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Does attention redirection contribute to the effectiveness of attention bias modification on social anxiety?

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ABSTRACT

Attention bias modification (ABM) is designed to modify threat-related attention bias and thus alleviate anxiety. The current research examined whether consistently directing attention towards targeted goals per se contributes to ABM efficacy. We randomly assigned 68 non-clinical college students with elevated social anxiety to non-valence-specific attend-to-geometrics (AGC), attention modification (AMC), or attention control (ACC) conditions. We assessed subjective, behavioral, and physiological reactivity to a speech task and self-reported social anxiety symptoms. After training, participants in the AMC exhibited an attention avoidance from threat, and those in the AGC responded more rapidly toward targeted geometrics. There was a significant pre- to post-reduction in subjective speech distress across groups, but behavioral and physiological reactivity to speech, as well as self-report social anxiety symptoms, remained unchanged. These results lead to questions concerning effectiveness of ABM training for reducing social anxiety. Further examination of the current ABM protocol is required.

1. Introduction

Cognitive theories posit that attention bias towards social threat is relevant to the genesis and maintenance of social anxiety (e.g., Clark, 2005; Heimberg, Brozovich, & Rapee, 2010). Empirically, the majority of research demonstrates that social anxiety is associated with negatively biased attention selectivity (for a review, see Bar-Haim, Lamy, Pergamin, Bakermans-Kraneneburg, & van IJzendoorn, 2007). The advent of attention bias modification (ABM) further illuminated the causal link between negatively biased selective attention and social anxiety proneness (Heeren, Peschard, & Phillippot, 2012). Consequently, researchers suggested that ABM programs might exert therapeutic effects by redirecting attention away from threat (for a review, see MacLeod & Clarke, 2015).

Several experiments included a valence-specific contingency with probes always replacing non-threatening cues in the dot-probe task to encourage attention bias away from threat in social anxiety, and indicated that the avoid-threat training could attenuate social anxiety (Amir et al., 2009; Heeren, Reese, McNally, & Philippot, 2012; Schmidt, Richey, Buckner, & Timpano, 2009). Nevertheless, the superiority of the attention modification condition (AMC) over the attention control condition (ACC) was not supported by research in the laboratory (Bunnell, Beidel, & Mesa, 2013; Julian, Beard, Schmidt, Powers, & Smits, 2012) or via the Internet or smartphones (Boettcher, Berger, & Renneberg, 2012; Carlbring et al., 2012; Enock, Hofmann, & McNally, 2014; Neubauer et al., 2013). Carleton et al. (2015) further observed pronounced symptom reduction in both the AMC and ACC irrespective of treatment delivery modality (in the lab or at home), suggesting limited impact of delivery modality on the effectiveness of ABM. The failure to observe a differential effect between AMC and ACC has thus been attributed to a failure to modify attention bias, and it was reasoned that successfully shifting attention away from threat is crucial for ABM to be effective (Clarke, Notebaert, & MacLeod, 2014).

Some research, however, provided no supportive evidence for the relationship between the valence-specific change in attention bias and reduction in social anxiety disorder (SAD) symptoms (e.g., Boettcher et al., 2013; Carleton et al., 2015). It was suggested that a general change in attention, rather than specifically redirecting attention away from threat, may contribute to ABM efficacy (for reviews, see Bar-Haim, 2010; Lowther & Newman, 2014). For example, social anxiety may be reduced by redirecting attention from neutral toward threatening faces (Klumpp & Amir, 2010) and by relocating attention toward more negative cues (e.g., neutral cues on neutral–positive trials, Boettcher et al., 2013); no such effect

Abbreviations: ABM, attention bias modification; AMC, attention modification condition; ACC, attention control condition; AGC, attend-to-geometrics condition; SAD, social anxiety disorder.

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was noted for shifting attention from positive to negative stimuli (Heeren, Reese et al., 2012).

Results remain inconclusive concerning the underlying mechanisms of ABM efficacy on social anxiety (Heeren, Mogoaşe, Philippot, & McNally, 2015). The majority of studies emphasize that ABM effectiveness relies on valence-specific change in attention bias (e.g., reduction in attention bias towards threat; Clarke et al., 2014). However, non-valence-specific change in attention (i.e., consistently directing attention towards targeted goals) may contribute to anxiety reduction. For example, repeated relocation of attention toward certain targets may promote the ability to control top-down attention (Heeren, Coussement, & McNally, 2016; Heeren, Mogoaşe, McNally, Schmitz, & Philippot, 2015) and thus decrease the deleterious impact of threatening information (Bar-Haim, 2010; Derakshan & Eysenck, 2009). Others proposed that task-related effects play a role in anxiety reduction; for instance, participants could learn links between cues and probes, thereby improving performance and promoting positive feelings (Klumpp & Amir, 2010). It has also been shown that standard ABM training induces attentional avoidance of threat while enhancing inhibitory attention control (Chen, Clarke, Watson, MacLeod, & Guastella, 2015), suggesting that mechanisms of ABM could be multifaceted (Heeren, De Raedt, Koster, & Philippot, 2013).

