Attentional biases in high social anxiety using a flanker task

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ABSTRACT

Background and objectives: The existence of threat-related attentional bias has been well supported in social anxiety research. However, most previous studies investigated separately attentional bias toward targets or distractors. This study examined the selective attention of socially anxious individuals in the presence of both emotional targets and distractors.

Methods: Participants with high vs. low social anxiety (HSA vs. LSA) took part in a modified flanker task. Participants initially focused on the center of the screen, and then were required to identify the emotion of the central face (target) regardless of the flanking faces (distractors).

Results: The response times (RTs) of the HSA and LSA groups did not differ significantly when responding to different central faces (targets), but the HSA group responded more slowly to central faces when the flankers (distractors) were negative faces as opposed to positive or neutral.

Limitations: The depression levels of participants in this non-clinical sample were not controlled.

Conclusion: The results support attention control theory and suggest impaired inhibition control in HSA..

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1. Introduction

Certain cognitive theories postulate that socially anxious individuals are characterized by attentional bias towards social threats (Clark & Wells, 1995; Rapee & Heimberg, 1997). Therefore, for people who are socially anxious, social situations are perceived to be more threatening than they really are, leading to increased anxiety as well as ineffective social behaviors, which may maintain or exacerbate their social fears (Heimberg, Brozovich, & Rapee, 2010).

Numerous research studies have supported the association between social anxiety and negatively biased attention, using a variety of experimental paradigms with either faces or words as stimuli (e.g., Amir, Elias, Klumpp, & Przeworski, 2003; Roberts, Hart, & Eastwood, 2010; for a review, see Bar-Haim, Lamy, Pergamin, Bakermans-Kraneneburg, & van Ijzendorn, 2007). Several studies have reported that highly socially anxious individuals respond vigilantly to threatening faces in the dot-probe task (Helfinstein, White, Bar-Haim, & Fox, 2008; Klumpp & Amir, 2009), detect negative faces faster in visual search tasks (Eastwood et al., 2005), and identify the color of social threat words slower than a control group under low anxiety conditions in an emotional Stroop task (Amir et al., 1996).

The threat-related attentional bias in social anxiety also complements attentional control theory (Eysenck, Derakshan, Santos, & Calvo, 2007). Accordingly, an anxiety-enhanced bottom-up attention system and an impaired top-down attention system are predicted to automatically deploy extra attentional resources to salient or emotional stimuli, especially threatening stimuli. Thus, threatening stimuli become harder to suppress than non-threatening stimuli for socially anxious participants (Chen, Clarke, Watson, MacLeod, & Guastella, 2015; Derakshan & Eysenck, 2009; Eysenck et al., 2007).

However, in most prior studies, the emotional task stimuli were either task relevant or task irrelevant, and the attentional bias toward both the task relevant and irrelevant stimuli was seldom investigated (for an exception, see Gilboa-Schechtman, Foa, & Amir, 1999). Furthermore, in most previous paradigms, participants did not know the location of the target or distractor, and thus needed to pay attention to multiple locations (exception: e.g., Kolassa & Miltner, 2006). As threatening faces are salient to socially anxious individuals (Rapee & Heimberg, 1997), it is expected that threat-related information will attract their attention while their attentional resources are dispersed.

The current study investigated attentional bias toward emotional stimuli in social anxiety using a flanker task, in contrast to the majority of studies, which have typically adopted a visual probe paradigm (e.g., Bar-Haim et al., 2007). In the classic flanker task (Eriksen & Eriksen, 1974), participants were required to identify the central (target) letters while ignoring the flanker (distractor) letters.

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The flanker effect is that congruent conditions (i.e., *HHH*) result in a faster response than incongruent conditions (i.e., *SHS*).

Our modified task replaced the letters with emotional faces, and the participants were instructed to respond to the emotion expressed by the central face while ignoring the emotions of the flanker faces. As the participants knew in advance the locations of the target and distractor, their attention was directed toward the target face location, while the flanker faces could act as distractors. According to attention control theory, anxiety impairs the inhibition of attention and it may be harder for socially anxious individuals to suppress threat-related irrelevant stimuli (Chen et al., 2015; Eysenck et al., 2007). Thus, performance in a flanker task may reflect the control of inhibition of attention. It has also been suggested that fixating participants' attention on certain stimuli (e.g., one of the faces in a dot-probe task) may facilitate a better understanding of the attentional processing of threat (Rudaizky, Basanovic, & Macleod, 2014). Further, the flanker paradigm could allow for the efficient investigation of socially anxious individuals' patterns of selective attention in the presence of emotional targets and distractors, and thereby illuminate how attention allocation is impacted by interactions between the emotional valence of target and distractor stimuli.

However, few studies have used a modified flanker task to assess the distribution of visual attention in social anxiety (Barker, Renfree, Pine, & Fox, 2015; Moser, Huppert, Duval, & Simons, 2008; Schmid, Kleiman, & Amodio, 2015). The most relevant study is that of Moser et al. (2008), who used a modified flanker task with emotional facial expressions (i.e., threatening and reassuring faces) as stimuli and a 500-ms stimulus presentation time. They observed no attentional bias towards threat, although they found a significant flanker effect, in that participants responded faster when the emotional valence of the flankers and target were identical. Nevertheless, they found evidence supporting threat-related bias in electrophysiological results, suggesting that a flanker task could be effective in assessing maladaptive patterns of attentional selectivity in social anxiety.

