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Social Anxiety and Selective Attention: A Test of the Vigilance-Avoidance Model

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SOCIAL ANXIETY AND SELECTIVE ATTENTION: A TEST OF THE VIGILANCE-AVOIDANCE MODEL

By

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To my parents, for their support throughout my educational journeys.

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ABSTRACT

Individuals with social anxiety have been found to exhibit hypervigilance to detection of socially-relevant threat cues. Additionally, it has been posited that socially anxious individuals experience increased anxiety when attending to a social threat, resulting in subsequent threat avoidance to decrease anxiety. Although this pattern of "vigilance-avoidance" is believed to maintain social anxiety as it prevents habituation to threat, this model has received little empirical investigation. The present study utilized an eye tracking paradigm to examine this model in an undergraduate sample ($N = 46$). Consistent with the model, it was hypothesized that, unlike non-socially anxious individuals, socially anxious individuals would demonstrate vigilance-avoidance for disgust faces (i.e., socially threatening stimuli) but not happy faces (i.e., non-threatening social stimuli). Results showed that high socially anxious (HSA) participants did not differ from low socially anxious (LSA) participants in attention to initial attention to disgust faces. However, HSA participants demonstrated avoidance of disgust faces by the 500-1,000 ms time block relative to LSA participants. Subsequently, HSA participants exhibited a significantly slower rate of disengagement from disgust faces than LSA participants. HSA participants did not differ from LSA participants in attention to happy faces. Results provide support for the avoidance component of the model and suggest socially anxious individuals may engage in delayed disengagement of social threat.

INTRODUCTION

Social anxiety disorder (SAD) is one of the most prevalent mental disorders, affecting up to13% of the population (Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996). SAD is associated with psychiatric and medical complaints, delinquent behavior in adolescence, and increased suicidal ideation and suicide attempts (Davidson, Hughes, George, & Blazer, 1993). Socially anxious individuals are at an increased risk for mood disorders (Kessler, Stang, Wittchen, Stein, Walters, 1999), alcohol use disorders (Burns & Teesson, 2002; Kessler et al., 1997; Lecrubier & Weiller, 1997; Schneier, Martin, Liebowitz, Gorman, & Fyer, 1989) and other substance use disorders (Agosti, Nunes, & Levin, 2002; Davidson et al., 1993). Individuals with social anxiety experience marked impairment in multiple domains of functioning, such as education, employment, family relationships, and romantic relationships (Schneier et al., 1994; Stein, Torgrud, & Walker, 2000). Further, the evidence suggests that social anxiety has an early age of onset and is an enduring disorder with low rates of recovery (Davidson et al., 1993). Elucidation of factors that maintain social anxiety could aid in our understanding of the course of this disorder and have important treatment implications.

Selective attention for threatening information appears to play a maintaining role in anxiety (see Kindt & Van Den Hout, 2001, for review). According to cognitive models of attentional processes (e.g., Beck, Emergy, & Greenberg, 1985; Williams, Watts, Macleod, & Mathews, 1988), early detection of threat is an evolutionary adaptation that aids in survival. All individuals are therefore vigilant, continually scanning the environment for stimuli that could signal impending harm. This results in the detection of actual threats and possible threats. Detection of possible threat occurs at an early state in cognitive processing during which the significance of the stimulus is assessed. For non-anxious individuals, once a possible threat is assessed as non-threatening, the stimulus is avoided. However, in an anxious individual, the possible threat is misperceived as threatening and the individual continues to attend to this stimulus. This misperception is posited to maintain anxiety as the anxious individual is overly preoccupied with threat as a result of the selective attention for threatening stimuli. Further, the nature of the perceived threat is posited to correspond with specific types of anxiety (e.g., individuals with panic would attend more to cues related to physical reactivity whereas individuals with social anxiety would attend more to socially relevant cues).

Selective attention to threat in SAD has been studied in various information processing paradigms. Initial studies of selective attention among individuals with social anxiety utilized modified Stroop tasks. In these tasks, words are presented in different colors and participants are asked to ignore the meaning of words and name the word's color as quickly as possible. Longer response latencies are posited to indicate that the individual is less able to ignore the meaning of the word. This is interpreted as the individual attending to the meaning of the word rather than the color. Socially anxious individuals demonstrate longer response times with social-threat words than socially-neutral words, suggesting a bias of attending to social-threat words (Hope, Rapee, Heimberg, & Dombeck, 1990; Maidenberg, Chen, Craske, Bohn & Bystritsky, 1996; Mattia, Heimberg, & Hope, 1993).

