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Does attention bias modification improve attentional control? A double-blind randomized experiment with individuals with social anxiety disorder

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ABSTRACT

People with anxiety disorders often exhibit an attentional bias for threat. Attention bias modification (ABM) procedure may reduce this bias, thereby diminishing anxiety symptoms. In ABM, participants respond to probes that reliably follow non-threatening stimuli (e.g., neutral faces) such that their attention is directed away from concurrently presented threatening stimuli (e.g., disgust faces). Early studies showed that ABM reduced anxiety more than control procedures lacking any contingency between valenced stimuli and probes. However, recent work suggests that no-contingency training and training toward threat cues can be as effective as ABM in reducing anxiety, implying that any training may increase executive control over attention, thereby helping people inhibit their anxious thoughts. Extending this work, we randomly assigned participants with DSM-IV diagnosed social anxiety disorder to either training toward non-threat (ABM), training toward threat, or no-contingency condition, and we used the attention network task (ANT) to assess all three components of attention. After two training sessions, subjects in all three conditions exhibited indistinguishably significant declines from baseline to post-training in self-report and behavioral measures of anxiety on an impromptu speech task. Moreover, all groups exhibited similarly significant improvements on the alerting and executive (but not orienting) components of attention. Implications for ABM research are discussed.

1. Introduction

People with social anxiety disorder (SAD) often exhibit an attentional bias for social-threat cues, such as faces expressing disgust or anger (e.g., Mogg, Philippot, & Bradley, 2004). This bias may causally contribute to increasing anxiety proneness (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002), and thereby figure in the etiology and maintenance of SAD and other anxiety disorders (for a review, see Van Bockstaele et al., 2014). Accordingly, reducing it may have yield clinical benefits.

Inspired by MacLeod et al. (2002), psychologists have used attention bias modification (ABM) procedures to diminish AB and thereby symptoms of SAD (e.g., Amir, Taylor, & Donohue, 2011). To develop an ABM procedure, MacLeod et al. (2002) modified the classic dot-probe paradigm that measures AB (MacLeod, Mathews, & Tata, 1986). In the original dot-probe tasks, participants viewed two stimuli (e.g., a threatening word/photograph and a neutral word/photograph) simultaneously presented in two locations of a computer screen for approximately 500 ms. Immediately thereafter, a probe appeared in the location previously occupied by one of the two stimuli. Participants have to respond to the probe as quickly as possible. An AB was demonstrated when participants respond faster to the probe when it replaces a threatening stimulus than when it replaces a non-threatening stimulus, indicating that their attention was directed to the location occupied by the threatening stimulus. In ABM, researchers typically modify the original task such so that the probe nearly always (e.g., 95% of the trials) replaces the neutral stimulus, thereby redirecting subjects'

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attention to non-threatening cues. In the control condition, there is no contingency between cues and probes. Relative to the control condition, ABM reduces symptoms in people with SAD, as several studies have shown (Amir, Weber, Beard, Bomyea, & Taylor, 2008; Amir et al., 2009; Li, Tan, Qian, & Liu, 2008; Schmidt, Richey, Buckner, & Timpano, 2009). These findings suggest that ABM could have important clinical potential, as it entails a very simple protocol, little contact with a mental health professional, and can be easily disseminated.

However, over the past two years, other studies have reported mixed findings (e.g., Boettcher et al., 2013; Bunnell, Beidel, & Mesa, 2013; Carlbring et al., 2012). Several explanations for these mixed findings have been formulated (Emmelkamp, 2012; Heeren, De Raedt, Koster, & Philippot, 2013; Klumpp & Amir, 2010). For example, training attention, regardless of the direction of the contingency between probes and cues, may bolster top-down attention control in ways that strengthen one's ability to control anxiety. Klumpp and Amir (2010) reported data congruent with this hypothesis. In their experiment, they randomly allocated moderately socially anxious individuals to one of three different conditions: (1) training to attend to non-threat (i.e., ABM), (2) attend to threat, or (3) a control condition in which there was no contingency between cues and probes. After a single-session, individuals who were trained to attend to threat as well as those receiving ABM reported less state anxiety in response to an impromptu speech compared to individuals in the no-contingency control condition.

