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Difficulty Disengaging Attention from Social Threat in Social Anxiety

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Abstract

Selective attention to threat is believed to maintain social anxiety, yet the nature of attentional processing remains unclear. It has been posited that difficulty disengaging from threat cues may be implicated. The present study tested this hypothesis using an eye tracking paradigm to directly examine eye fixations in a non-clinical sample ($N = 46$). Eye movements were tracked during presentation of social cues (happy or disgust faces) embedded with non-social cues matched on dimensions of valence, threat, and arousal. Stimuli were presented for 2,000 ms to allow for examination of attention over time. Results suggest that individuals with higher social anxiety may demonstrate relative difficulty disengaging from negative social cues (i.e., disgust faces). Social anxiety was unrelated to eye movements concerning happy faces. Implications for the maintenance and etiology of social anxiety are discussed.

Keywords

Attentional bias; Disengagement; Eye movements; Faces; Social anxiety; Social phobia

Social anxiety is one of the most prevalent psychiatric conditions (Kessler et al. 2005). Selective attention to threat may play a maintaining role in social anxiety (Rapee and Heimberg 1997). Studies in clinical (Asmundson and Stein 1994; Maidenberg et al. 1996; Mattia et al. 1993) and non-clinical samples (Mogg and Bradley 2002; Pishyar et al. 2004) suggest that socially anxious individuals display heightened attention to social threat cues. On the other hand, some data suggest socially anxious individuals *avoid* social cues rather than attend to them (Chen et al. 2002; Horley et al. 2003; Mansell et al. 1999; Stirling et al. 2006). Thus, the nature of attentional bias in social anxiety has not been adequately specified.

One promising model of attention in social anxiety concerns the ability to disengage from socially threatening stimuli. Although attention is usually directed away from stimuli people have already seen and processed (Posner and Cohen 1984), high state anxious individuals exhibit difficulty disengaging attention from threatening facial stimuli (Fox et al. 2001,

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2002). Thus, difficulty disengaging from threat cues may play a maintaining and/or exacerbating role in problematic anxiety. Regarding social anxiety specifically, those with higher social anxiety may have difficulty disengaging from socially threatening stimuli. There is preliminary support for this model: using dot-probe methodology, Amir et al. (2003) found that patients with social anxiety disorder demonstrated difficulty disengaging attention from social threat words relative to neutral and positive words.

Although promising, much remains unknown about attention disengagement from threat among those with social anxiety. One potential limitation of prior research is the choice of comparison stimuli. We know of no studies of attention in social anxiety that have controlled for the threat value, valence, or arousal of the comparison stimuli. For instance, in the prior report of disengagement in social anxiety (Amir et al. 2003), attention to socially threatening words was compared to positive and neutral words without evaluation of whether those words were comparable on other relevant dimensions. In studies in which facial cues are compared to non-facial objects (household items), it is unknown whether the objects demonstrated comparable threat, arousal, and/or valence to the faces (Chen et al. 2002). It is important to control for these dimensions to determine if socially anxious individuals demonstrate attentional bias toward social *threats* specifically or to social cues generally. It may be that observed differences in prior research were the result of faces being more exciting or arousing than household objects. A second limitation may be that most studies of facial stimuli have used angry faces as threat cues and little empirical work has investigated attentional processes related to disgust faces. However, individuals with social anxiety rate disgust faces (which convey the desire to avoid or reject) even more negatively than angry faces (Amir et al. 2005).

The primary goal of the present study was to investigate attentional processes in social anxiety. The following research questions were addressed. First, would the disengagement difficulty observed by Amir et al. (2003) be replicated using a more direct measure of attention? We expected to observe disengagement difficulty using eye tracking to directly examine eye movements. Second, would disengagement difficulty be specific to social threat cues versus social cues generally? Consistent with the notion that attentional bias occurs in response to threat cues that are specific to the source of anxiety, we predicted that disengagement difficulty would be observed for social threat (i.e., disgust faces) but not non-threatening social cues (i.e., happy faces) or non-social threat cues (e.g., a threatening object).