Selective attention in social anxiety has also been investigated using dot-probe paradigms in which a clearly visible dot stimulus is presented following threat-neutral word pairings. Participants are instructed to press a button as quickly as possible when the dot appears. It is thought that participants respond more quickly to probes that are presented in attended regions than to probes that occur in unattended regions. In this way, response latencies serve as a measure of attention allocation. Studies have found that responses to probes were faster when they followed social-threat words, suggesting selective attention toward social-threat words (Asmundson & Stein, 1994; Musa, Lepine, Clark, Mansell, & Ehlers, 2003).

Researchers have also examined selective attention in response to pictures of emotional facial expressions. These stimuli are thought to be more ecologically valid than words, although results from studies using pictures are consistent with those utilizing words. Using the dot-probe paradigm, participants are presented with threat-neutral face pairs or happy-neutral face pairs. A dot is presented after the pictures. The location of the dot corresponds with the location of one of the faces. Again, response latencies are used as a measure of attention as individuals are thought to respond more quickly to probes that are presented in an attended region. On these tasks, high socially anxious individuals demonstrate faster response times when the probe follows threatening faces that have been presented for 500 ms (Mogg & Bradley, 2002; Pishyar, Harris, & Menzies, 2004), suggesting that individuals with social anxiety selectively attend to threatening faces. This attentional bias appears to be specific to social anxiety and not a result of trait anxiety (Mogg & Bradley, 2002).

However, there is also evidence to suggest that high socially anxious individuals do not differ from low socially anxious individuals in attention toward pictures of threatening faces when the faces are presented for 1,100 ms (Bradley et al., 1997). A "vigilance-avoidance" model has been proposed to explain these discrepant findings along with similarly puzzling findings in information processing studies of anxiety (Mogg et al., 1987). According to vigilance-avoidance model, anxious individuals vigilantly monitor the environment for threatening stimuli. They therefore detect threatening stimuli more quickly than non-anxious individuals. The detection of threat leads to increases in anxiety, which causes anxious individuals to avoid the source of the threat in an attempt to decrease anxiety. This pattern of avoidance is believed to maintain the anxiety as it prevents anxious individuals from evaluating vague stimuli as non-threatening or habituating to threatening stimuli.

A vigilance-avoidance model of social anxiety has been the subject of only two known empirical investigations. Amir, Foa, and Coles (1998) tested this model using homographs (i.e., words with multiple meanings). Participants were presented sentences that ended in homographs, some of which were socially threatening (e.g., "She wrote down the mean") and some of which were socially irrelevant (e.g., "He dug with a spade"). Participants were then presented a cue word (e.g., "unfriendly") and asked to either reject or accept the word as an interpretation of the sentence. Sentences were constructed such that the context implied socially irrelevant interpretations. Response latencies were used as a measure of attention, as longer response times were posited to reflect greater preoccupation with homograph meaning. The results indicated that individuals with generalized SAD were slower than nonclinical controls in responding to cue words that were presented after socially threatening homographs when the time between sentence and cue word presentations was small. However, when the time between socially threatening homographs and cue word was longer, the opposite pattern occurred. This pattern was specific to potentially socially threatening words and suggests that individuals with generalized SAD initially attend to and subsequently avoid socially-threatening stimuli, providing support for a vigilance-avoidance model of social anxiety.

Mogg, Philippot, and Bradley (2004) tested the vigilance-avoidance model of social anxiety using a modified dot-probe task with facial stimuli. They compared individuals with SAD to nonclinical controls when the stimuli were presented for 500 ms and when the stimuli were presented for 1,250 ms. At 500 ms they found that individuals with SAD demonstrated faster

response times when the dot was presented after the angry faces than the neutral faces, suggesting attentional bias toward angry faces as compared to neutral ones. Individuals with SAD did not exhibit faster response times in response to happy faces relative to neutral faces. Non-anxious participants did not did not demonstrate faster reaction times to either angry or happy faces. At 1,250 ms, increased social anxiety among controls was associated with greater attentional bias away from angry faces. These findings provide some support for a vigilance-avoidance model of social anxiety.

However, the utility of dot-probe paradigms as a measure of attention has been questioned, as probes are typically presented 500 ms after stimulus presentation which limits information regarding the actual speed with which threatening stimuli are detected (Byrne & Eysenck, 1995). Dot-probe paradigms only provide information regarding to what the individual was attending immediately prior to the dot presentation. They are thereby limited in the data they provide regarding the vigilance component of the vigilance-avoidance model as they provide little information regarding to which stimulus the individual first attended.