As a step towards illuminating the mechanisms of ABM, Heeren et al. (2016) untangled the standard ABM protocol from emotion using geometrics as materials and observed that non-valence-related attention training with or without contingency between cues and probes equally improved social anxiety symptoms and top-down control. It remains unclear whether the valence-related attention redirection away from threat specifically contributed to the ABM efficacy (Heeren et al., 2016); therefore, we compared the anxiolytic effect of valence-related attention modification and non-valence-related attention redirection. An attend-to-geometrics condition (AGC), where participants were trained to redirect their attention towards geometric targets (i.e., rectangles or ellipses), was used. This allowed examination of how non-valence-related attention redirection alleviates anxiety while eliminating the effects of simple exposure and extinction (Bar-Haim, 2010; Heeren et al., 2016). Participants with high social anxiety were randomly assigned to one of three conditions: (1) AMC with valence-specific training contingency, (2) AGC with non-valence-specific training contingency, and (3) ACC with no contingency. Further, we combined self-report, behavioral, and physiological measures of social anxiety to more thoroughly assess the effectiveness of the ABM program (Heeren, Reese et al., 2012).

Our hypotheses were as follows: (1) we expected participants in the AMC to exhibit a biased attention away from threat after training compared to those in the AGC and ACC, and participants in the AGC to exhibit a quicker response to targeted geometrics compared to the ACC. (2) We expected that, if valence-specific modification diverting attention away from threat is crucial, participants in the AMC would exhibit reduced social anxiety compared to both the AGC and ACC; no anxiety reduction would be expected in the AGC. If non-valence-specific attention redirection accounts for the observed effects of ABM, participants in both the AMC and AGC would show reduced anxiety compared to the ACC.

2. Materials and methods

2.1. Participants

Participants were selected from a pool of 442 students from Peking University based on their scores on the Chinese version of the Liebowitz Social Anxiety Scale (LSAS; He & Zhang, 2004; Liebowitz, 1987). A cutoff score of 38 was adopted (He & Zhang, 2004), resulting in 204 individuals with a variety of SAD symptoms. These potential participants were contacted by telephone or email and were told that the current study was a preliminary test of a computerized training program for people with attention deficits. The training structure (i.e., a 4-day consecutive training with pre-, post-, and follow-up tests) was introduced, but the potential anxiolytic effect of attention training was not mentioned to reduce expectancy effects.

Students who agreed to participate were invited to the laboratory, and the LSAS was administered again. Participants had to score above 38 on the most recent LSAS administration to be included. Further exclusion criteria were (1) having current or past psychological or psychiatric treatment; (2) currently being on prescribed psychotropic medication; (3) meeting the diagnostic criteria for psychosis, substance abuse, or mood disorder; and (4) having prominent suicidal ideation. We assessed the first three exclusion criteria by asking three corresponding questions and defined the fourth criterion as scoring a 3 on item 9 of the Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1996; Wang, Wang, & Ma, 1999, pp.191–194).

This recruitment procedure resulted in 68 eligible individuals (aged 17–28 years; $M = 20.46$, $SD = 2.31$; Fig. 1). Their LSAS mean at pre-test ($M = 63.31$, $SD = 13.88$) was more than two standard deviations above the mean for healthy Chinese individuals ($M = 22.31$, $SD = 16.86$, He & Zhang, 2004; $t(67) = 24.36$, $p < .01$, Hedges's $g = 2.47$), yet the current LSAS mean was lower than the mean for Chinese individuals with a diagnosis of SAD ($M = 69.59$, $SD = 28.65$, He & Zhang, 2004; $t(67) = -3.73$, $p < .01$, Hedges's $g = 0.25$). Individuals who participated and those who refused participation (e.g., did not reply to our emails or phones during recruitment, had no interest in participation, were too busy to participate, or had concern about the participation burden) exhibited no significant difference in gender, $\chi^2(1, N = 186) = 0.46$, $p = .50$, age, $t(193) = -1.38$, $p = .17$, LSAS, $t(200) = 1.64$, $p = .10$, or BDI scores, $t(199) = -1.67$, $p = .10$. A significant difference was observed in terms of birthplace, $\chi^2(1, N = 189) = 8.05$, $p = .01$.

2.2. Attention bias assessment and modification procedure

2.2.1. Face pairs

We generated 90 face pairs using FaceGen 3.1 software (Singular Inversions Inc., 2008); each pair contained two facial expressions (anger and mild smile) of the same individual (images measured 300×300 pixels, 96 pixels/in; Fig. 2). Smiling faces were rated as less threatening than were angry faces, $t(89) = 27.16$, $p < .001$. We utilized 60 face pairs in the AMC; the remaining 30 pairs were used for attention bias assessment. We used smiling faces because socially anxious individuals tend to interpret ambiguous stimuli (e.g., neutral faces) in a negative manner (e.g., Carleton, Collimore, & Asmundson, 2010; McEvoy & Mahoney, 2012; Mobini et al., 2014).

2.2.2. Geometric figures

We generated 60 pairs of geometric shapes using MATLAB 2010b (MathWorks, Natick, MA, USA). Specifically, there were 48 ellipse–rectangle pairs and 12 ellipse–ellipse or rectangle–rectangle pairs. Each pair contained geometric shapes of similar size; the shape sizes differed between pairs (images measured 260×260 pixels, 72 pixels/in; Fig. 2).

2.2.3. Attention bias modification procedure

We used MATLAB 2010b (MathWorks, Natick, MA, USA) to program the ABM procedures. Stimuli were presented randomly within each condition on a screen with a black background at a viewing distance of 30 cm. In the AMC, a pair of angry–smiling faces appeared for 500 ms immediately after a 500-ms fixation display. Each image was centered horizontally in a window of 260×260