Method

Participants

The sample consisted of 46 undergraduates (30 women) who received research credit for participation. Prior to the present study, students completed a mass screening conducted in their psychology classes that included the *Social Interaction Anxiety Scale (SIAS)* (Mattick and Clarke 1998). We oversampled for those students scoring in the clinical range (Heimberg et al. 1992). This sample should be appropriate to examine attention in social anxiety given meta-analytic evidence indicating that people with diagnosed anxiety disorders do not differ from high anxious non-clinical people in the magnitude of threat bias (Bar-Haim et al. 2007). The mean age of the sample was 20.02 ($SD = 3.51$) and the racial/ethnic composition was: African American (6.4%), Asian American (2.1%), Caucasian (87.2%), Hispanic/Latino (2.1%), and mixed race/ethnicity (2.1%). No participant reported a history of psychiatric treatment.

Stimulus Photos

Eye movements were tracked during presentations of facial photos paired with non-facial photos that were matched to facial photos on dimensions of threat, valence, and arousal.

Pictures were presented on a PC computer screen and were spaced apart on the screen to accommodate the slight measurement error of 1–2° visual angle of the eye tracker. Each presentation consisted of four pictures. Each facial picture was presented with three non-facial pictures. To mask the goal of the study, every third trial consisted of a filler trial comprised entirely of non-facial pictures.

The facial pictures consisted of eight different people (four men, four women). To control for factors such as perceived aggressiveness and attractiveness of the target faces, each face was presented with both facial expressions (disgust, happy) for a total of 16 facial pictures. To control for picture position and gender, a picture of each gender with each facial expression appeared at each of the four possible positions on the screen. Each trial was presented for 2,000 ms, as previous research found this to be sufficient to examine disengagement (Amir et al. 2003). There were 2 s between trials with 23 stimulus presentations; 16 trials contained facial pictures (trial comprised of one facial and three non-facial photos) and seven filler presentations (trial comprised of four non-facial photos). Each of the 16 facial pictures was presented only once and given the need for 76 non-facial pictures, a random selection of the 69 non-facial pictures was used twice. Picture order and screen location were randomized. Total stimulus presentation time was approximately 90 s.

Facial pictures were drawn from the Ekman pictures of facial affect (Ekman and Friesen 1978) and the non-facial pictures were from the International Affective Pictures Systems (Lang et al. 1995) and pictures taken by the investigators. Non-facial pictures contained nonhuman objects (e.g., buildings, nature scenes). All photos were black and white. Prior to the experiment, a pilot study was conducted in which 100 facial and non-facial pictures were rated in group testing sessions by 92 (63 women) undergraduates using the Self-Assessment Manikin (SAM) scale, a 1-9 Likert-type scale of valence and arousal. Participants also rated each picture's threat level from 1 to 9. Ekman threatening and happy faces were included to provide ratings for the population from which the sample would be drawn (i.e., undergraduate psychology students at a large, public university in the Southeast).

Disgust faces received the following ratings: threat ($M = 4.20$, $SD = 1.79$), valence ($M = 3.88$, $SD = 0.79$), and arousal ($M = 4.20$, $SD = 1.62$). Happy faces received the following ratings: threat ($M = 1.67$, $SD = 1.02$), valence ($M = 6.36$, $SD = 1.58$), and arousal ($M = 3.61$, $SD = 1.72$). No differences were found based on participant demographics or social anxiety (P 's > 0.05). To control for threat, valence, and arousal in the present study, only non-facial pictures with mean ratings that were within 1 SD of mean facial picture ratings on all three domains (threat, valence, and arousal) were used. Using these criteria, 69 non-facial pictures were identified.