Eye tracking studies, however, provide a more exact measure of attention. Two studies have employed eye tracking to investigate the vigilance-avoidance hypothesis among anxious individuals. In a study of spider phobia, Hermans, Vansteenwegen, and Eelen (1999) presented participants with slides containing two pictures: one of a spider and one of a flower. They found that from 0-500 ms, there was no difference between high spider phobic individuals and low spider phobic individuals as both groups attended to the spider pictures approximately 50% of the time. From 500-3000 ms, there was a significant and increasing difference between the groups such that high spider phobic individuals attended less to spider pictures than did low spider anxious individuals. Controls looked at pictures of spiders more than 50% of the time throughout the stimulus presentation. From 2000-3000 ms, individuals with high spider phobia looked at the pictures of flowers significantly more than they looked at the pictures of spiders. This study provides support only for the avoidance component of the vigilance-avoidance model as individuals with high spider phobia did not demonstrate vigilance relative to individuals with low spider phobia.

Rohner (2002) presented high and low trait anxious participants with slides containing two types of faces, angry-neutral and happy-neutral pairings. A bias index was created such that the amount of time attended to happy faces relative to neutral faces was subtracted from the amount

of time participants attended to angry faces relative to neutral faces. A positive bias index is interpreted as the individual viewing angry faces more than happy faces. During the first 1000 ms, there was a significant main effect of bias index such that both high and low trait anxiety individuals exhibited positive bias indexes, suggesting they attended more to angry faces more than happy faces There was no difference in bias indexes between the high and low trait anxiety groups. From 1000-2000 ms, the groups did not significantly differ and there was no significant pattern of bias indexes. From 2000-3000 ms, the interaction between bias index and group was significant such that individuals with high trait anxiety exhibited a negative bias index, suggesting that they viewed angry faces less than happy faces. The relationship between trait anxiety and bias index was not significant. The two groups' bias indexes began to significantly differ at 1800 ms, with individuals with high trait anxiety exhibiting negative indexes (suggesting attention to happy faces) and individuals with low trait anxiety exhibiting positive indexes (suggesting attention to angry faces). This study also only partially supports the vigilance-avoidance model of anxiety. While the bias indexes suggest that at later time blocks, high trait anxious individuals avoided threat while low trait anxious individuals did not demonstrate a significant bias, the bias indexes also suggest that high trait anxious individuals did not demonstrate vigilance relative to low trait anxious individuals.

These two studies provide partial support of the vigilance-avoidance model of anxiety. The results suggest that both anxious and non-anxious individuals attend to threatening stimuli within the first 1000 ms of presentation. Whereas anxious individuals then begin to demonstrate avoidance of threat, non-anxious individuals either attend to threat throughout stimulus presentation or attend equally to both threatening and non-threatening stimuli. Taken together with studies of the vigilance-avoidance model of social anxiety, there is at least partial support of the vigilance-avoidance model of social anxiety.

Despite some attention to the vigilance-avoidance model of social anxiety, the current literature is limited in a number of ways. One possible limitation is that pictorial stimuli have consisted solely of pictures of different facial expressions. This is problematic because individuals with social anxiety may perceive faces in general as threatening. As a result, they may avoid faces altogether and attend to stimuli that is not socially relevant in an effort to ameliorate their anxiety. In fact, there is data to suggest that when given the opportunity to attend to objects other than faces (e.g., household objects) individuals with generalized SAD directed their attention away

from faces (negative, positive, and neutral expressions) and toward the objects (Chen, Ehlers, Clark, & Mansell, 2002). Non-socially anxious have not been found to exhibit this attentional preference. These data suggest that paradigms that solely use facial stimuli may be incorrectly operationalizing happy faces as non-threatening. Additionally, studies that have used pictorial stimuli have consisted of two pictures per stimulus presentation. The use of more photos per stimulus presentation may serve to mask the goal of the study and provide incremental ecological validity. Providing socially anxious participants with social stimuli embedded in an array of socially irrelevant stimuli may elucidate the attentional processes among these individuals.

In addition to the restricted ability of dot-probe tasks to detect vigilance described above, there are further limitations to the dot-probe paradigm that warrant discussion. The dot-probe paradigm requires the participant to press a key following stimulus presentation. However, there is evidence to suggest that the intention to act (e.g., press a key) operates on pre-existing motor representations of possible responses (e.g., Tucker & Ellis, 1998). Thus, it may be that an anxious individual's pre-existing motor response to threat is avoidance. The motor response of pressing a key represents an approach response. Instructing anxious individuals to act in a manner that may be contrary to their pre-existing motor response confounds results obtained using dot-probe paradigms. The present study's use of eye tracking can address this confound as participants will not be instructed to engage in any activity that may contradict their response to the presented stimuli.

A possible limitation of the extant studies of anxiety that utilized eye tacking is the use of 500 and 1000 ms time blocks as a measure of vigilance. While proportions of time spent attending to a particular stimulus during the first 500-1000 ms is somewhat informative, it does not provide data regarding to what the individual attended first. This restricts conclusions that can be made regarding vigilance. Examination of at what stimuli participants look first may provide data that will clarify the mixed findings regarding vigilance in the extant literature.