However, Heeren, Reese, McNally, and Philippot (2012) did not replicate this effect among participants diagnosed with generalized social phobia. In this experiment, participants were randomly assigned to receive four sessions of one of the three conditions mentioned above. They found that, in contrast to the two other conditions, those who were trained to attend to non-threat reported less behavioral and physiological (i.e., skin conductance reactivity) indices of anxiety in response to an impromptu speech, and a decrease in AB. These studies suggest that the processes mediating the impact of ABM on anxiety may be more complicated than commonly assumed. However, it remains unclear whether the benefits apparent in these two studies result from increased executive control over attention as none measured it. More recently, McNally, Enock, Tsai, and Tousian (2013) reported an experiment in which they randomly assigned speech-anxious individuals to one of the three training conditions mentioned above while also including self-report and behavioral measures of executive attention control before and after the training. After four sessions of training, participants, irrespective of group assignment, exhibited significant decreases in self-report, behavioral, and physiological measures of anxiety associated with a speaking task. More importantly, all three training conditions improved attentional control, as indexed through the executive conflict score of the attention network task (ANT; Fan, McCandliss, Sommer, Raz, & Posner, 2002) and the Attentional Control Scale questionnaire (Derryberry & Reed, 2002).

Considering a placebo effect for the widespread clinical benefits, McNally et al. (2013) suggested that the halo of technology embodied in a computerized fix for one's public speaking fear might foster positive expectancies that account for the observed improvement. This interpretation seems plausible as McNally et al. informed participants of the potential therapeutic benefits of training. In contrast, Heeren, Reese, et al. (2012) and Klumpp and Amir (2010) informed participants that the research concerned processes associated with SAD; they did not mention any potential therapeutic benefits.

Further, in contrast to Klumpp and Amir's hypothesis, recent evidence suggests that AB in SAD may result not only from impairment in the executive control of attention, but also from impairment in orienting toward non-emotional stimuli (e.g., Moriya & Tanno, 2009). According to Posner and Petersen (1990), there are three components to attention: alerting, orienting, and executive control. However, even if the ANT evaluates these three independent attentional networks, McNally et al. (2013) only reported data on the change in executive conflict component of the ANT as their hypothesis only concerned executive control. To date, no published study has explored the impact of ABM on all three components of attention.

In the present double-blind experiment, we randomly assigned individuals with a DSM-IV diagnosis of SAD to one of three conditions: (1) attend to non-threat stimuli, (2) attend to threat stimuli, and (3) no-contingency control. Subjects were not told about the possible therapeutic benefits of training. Rather, they were merely informed that the study concerned the cognitive mechanisms underlying social interaction among shy people. We assessed the effects of these procedures on change in AB, on self-report and behavioral measures of anxiety during a speech performance, and on all three attentional networks of the ANT, in contrast to McNally et al. (2013) whose hypothesis concerned only the executive conflict measure of the ANT.

We addressed several issues. If, as Klumpp and Amir (2010) have suggested, attention training is effective because of increased attentional control arising from any contingency-based procedure regardless of the direction of attention, then participants in either the attend to threat or attend to non-threat conditions should exhibit greater improvement than participants in the no-contingency control condition on the executive network of the ANT as well as measures of anxiety. By constrast, if attention training is effective because of attending to non-threat, as Heeren, Reese, et al. (2012) have suggested, then only the participants in the attend to non-threat condition should demonstrate clinical benefits. Finally, if attention training is effective regardless of the presence of a contingency, as McNally et al. (2013) have suggested, all groups should exhibit improvement in the executive network of ANT.

2. Materials and methods

2.1. Participants

We recruited 61 individuals with a primary DSM-IV diagnosis of SAD (American Psychiatric Association, 1994) from the Université Catholique de Louvain community. A total of 445 volunteers responded to our invitation to take part in an investigation of the mechanisms underlying social interaction among shy people. Following screening, 148 individuals who scored above 56 on the self-report version of the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) were selected. A clinical psychologist then used the French version of the Mini International Neuropsychiatric Interview (MINI; Lecrubier, Weiller, Bonora, Amorin, & Lépine, 1998) to diagnose DSM-IV Axis I disorders.

In addition to the presence of a DSM-IV diagnosis of Social Anxiety Disorder, all participants had to fulfill several inclusion criteria: (a) no current substance abuse or dependence, (b) no current heart, respiratory, neurological problems, or use of psychotropic medications, (c) no current psychological or psychiatric treatment, and (d) normal or corrected-to-normal vision. These criteria were assessed via questionnaire. Sixty-two participants met the DSM-IV diagnosis of Social Anxiety Disorder; 41 had the generalized subtype, and 21 had the specific subtype. One declined our invitation to participate, and so 61 participants enrolled in the study; their characteristics are displayed in Table 1. We obtained written informed consent from each participant. Each participant was tested individually in a quiet room and all sessions occurred in the same laboratory. The study was approved by the Ethical Committee of the Université Catholique de Louvain (UCL, Belgium), and conducted according to the Declaration of Helsinki. Participants received financial compensation (15 Euros) for their participation.