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The time course of attentional disengagement from angry faces in social anxiety

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ABSTRACT

While impaired attentional disengagement from threatening stimuli is thought to enhance social anxiety, it is unclear when the impaired disengagement occurs accurately. We used a gap task (Experiment 1) and an overlap task (Experiment 2) to reveal the impaired attentional disengagement from angry faces in socially anxious people with non-treatment seeking undergraduates. High ($N = 17$ in Experiments 1 and 2) and low socially anxious people ($N = 17$ in Experiment 1 and 19 in Experiment 2) were asked to fixate on an angry or neutral face presented at the center of a screen. Then, they discriminated the peripheral target stimuli. When there was a temporal gap between the face and target in Experiment 1 (gap task), the reaction times (RTs) for angry and neutral faces did not differ for all participants. However, when there was no gap and the face continued to appear in Experiment 2 (overlap task), the RTs for angry faces in high socially anxious people were longer than those for neutral faces after presentation times of 300 ms or longer. In low socially anxious people, the RTs following the angry and neutral faces did not differ. These results suggest that high socially anxious people face difficulty in disengaging attention from angry faces after recognizing them.

1. Introduction

Previous studies have revealed that individuals suffering from anxiety are sensitive to threatening stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Cisler & Koster, 2010; MacLeod, Mathews, & Tata, 1986; Mogg & Bradley, 1998; Yiend, 2010). When neutral and threatening stimuli (e.g., threatening facial expressions) were presented simultaneously, people with high trait anxiety or generalized anxiety disorders directed their attention to the threatening stimuli (Bradley, Mogg, Falla, & Hamilton, 1998; Bradley, Mogg, White, Groom, & de Bono, 1999). Moreover, it has been elucidated that attention to threatening stimuli enhances anxiety, while attention away from threatening stimuli decreased anxiety by several methods (Amir, Beard, Burns, & Bomyea, 2009; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). Amir et al. (2009) demonstrated that participants with generalized anxiety disorders, who were trained to decrease attention to negative words, showed a decrease in anxiety.

In social anxiety disorders, the cognitive behavioral model also emphasizes the importance of selective attention to threatening stimuli, especially socially threatening stimuli (e.g., angry, disgusted faces, socially threatening words), and selective attention might be an important factor for continuing anxiety (Bögels & Mansell, 2004; Rapee & Heimberg, 1997). For example, people with social anxiety disorders detected angry faces faster than they did happy faces in a crowd of neutral faces (Eastwood et al., 2005; Gilboa-Schechtman, Foa, & Amir, 1999). Their attention was also directed to angry faces when the faces were simultaneously presented with neutral faces (Mogg, Philippot, & Bradley, 2004). This attentional bias is also found in non-clinical samples who had enhanced attention to the threatening faces in high socially anxious people (Mogg & Bradley, 2002). As with generalized anxiety disorders, in social anxiety disorders, disengagement from negative social cues decreased social anxiety (Schmidt, Richey, Buckner, & Timpano, 2009). These attentional biases to threatening stimuli are assumed to play an important role in anxiety and social anxiety.

However, selective attention to threatening stimuli may not necessarily be specific to anxious people. It is known that regardless of the degree of anxiety, everyone attends to threatening stimuli (Öhman, 2005). According to the evolutionary theory, people have evolved in the environment, which has included many dangerous situations. Detecting dangerous events or rapidly directing attention toward them is evolutionally adaptive for the improvement of the survival rate (Öhman & Mineka, 2001). In a visual search task, threatening stimuli (e.g., angry faces, snakes),

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crowded with neutral distractors, were detected faster than positive or non-threatening stimuli in non-clinical participants (Eastwood, Smilek, & Merikle, 2001; Öhman, Flykt, & Esteves, 2001). The reaction times (RTs) for detecting threatening stimuli were not affected by the number of distractors (Öhman et al., 2001). Some studies revealed that rapid attentional bias to highly threatening pictures was independent from anxiety (Koster, Verschuere, Crombez, & van Damme, 2005). When a threatening picture was presented with a neutral picture, not only high anxious people but also low anxious people rapidly directed attention to the threatening stimuli. These results support the concept of adaptive attentional bias to threatening stimuli.

While some previous studies showed that only anxious or socially anxious people directed attention to a threat, some others revealed that all people (not just the anxious ones) rapidly attended to a threat. Why do the results of the previous studies differ? One of the reasons for this is the time course of attention (Fox, Russo, & Dutton, 2002; Yiend, 2010). According to the evolutionary theory, when threatening and neutral stimuli are presented, all people first direct their attention to the threatening stimuli. After attending to the threatening stimuli, the attentional mechanisms of anxious and non-anxious people may differ. Previous studies have shown that anxious people focus on threatening stimuli and face difficulty in disengaging their attention from the stimuli (Amir, Elias, Klumpp, & Przeworski, 2003; Fox, Russo, Bowles, & Dutton, 2001; Fox et al., 2002; Georgiou et al., 2005; Koster, Crombez, Verschuere, & de Houwer, 2004; Moriya & Tanno, 2007; Yiend & Mathews, 2001). For example, in Fox et al. (2001), an emotional word (i.e., neutral, positive, or threatening word) was presented as a cue stimulus at the center of a screen for 600 ms. Then, a target stimulus appeared either above, below, to the left, or to the right of the word. The participants were instructed to voluntarily attend to the emotional word and respond to the target stimulus as accurately and quickly as possible. The result revealed that the high anxious people took a longer time to respond to the target when they attended to a threatening word as compared to when they attended to either a neutral or positive word. It was concluded that anxious people had difficulty in disengaging attention from a threatening stimuli and focused on the stimuli. However, the non-anxious people could disengage their attention from the threatening stimuli.