Given that the results of previous research of attention and social anxiety have yielded mixed results and the methods used to obtain these results are limited, the nature of attentional biases in social anxiety remains unclear. The present study aimed to elucidate the attentional processes utilized by individuals with social anxiety by evaluating the vigilance-avoidance model of social anxiety. To address the limitations of previous research, eye movements of individuals with high social anxiety and individuals with low social were tracked during presentations of

disgust faces (i.e., socially threatening stimuli) paired with socially irrelevant photos and happy faces (i.e., non-threatening social stimuli) paired with socially irrelevant photos. In addition, initial fixations were examined as an additional measure of vigilance. Consistent with the vigilance-avoidance model, the following responses were hypothesized in response to disgust faces. Individuals with low social anxiety were expected to attend to faces and socially irrelevant stimuli equally throughout stimulus presentation. Individuals with social anxiety were expected to demonstrate an initial fixation on faces whereas individuals with low social anxiety were not; from 0-500 ms, the two groups were expected to be significantly different, with individuals with high social anxiety attending more to faces than objects; from 500-2000 ms, individuals with social anxiety were expected to begin to avoid faces and the groups were not expected to be significantly different from each other; from 2000-3000 ms, the two groups were expected to be significantly different, with individuals with high social anxiety attending more to objects than faces.

Happy face-socially irrelevant pairings were also examined to determine if vigilance-avoidance response is unique to socially threatening facial expressions. Consistent with earlier theories of anxiety (e.g., Beck et al., 1985; Williams et al., 1988), it was expected that individuals with social anxiety would demonstrate hypervigilance toward potentially threatening social stimuli (i.e., faces). However, once a happy face was assessed as non-threatening, socially anxious individuals were not expected to demonstrate any further attentional bias. Individuals with low social anxiety were expected to attend to both stimuli equally throughout stimulus presentation. Individuals with social anxiety were expected to exhibit an earlier fixation on faces compared to low socially anxious individuals; from 0-500 ms, the two groups were expected to be significantly different, with individuals with high social anxiety attending more to faces than objects; from 500-3000 ms, the groups were not expected to be significantly different from each other with both groups attending equally to faces and objects.

METHOD

Participants

The sample consisted of undergraduate students at Florida State University who received academic credit for participation. Although 58 students completed the eye tracking paradigm, due to equipment malfunction, only 46 (30 female) participants' data were used in the present analyses. Participants were divided into high (HSA; n=23) and low social anxiety groups (LSA; n=23), depending on whether their scores on the Social Interaction Anxiety Scale (SIAS) were above or below the median of 28.00. The mean age of the participants was 20.0 (*SD* = 3.5). The majority of participants classified themselves as Caucasian (87.2%), with the remainder reporting their race/ethnicity as follows: African American (6.4%), Asian American (2.1%), Hispanic/Latino (2.1%), and mixed race/ethnicity (2.1%). Most were not working (72.4%) or were employed part-time (10.6%). As evidenced in Table 1, there were no significant differences between HSA and LSA participants on demographic variables (all *r*'s < 2.6, *p*'s > .05).

Self-Report Measures

Social Interaction Anxiety Scale (SIAS). The SIAS assesses general social interaction fears and corresponds to the description of generalized SAD (Mattick & Clarke, 1998). The scale demonstrates high levels of internal consistency across clinical, community, and student samples (Heimberg, Mueller, Holt, Hope, & Leibowitz, 1992; Mattick & Clarke, 1998; Osman, Gutierrez, Barrios, Kooper, & Chiros, 1998) and test-retest reliability in clinical and nonclinical samples (Heimberg et al., 1992; Mattick & Clarke, 1998). Individuals with SAD score higher than individuals with other anxiety disorders and non-anxious individuals on this measure (Brown et al., 1997). In the present sample, the SIAS demonstrated excellent internal consistency (alpha = .91) and scores ranged from 5 to 52 (*M* = 27.63, *SD* = 11.50).

Speilberger's State-Trait Anxiety Scale (STAI). The STAI-T was used to assess trait anxiety (Spielberger et al., 1983). This scale has been found to demonstrate good internal consistency, test-retest reliability, and convergent validity with other measures of anxiety (Spielberger et al., 1983). In the present sample, the STAI-T demonstrated excellent internal consistency (alpha = .89) and scores ranged from 13 to 56 (*M* = 27.96, *SD* = 9.25).