Measures

Social anxiety was assessed using the SIAS, a measure of general social interaction fears (Mattick and Clarke 1998). The scale demonstrates high levels of internal consistency across clinical, community, and student samples and test-retest reliability in clinical and non-clinical samples (Heimberg et al. 1992; Mattick and Clarke 1998). In our sample, the SIAS demonstrated excellent internal consistency ($\alpha = 0.91$).

Attention was operationalized in terms of eye fixations. An eye fixation was recorded whenever the participant attended to a given target picture for at least 100 ms. To investigate attention over time, four time blocks were established that are consistent with prior eye tracking studies of attention and anxiety (Hermans et al. 1999): 0–500 ms (T1), 500–1,000 ms (T2), 1,000–1,500 ms (T3), and 1,500–2,000 ms (T4). We examined the proportion of time fixating on the face picture relative to the total captured fixation time for each time block. For instance, we calculated the proportion of time fixating on the happy facial pictures by determining the

proportion of time fixating on a face picture divided by the total captured fixation time for all happy face trials.

Apparatus

Eye movements were recorded with an Applied Science Laboratory's (Bedford, MA) series 5000 eye tracker with magnetic head-tracking to enable the participant to engage in natural head movements. The eye tracker is accurate within 1–2° visual angle (approximately half an inch of monitor space). It records eye saccades at 60 Hz (i.e., 60 samples per second).

Procedure

This study was approved by the Institutional Review Board of the university prior to data collection. No eligible participant refused participation. Following written informed consent, participants completed self-report measures. Next, they were seated in front of the computer and fitted with the magnetic head-tracking headband. Similar to prior eye tracking studies (Hermans et al. 1999; Maner et al. 2003), participants were told to “look naturally at the screen” throughout the experiment. The research assistant (RA) then left participants alone in the room and spent the remainder of the experiment in an adjacent room. A microphone allowed the participant and RA to communicate throughout the experiment. In line with prior eye tracking work (Hermans et al. 1999), participants were told the purpose of the experiment was to measure pupil diameter in response to visual stimuli. This cover story was used to disguise the true nature of the investigation.

After the experimenter calibrated the eye tracker, the participant viewed a set of nine filler stimuli comprised of four unique pictures arranged in the same manner as those viewed during data collection. These photos were not those viewed during data collection but were similar (faces were different individuals from the Ekman series, non-facial pictures were photos from the pilot study not used during data collection). The presentation of these photos allowed the experimenter to check the accuracy of the eye calibration.

Next, the participant viewed the stimulus arrays. Before each array, the word *focus* appeared in the center of the screen for 2 s and participants were instructed to fixate on this word any time it appeared. This ensured that all participants were looking in the center of the screen when the stimuli were presented. Upon completion of the eye tracker task, participants were probed for suspicion and debriefed. No participant indicated suspicion of the true aim of the study.

Statistical Analyses

Participants were divided into two groups based on whether their SIAS score fell above or below the median of 28.00: higher social anxiety (HSA; $n = 23$) and lower social anxiety (LSA; $n = 23$). Baseline demographic characteristics (age, sex, race/ethnicity, employment status) were analyzed using analysis of variance (ANOVA) models for continuous variables and χ^2 tests for nominal/categorical variables. Next, to examine the relation of social anxiety and attention for each face type over time, two mixed-model ANOVAs were conducted with time as the within-subjects factor and social anxiety as the between-subjects factor. Separate analyses were conducted for each face type (disgust, happy). Greenhouse–Geisser corrections were applied when necessary (Mauchley's Sphericity Test < 0.05). Power analyses (Faul et al. 2007) suggest the current sample allowed for examination of study hypotheses at a power $> 80\%$ ($\beta < 0.20$) to test a medium effect size with a Type 1 error ($\alpha < 0.05$).

Results

In the present sample, SIAS scores ranged from 5 to 52 ($M = 27.63$, $SD = 11.50$), with 27.7% of the sample with scores in the clinical range (Heimberg et al. 1992). Social anxiety was not significantly correlated with any demographic variable (P 's > 0.23). There was a significant Time \times Social Anxiety Group interaction for disgust faces, $F(3, 123) = 3.14$, $P < 0.05$.

