0.38$; Set 2: $M = 7.46$, $SD = 0.40$; Set 3: $M = 7.42$, $SD = 0.31$; $F < 1$) or arousal (Set 1: $M = 4.96$, $SD = 0.92$; Set 2: $M = 4.82$, $SD = 1.05$; Set 3: $M = 4.69$, $SD = 1.06$; $F < 1$).