Beck Depression Inventory-II (BDI-II). As there is some evidence that depressive symptoms suppress the relationship between social anxiety and attentional biases (Bradley et al., 1997), the BDI-II was administered to assess level of depressive symptoms. The BDI-II is a

reliable and well-validated measure of depressive symptomatology (Beck, Steer, & Brown, 1996). In the present ample, the BDI demonstrated excellent internal consistency (alpha = .88) and scores ranged from 0 to 25 (M = 8.20, SD = 6.35).

Stimulus Photos

The pictures of facial expressions were drawn from the Ekman pictures of facial affect (Ekman & Friesen, 1976) and the socially irrelevant pictures were drawn from Lang, Bradley, and Cuthbert's (1995) International Affective Pictures Systems (IAPS) and pictures taken by the investigators. Prior to the experiment a pilot study was conducted in which all pictures were rated in black and white by high and low socially anxious undergraduates (as determined by SIAS scores). Pictures were converted to black and white to be consistent with Ekman face pictures. Consistent with the IAPS rating procedures, pictures were rated in a pilot study using the Self-Assessment Manikin (SAM) scale, a 9-point Likert scale of valence and arousal. Pictures were also rated on a 9-point Likert scale asking participants to rate the level of threat associated with each picture. 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 Florida State University). One hundred facial and socially irrelevant pictures were rated in group testing sessions by 92 (63 female) undergraduate participants who received course credit for participation.

Threat faces received the following ratings: threat (mean = 4.20, SD = 1.79), valence (mean = 3.88, SD = .79), and arousal (mean = 4.20, SD = 1.62). Happy faces received the following ratings: threat (mean = 1.67, SD = 1.02), valence (mean = 6.36, SD = 1.58), and arousal (mean = 3.61, SD = 1.72). Picture presentation was counterbalanced to control for order effects. No differences were found based on participant gender, race, or social anxiety rating (all F's < 2.37, p's > .05). To control for the effects of threat, valence, and arousal in the present investigation, only those socially irrelevant pictures that were rated comparable to the face pictures were used. Using these criteria, 69 socially irrelevant pictures were identified.

For the current investigation, pictures were presented on a PC computer screen. Pictures were spaced apart on the screen to accommodate the slight measurement error of 1º-2º visual angle of the eye tracker. Each presentation consisted of four pictures. Each facial picture was presented with three socially irrelevant pictures. In order to mask the goal of the study, every third trial consisted of a filler trial comprised of four socially irrelevant pictures. Socially

irrelevant pictures were used no more than twice and their order and screen location were randomized.

The facial pictures consisted of eight different individuals (four males and four females). To control for individual differences such as perceived aggressiveness and attractiveness among the photographed individuals, each individual was presented with both facial expressions of interest (disgust and happiness). There were therefore a total of 16 facial pictures. To control for effects of picture position and gender, a picture of each gender with each facial expression appeared at each of the four possible positions on the screen. For example, a happy female picture was presented at the upper-right, upper-left, lower right, and lower-left hand positions. Each trial was presented for 3000 ms, as previous research has found this to be more than adequate time to illicit an avoidance response (Hermans et al., 1999; Rohner, 2002). There were two seconds between trials. The investigation consisted of 23 stimulus presentations (16 facial presentations and 7 filler presentations). Each facial picture was presented once. Stimulus presentation lasted approximately 2.7 minutes.

Apparatus

Eye movements were recorded with an Applied Science Laboratory's (Bedford, MA) series 5,000 eye tracker with magnetic head-tracking. The magnetic head-tracker enabled the participant to engage in natural head movements. The eye tracker is accurate within 1º-2º visual angle (approximately half an inch of monitor space) and records eye saccades at 60 Hz (i.e., 60 samples per second).

Two measures of attention were examined: the proportion of time fixating on the facial picture relative to the total captured fixation time (i.e., total presentation time minus time in which data were lost due to temporary loss of calibration, blinking, etc.) and the proportion of number of fixations on facial picture relative to total number of captured fixations. These proportions served as the dependent variables. To investigate the study's primary hypotheses (i.e., differences in attention over time), six time blocks were established consistent with that of previous research (Hermans et al., 1999). The time blocks were as follows: 0-500 ms, 500-1000 ms, 1000-1500 ms, 1500-2000 ms, 2000-2500 ms, and 2500-3000 ms. Separate dependent variables were calculated for each individual time block. The initial fixation (picture on which participant initially fixated) served as a seventh dependent variable.

Procedures

Participants were greeted in the lab by a research assistant (RA). Consistent with Hermans et al. (1999), participants were told the purpose of the experiment was to measure physiological reactivity in response to visual stimuli, specifically pupil diameter. Participants were told that previous research has demonstrated that the size of the pupil serves as an index of an individual's interest in visual stimuli and that pupil diameter cannot be voluntarily controlled. This cover story was chosen because the calibration phase of eye tracking may have made some participants suspicious of the true nature of the investigation. Participants then provided written informed consent and completed self-report measures.