The impaired attentional disengagement from threatening stimuli may also be a problem for socially anxious people; however, few studies have focused on attentional disengagement in social anxiety (Amir et al., 2003; Moriya & Tanno, 2007). In the field of social anxiety, avoidant behavior in social situations or avoidance of eye contact has been studied as important characteristics of social anxiety (Dell'Osso et al., 2003; Horley, Williams, Gonsalvez, & Gordon, 2004). Therefore, it is appropriate for researchers to assume that socially anxious people do not focus on a threat but direct attention away or disengage from it. However, behavior and attention are not necessarily the same aspect of social anxiety. In the present study, we investigated attentional disengagement from threatening stimuli in high socially anxious people, where the participants were undergraduate students. We used angry faces as threatening stimuli because some studies have shown that socially anxious people are sensitive to angry faces (Mogg et al., 2004; Phan, Fitzgerald, Nathan, & Tancer, 2006).

In previous studies on attentional disengagement in people with anxiety and social anxiety, at least two inadequacies were found. First, in some studies, an overlap task was used to investigate attentional disengagement from threatening stimuli (Fox et al., 2001; Georgiou et al., 2005); however, this task could not exclusively measure attentional disengagement. Moreover, the task included the effect of other attentional components. In the overlap task, a cue stimulus is presented first and continues to appear when a target stimulus is presented. This task could measure not only the disengagement from the cue stimulus but also the attentional shift and engagement to the target stimulus (Fisher & Weber, 1993; Gómez et al., 1998). According to Posner and Petersen (1990), spatial attention has not one but three components—disengagement, shift, and engagement, that is, disengaging attention from a stimulus, a transient shift of attention to a new stimulus, and engaging attention with the stimulus, respectively. Therefore, individual differences in attentional shift and engagement might influence the RTs in the overlap task. On the other hand, in the gap task, the cue stimulus disappears before the target stimulus is presented. This task could measure the attentional shift and engagement to the target stimulus but could not measure disengagement from the cue stimulus. The appearance of the cue stimuli in the overlap task reinforces attentional engagement to the cue stimuli and results in the inhibition of disengagement, while the offset of the cue stimuli in the gap task enables attention to be disengaged before the target stimuli appear (Fisher & Breitmeyer, 1987; Fisher & Weber, 1993). It is known that the offset of the cue stimuli facilitates eye movement or attentional shift and decreases the RTs to the target stimuli (Fisher & Weber, 1993; Gómez et al., 1998; Mackeben & Nakayama, 1993; Pratt & Nghiem, 2000; Tanaka & Shimojo, 2001). In order to reveal the impaired attentional disengagement from threatening stimuli in socially anxious people, it is necessary to show that the RTs do not differ between threatening and neutral cue stimuli in the gap task. Moreover, studies should show that in the overlap task, the RTs are longer when directing attention to threatening stimuli than when directing attention to neutral stimuli.

Second, it is unclear as to when socially anxious people are unable to disengage their attention from threatening stimuli. Moriya and Tanno (2007) revealed that socially anxious people could disengage from socially threatening words at 100 ms stimulus onset asynchrony (SOA[1]). However, the impaired attentional disengagement from the threatening words was found at 800ms SOA. These results might imply that impaired attentional disengagement depends on semantic processing or on the recognition of the threatening stimuli. The emotional value of facial expressions would be processed before 100 ms post-stimulus (Williams, Palmer, Liddell, Song, & Gordon, 2006) and would be discriminated as early as 200 ms (for a review, see Palermo & Rhodes, 2007; Vuilleumier & Pourtois, 2007). When using facial expressions as the cue, the impairment of attentional disengagement in socially anxious people might be found at a short SOA (e.g., 100 ms).

In the present study, we also investigated whether selective attention to threatening stimuli was a unique function in social anxiety. Comorbidity, which is the tendency for mental disorders to co-occur at higher-than-chance rates, is the important feature among anxiety, depression, and social anxiety (Mineka, Watson, & Clark, 1998; Zimmerman, Chelminski, & McDermut, 2002). Previous studies have revealed that impaired attentional control was especially associated with social anxiety and not trait anxiety and depression (Moriya & Tanno, 2008). It is possible that impaired disengagement from threatening stimuli is specific to social anxiety.

The aim of the present study was to investigate whether socially anxious people have difficulty in disengaging attention from angry faces, and if this is true, to investigate when the impaired disengage from angry faces has occurred. We used a gap task in Experiment 1 and an overlap task in Experiment 2.

[1] This is the time between when a cue stimulus (i.e., socially threatening stimulus) is shown and the target is presented.