Examination of the correlations between continuous SIAS scores and fixations on disgust faces at each time point revealed that higher social anxiety was related to greater fixation time only at T4 ($r = 0.32$, $P < 0.05$). Social anxiety was unrelated to fixation time at T1 ($r = -0.12$, $P = 0.42$), T2 ($r = -0.23$, $P = 0.14$), and T3 ($r = 0.09$, $P = 0.56$). Figure 1 suggests that participants with higher social anxiety appear to have a slower rate of disengagement from T2 to T4. To test this hypothesis, rate of disengagement was examined by calculating change scores (fixation time at T4 subtracted from fixation time at T2). Social anxiety was significantly related to change in fixation over this time period ($r = -0.37$, $P = 0.01$). In other words, individuals with higher social anxiety appear to have disengaged from the disgust faces at a significantly slower rate than individuals with lower social anxiety, suggesting disengagement difficulty.

For happy faces, the Time \times Social Anxiety Group interaction was not significant, $F(3, 126) = 15$, $P = 0.92$ (Fig. 2). As this non-significant finding does not preclude the possibility that social anxiety may be related to fixations at specific time points, correlations between continuous SIAS scores and fixations at each time block were examined. There were no significant relations between social anxiety and fixation time on happy faces at any time block (r 's < 0.10 , $P > 0.51$).

Discussion

The present study provides preliminary support for a disengagement difficulty model of social anxiety (Amir et al. 2003). Participants with higher social anxiety appeared to exhibit slower disengagement from disgust faces. Importantly, social anxiety seemed unrelated to attention for happy faces, suggesting that difficulty disengaging from disgust faces may not reflect difficulty disengaging from social cues altogether. Rather, these data imply that disengagement difficulty may be specific to social *threat*.

These findings have implications for our understanding of the nature of social anxiety. Disengagement difficulty is believed to play a maintaining and/or exacerbating role in problematic anxiety (Fox et al. 2001, 2002). Fox et al. (2001) propose that the ability to rapidly disengage from threat cues may serve as a protective factor from anxiety reactivity whereas an inability to effectively disengage from threat may serve to maintain or even increase anxious responding. They posit that the tendency to dwell on threat cues may contribute to rumination on negativity. In the case of social anxiety, it may be that disengagement difficulty increases the tendency of socially anxious individuals to ruminate on the possibility that the negative social threat is directed at them, thereby encouraging activation of memories of prior experiences of negative evaluation. It may also be that disengagement difficulty results in continued and/or increased anxiety by creating a vicious cycle in which anxiety is increased as the individual remains fixated on the socially threatening cue. Further research is needed to evaluate these possibilities.

Another pathway by which disengagement difficulty may impact social anxiety is that difficulty disengaging from social threat could hinder socially anxious people's ability to place social threat cues in their proper context. For example, someone may express disgust toward something in the environment, yet a socially anxious individual may perceive that the expression is directed at her because she is too focused on the facial expression of disgust to perceive the environmental cue that evoked the facial expression. Future work is necessary to

explore the possible pathways that disengagement difficulty may contribute to the maintenance and/or etiology of social anxiety.

The current findings need to be considered in light of limitations that point to promising new research. Given the cross-sectional nature of these analyses, future prospective research is needed to determine causal relations. The use of photographic faces served as a proxy measure of social threat and future work should determine if results replicate in actual social situations. The present sample was comprised primarily of women and replication in predominantly male samples is warranted. Also the present study did not include angry or neutral faces for comparisons. Finally, given recent evidence that anxious individuals, regardless of type of anxiety, appear to demonstrate attentional biases toward threat (Bar-Haim et al. 2007), future work should examine whether the observed effects generalize to individuals with other anxiety conditions.