Participants were then seated in front of the computer that presented the stimuli. The RA fit participants with the magnetic head-tracking headband and instructed participants to calmly watch the slides while pupil diameter was measured. The 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.

The RA calibrated the eye tracking equipment to participants' eye by instructing participants to fixate on nine different locations on the computer screen above the eye tracker. After the eye tracker was calibrated, participants were again instructed to calmly watch the series of pictures. Consistent with previous eye tracking protocols (e.g., Maner et al., 2003), participants were then shown 30 seconds of filler stimuli consisting of four pictures (one face and three socially irrelevant photos) similar to those that were viewed during data collection. The filler stimuli allowed the experimenter to confirm that the eye tracker was working properly before beginning data collection. After the filler stimuli, participants viewed a series of trials. Before each trial, the word *focus* will appear in the center of the screen for two seconds 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, the RA entered the room with participants and removed the head-tracker. Participants were probed for suspicion, debriefed, and given a receipt for their participation credit. No participant indicated suspicion of the true aim of the present investigation.

RESULTS[1]

Initial Fixations

Zero-order correlations were computed to provide an initial examination of the relationships among social anxiety, trait anxiety, depression, and initial fixation (Table 2). Social anxiety was negatively correlated with initial fixation on happy faces (r = -.29, p = .05), but not correlated with initial fixation on disgust faces (r = -.22, p > .05). Initial fixation for either face regardless of valence was not correlated with depression and trait anxiety scores (all r's < -.03, p's > .05).

Vigilance-Avoidance Hypothesis: Fixation Time

To evaluate the vigilance-avoidance model through an examination of fixation time, a 2 (Valence: Disgust Faces, Happy Faces) X 6 (Time: 0-500 ms, 500-1000 ms, 1000-1500 ms, 1500-2000 ms, 2000-2500 ms, 2500-3000 ms) X 2 (Condition: HSA, LSA) mixed-model analyses of covariance (ANCOVA) was conducted with repeated measures on the first two factors and depression and trait anxiety continuous scores entered as covariates to ensure any observed effects occurred above and beyond that attributable to these theoretically relevant variables (Table 3)[2]. Contrary to the vigilance-avoidance model, this model did not show a significant Time X Valence X Condition three-way interaction, F(6.51, 234.23) = 1.08, p > .10. There was a significant Time X Valence interaction, F (3.22, 115.76) = 4.91, p < .01. Inspection of the simple effects indicated that participants attended significantly more to disgust faces relative to happy faces at 2000-2500 ms [F(1, 36) = 7.76, p < .01] and 2500-3000 ms [F(1, 36) = 10.93, p < .01]. There was also a significant main effect of Time, F(3.07, 110.38) = 4.58, p < .01. Inspection of mean time attended to faces (regardless of valence) at each time block indicated that participants looked more at faces during the first time block (M = .50) than during any other time block: 500-1000 ms (M = .33), 1000-1500 ms (M = .24), 1500-2000 ms (M = .20), 2000-2500 ms (M = .34), 2500-3000 ms (M = .34).

Consistent with Hermans et al. (1999), the specific study hypotheses were examined using separate Time X Condition ANCOVAs for each face type (Table 4). Depression and trait anxiety scores remained in each ANCOVA as covariates. The Time X Condition interaction did not reach significance for disgust faces, F (2.33, 83.90) = 2.20, p > .10 (Figure 1). For happy faces, the Time X Condition interaction also did not reach significance, F (3.90, 144.23) = .15, p > .10 (Figure 2). Given the study hypotheses regarding specific differences posited between conditions

at each time block, the simple effects were examined between LSA and HSA across all time blocks for each face type (Table 5). Only the difference between LSA and HSA at 500-1000 ms demonstrated a trend toward significance for disgust faces F (1, 36) = 3.65, p = .06. The size of this difference represents a small to medium effect (d = .31; Cohen, 1988). This finding is contrary to the vigilance-avoidance model, as LSA (M = .42) showed a trend toward *greater* proportion of fixation time on disgust faces relative to HSA (M = .29). The vigilance-avoidance model posits anxious individuals demonstrate avoidance of threat at later time blocks. There were no significant simple effects between LSA and HSA at any time block for happy faces.