Building on Moser et al. (2008), the current research investigated how negative, positive, and neutral flankers modify selective attention toward designated targets in individuals with high social anxiety (HSA) and low social anxiety (LSA), and explored whether the emotional valence of distracting flankers impacts the response to the target face. Emotional and neutral faces were used in this study. It has been suggested that emotional faces are more salient than neutral faces in the early stages of attention (Wieser, Pauli, Weyers, Alpers, & Mühlberger, 2009); the inclusion of neutral faces as targets and/or flankers formed a baseline condition, for which reaction times were gathered. This allowed us to examine how the emotions expressed by targets and distractors modify attentional selectivity. Additionally, we used a 300-ms stimulus presentation time to increase the difficulty of the current flanker task and to thus increase the possibility that participants remained focused throughout the task. Further, as dot-probe studies using a 500-ms presentation time have generated inconsistent results (i.e., vigilance to negative faces: Klumpp & Amir, 2009; avoidance of negative faces: Chen, Ehlers, Clark, & Mansell, 2002), it is unclear whether the attentional patterns observed for this stimulus presentation time represent early, automatic or later, controlled attentional processes (Koster, Baert, Bockstaele, & De Raedt, 2010). The current research limited the presentation duration of stimuli so as to investigate attention in social anxiety at a relatively early stage of information processing.

The present study tested the following hypotheses: 1) Both groups would respond faster to the central (target) face regardless of its emotional valence when the valence of central and flanker (distractor) faces were congruent; 2) The HSA group would respond faster to negative central faces versus positive or neutral faces; and 3) The HSA group would respond slower to the central face when

the flankers were negative versus positive or neutral flanker faces.

2. Method

2.1. Participants

Participants were selected from a pool of 500 students from Peking University based on their scores on the Chinese version of the Liebowitz Social Anxiety Scales (LSAS; He & Zhang, 2004; Liebowitz, 1987). Participants who scored above 56 were invited to participate as members of the high social anxiety (HSA) group, and those who scored below 26 were invited to participate as members the low social anxiety (LSA) group, resulting in 35 participants in each group.

We excluded the data of ten participants because their correct response proportions were low (less than 60%). Three participants responded significantly more slowly than others, and their data were also excluded. An additional participant's data were deleted for both reasons (details in Result section). Thus, the final group numbers were 27 HSA (10 males, 17 females; $M_{age} = 20.25$ years, $SD = 2.11$; $M_{LSAS} = 68.20$, $SD = 12.21$) and 29 LSA (15 males, 14 females; $M_{age} = 22.02$ years, $SD = 4.17$; $M_{LSAS} = 18.19$, $SD = 6.31$). A chi-square test showed that there was no significant difference in gender distribution between the two groups ($\chi^2 = 0.27$, $p = .296$).

2.2. Materials

MeasurementThe Chinese version of LSAS is a 24-item self-report scale assessing experiences of anxiety and the frequency of avoidance of social and performance situations during the preceding week. Responses are collected via 4-point Likert scales, with responses ranging from 0 (*none*) to 3 (*severely/usually*). Cronbach's alpha in this current sample was 0.95.

StimuliThe stimuli comprised 10 sets of faces: 5 male and 5 female models each displayed two emotional (positive and negative) and one neutral facial expression, resulting in 30 face stimuli in total (see Appendix 1). Because certain emotional expressions differ according to whether the teeth are presented (e.g., anger versus disgust), the negative expressions were a mix of angry and disgusted faces, while the positive expressions were a mix of happy and surprised faces. The 10 experimental sets were selected from 15 sets based on ratings of their valence (ranging from -7 = negative to 7 = positive) made by 14 graduate students majoring in psychology. The selection criteria were that the expression intensity of the negative and positive faces in the same set were approximately equal while the neutral faces ratings approximated zero ($M_{negative} = -3.68$, $SD_{negative} = 1.18$; $M_{positive} = 3.51$, $SD_{positive} = 1.14$; $M_{neutral} = 0.02$, $SD_{neutral} = 0.70$). All stimuli were East Asian faces generated by Facegen Modeler 3.3 (http://facegen.com). Two of the 10 sets were used for practice trials, and the remaining 8 sets were used for experimental trials.

2.3. Procedure

A modified version of the flanker task was adopted in our study. We substituted emotional faces for letters, and participants were instructed to respond to the emotion of the central face while ignoring the flanker faces, whose emotional valence could be identical to or different from the central face.

There was one practice block and six experimental blocks. The practice block consisted of 18 trials (3 valences of central faces × 3 valences of flanker faces × 2 sets) and each experimental block of 72 experimental trials (3 valences of central faces × 3 valences of flanker faces × 8 sets), resulting in a total of 432 trials per participant that were available for analysis. Participants completed each