In sum, findings from this study suggest that difficulty disengaging from social threat cues may play a role in social anxiety. Further work aimed at better understanding the role of attentional processes in social anxiety may ultimately lead to elucidation of underlying causal and maintaining cognitive factors in social anxiety. Such work could also inform the development of targeted cognitively oriented prevention and treatment programs aimed at ameliorating social anxiety symptomatology.

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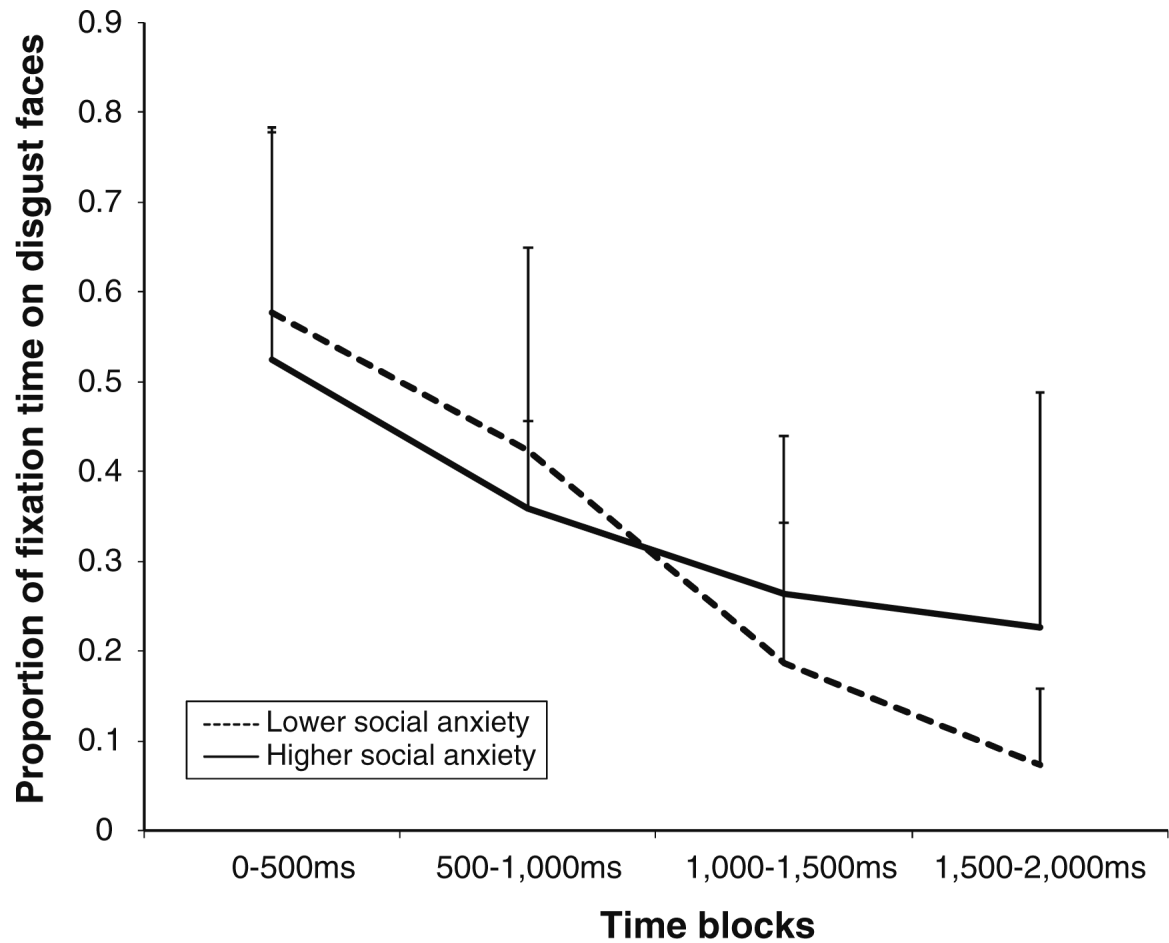


Fig. 1. Mean proportion of fixation time on disgust faces by social anxiety. Lower social anxiety is 1 *SD* below sample mean social anxiety whereas higher social anxiety is 1 *SD* above the mean. Bars indicate *SD*