The finding that the overall Time X Condition interactions for each face type were not significant does not preclude the possibility that rate of change in attention may differ between LSA and HSA at specific time points (Maxwell & Delany, 2004). Therefore, interaction contrasts were examined to determine if the mean differences between adjacent time blocks differed between LSA and HSA individuals. For disgust faces, the 500-1000 ms to 1000-1500 ms interaction contrast was significant, F(1, 36) = 8.94, p < .01, indicating the mean difference between 500-1000 ms and 1000-1500 ms for LSA (.25) was significantly larger than the mean difference between 500-1000 ms and 1000-1500 ms for HSA (.05). Inspection of the graph indicates this difference illustrates a steeper slope of disengagement from disgust faces for LSA individuals relative to HSA individuals. There were no other significant interaction contrasts for disgust faces (all F's < 2.10, p's > .10) and no significant interaction contrasts for happy faces (all F's < .48, p's > .10).

Vigilance-Avoidance Hypothesis: Number of Fixations

To evaluate the vigilance-avoidance model through an examination of number of fixations, a 2 (Valence: Disgust Faces, Happy Faces) X 6 (Time: 0-500 ms, 500-1000 ms, 1000-1500 ms, 1500-2000 ms, 2000-2500 ms, 2500-3000 ms) X 2 (Condition: HSA, LSA) mixed-model analyses ANCOVA was conducted with repeated measures on the first two factors (Table 6). Depression and trait anxiety continuous scores were entered as covariates to ensure any observed effects occurred above and beyond that attributable to these theoretically relevant variables. This model also did not demonstrate a significant Time X Valence X Condition three-way interaction, F(2.74, 106.71) = .92, p > .10. There was a significant Time X Valence interaction, F(2.74, 106.71) = 8.99, p < .01. Inspection of the simple effects indicated that participants attended significantly more to disgust faces relative to happy faces from 2000-2500 ms [F(1, 39) = 11.39, p

< .01] and 2500-3000 ms [$F(1, 39) = 13.63$, $p < .01$]. There was also a significant main effect of Time, $F(2.21, 86.11) = 6.72$, $p < .01$. Inspection of proportion of number of fixations on faces (regardless of valence) at each time block indicated that participants engaged in more fixations on faces during the first time block ($M = .45$) than during any other time block: 500-1000 ms ($M = .28$), 1000-1500 ms ($M = .19$), 1500-2000 ms ($M = .16$), 2000-2500 ms ($M = .30$), 2500-3000 ms ($M = .29$). There was also a trend toward a significant effect of Valence, $F(1, 39) = 3.47$, $p = .07$. Inspection of proportion of number of fixations on faces (regardless of time) indicated that participants engaged in more fixations on disgust faces ($M = .43$) than happy faces ($M = .34$).

Consistent with the strategy outlined for fixation time, the specific study hypotheses were examined using separate Time X Condition ANCOVAs for each face type (Table 7). Depression and trait anxiety scores remained in each ANCOVA as covariates. The Time X Condition interaction did not reach significance for disgust faces, $F(1.85, 72.15) = .56$, $p > .10$ (Figure 3), or for happy faces, $F(3.17, 123.49) = .38$, $p > .10$ (Figure 4). Given the study hypotheses regarding specific differences posited between conditions at each time block, the simple effects were examined between LSA and HSA across all time blocks for each face type (Table 8). Contrary to the vigilance-avoidance model, there were no significant simple effects at any time block for either face type. Interaction contrasts were examined to determine if the mean differences between adjacent time blocks differed between LSA and HSA individuals (Maxwell & Delany, 2004). There were no significant interaction contrasts for disgust faces (all F's < 2.75, p's > .10) or for happy faces (all F's < 1.01, p's > .10).

Follow-Up Analyses – Attentional Processing from 0-2000 ms

The initial analyses suggest that there appear to be differences in attention to disgust faces between the HSA and LSA groups within the first 2000 ms, but that HSAs no longer differ from LSAs by 3000 ms. Given that the aim of this study is to elucidate potentially problematic information processing among socially anxious individuals, additional analyses were conducted to further probe the apparent attentional differences from 0-2000 ms between LSA and HSA individuals. A 2 (Valence: Disgust Faces, Happy Faces) X 4 (Time: 0-500 ms, 500-1000 ms, 1000-1500 ms, 1500-2000 ms) X 2 (Condition: HSA, LSA) mixed-model ANCOVA was conducted with repeated measures on the first two factors. Depression and trait anxiety continuous scores were entered as covariates to ensure any observed effects occurred above and beyond that attributable to these theoretically relevant variables. This model demonstrated a trend

toward a significant Time X Valence X Condition three-way interaction, $F(3, 108) = 2.56$, $p = .06$. Following the recommendations of Olejnik and Algina (2000), omega squared effect sizes were calculated for repeated measures effects and covariates remained in the model. This interaction demonstrated a small effect size ($\omega^2 = .02$; Olejnik & Algina, 2000).