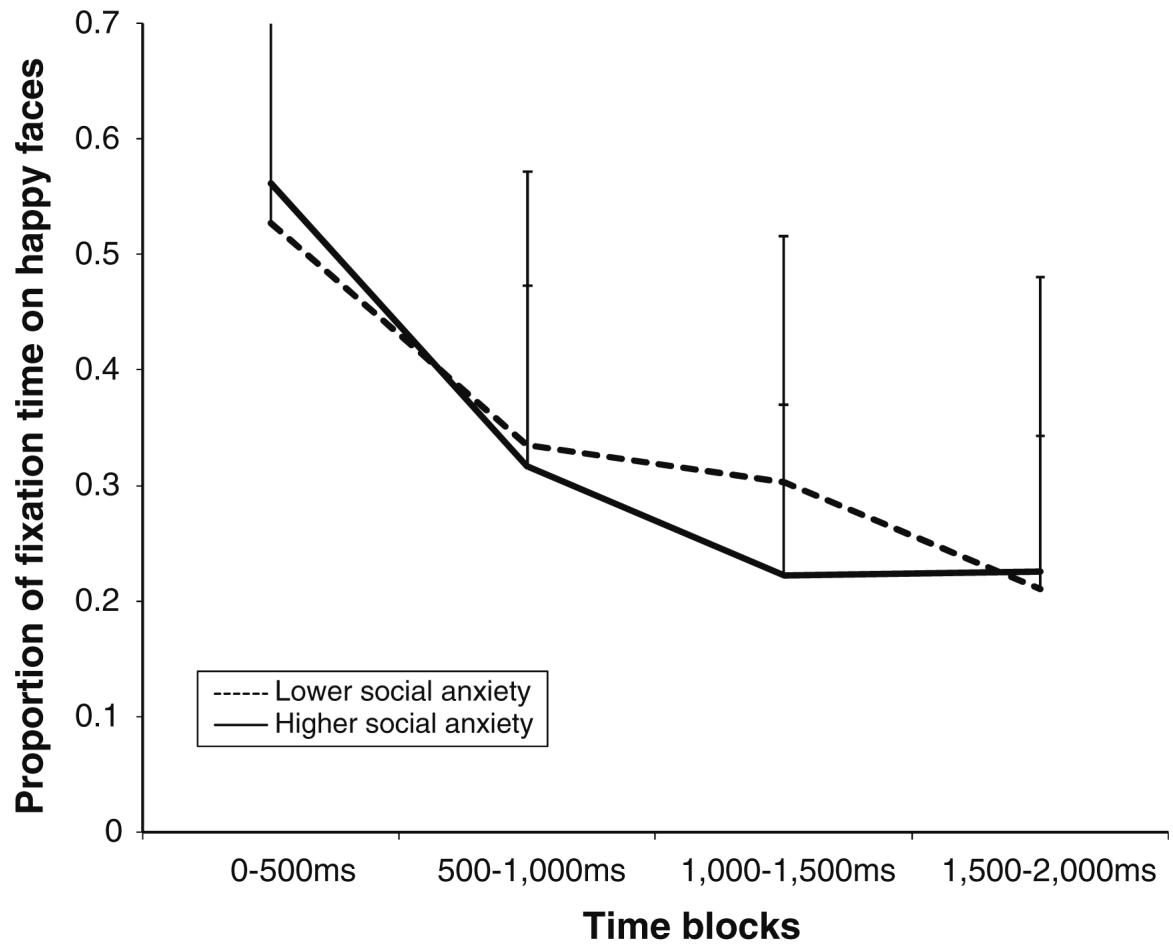


Fig. 2. Mean proportion of fixation time on happy faces by social anxiety. Lower social anxiety is 1 *SD* below sample mean social anxiety whereas higher social anxiety is 1 *SD* above the mean. Bars indicate *SD*