Consistent with Hermans et al. (1999), separate Time X Condition ANCOVAs were performed for each face type to obtain a more detailed understanding of this three-way effect. Depression and trait anxiety scores remained in each ANCOVA as covariates. For disgust faces, the Time X Condition interaction did reach significance, $F(3.56, 92.16) = 3.14$, $p < .05$ (Figure 5). Examination of the simple effects again revealed a trend toward a significant difference in fixation time between LSA ($M = .42$) and HSA ($M = .29$) at 500-1000 ms, $F(1, 36) = 3.65$, $p = .06$. The size of this difference represents a small to medium effect ($d = .31$; Cohen, 1988) and is contrary to the vigilance-avoidance model which posits avoidance at later time blocks. Examination of the interaction contrasts indicated that the mean difference between the 500-1000 ms and 1000-1500 ms time blocks for LSA (.25) was significantly larger than the mean difference between the 500-1000 ms and 1000-1500 ms time blocks for HSA (.05), $F(1, 36) = 8.94$, $p < .01$. In addition, the mean difference between the 500-1000 ms and 1500-2000 ms time blocks for LSA (.31) was significantly larger than the mean difference between the 500-1000 ms and 1500-2000 ms time block for HSA (.09), $F(1, 36) = 6.36$, $p < .05$. In other words, these data suggest that LSA individuals demonstrated a significantly larger rate of change in fixation time to disgust faces relative to HSA individuals between the 500-1000 ms and 1000-1500 ms time blocks and the 500-1000 ms and 1500-2000 ms time blocks. Inspection of the graph indicates these significant differences suggest that LSA individuals attended to non-disgust face stimuli at a faster rate than HSA individuals.

For happy faces, the Time X Condition interaction was not significant, $F(3, 111) = .08$, $p > .10$ (Figure 6). Further, as evidenced by Tables 11 and 12, there were no significant simple effects or interaction contrasts, suggesting that the rate of change in attention did not differ between LSA and HSA participants.

DISCUSSION

The present study was designed to elucidate the mixed findings in the extant literature regarding attentional processes among socially anxious individuals. This study differs from previous investigations of attentional processing among socially anxious individuals in the use of an eye tracking paradigm to directly examine on which stimuli participants fixate. Specifically, the present investigation examined the utility of a vigilance-avoidance model of attentional bias in social anxiety. According to this model, when confronted with threatening stimuli, socially anxious individuals should initially direct their attention toward a social threat cue then subsequently avoid the threat by turning attention to non-threatening stimuli (Mogg et al., 1987). The current investigation found little support for this model. HSA individuals do not demonstrate hypervigilance for social threat cues relative to LSA individuals. HSA individuals did demonstrate avoidance for social threat relative to LSA individuals. However, this avoidance occurred much earlier than expected given findings from other eye tracking studies of vigilance-avoidance in other anxious populations (Hermans et al., 1999; Rohner, 2002). Taken together, the current findings are consistent with previous eye tracking investigations that found little support for vigilance-avoidance models for other anxious groups. Studies of trait anxiety (Rohner, 2002) and spider phobia (Hermans et al., 1999) suggest that anxious individuals do not appear to demonstrate hypervigilance relative to non-anxious individuals, although anxious individuals appear to engage in subsequent avoidance of potentially threatening cues.

Given that previous studies of vigilance-avoidance in social anxiety did find support for this model (Amir et al., 1998; Mogg et al., 2004), why were these findings not replicated by the present investigation? There are several methodological differences between the current study and previous studies that could account for these discrepant findings. First, the use of eye tracking as a direct measure of attention suggests that previous findings that appear to reflect vigilance-avoidance are actually the result of other cognitive processes such as memory or of pre-exiting motor responses. Second, the current investigation is the only known study to isolate the effects of social threat by controlling for the threat, valence, and arousal of the "neutral" photo pairings. Finally, the current investigation is also the first known study of the vigilance-avoidance model that did not consist solely of two picture pairings, but rather embedded photos in an array of photos to increase ecological validity. It may therefore be that when given the opportunity to

attend to an array of non-facial stimuli, socially anxious individuals avoid threat faces at a faster rate than when presented solely with facial stimuli.

Our findings therefore indicate that the vigilance-avoidance model does not capture attentional processing among socially anxious individuals. Rather, the data suggest that although HSA individuals do not differ from LSA individuals in initial (0-500 ms) attention to social threat cues (i.e., disgust faces), they do differ in their rate of disengagement from social threat as evidenced by the significant differences in rate of disengagement from threat cues beginning from 500-2000 ms. In other words, the current findings suggest that HSA individuals disengage from social threat at a slower rate than LSA individuals.

These findings are consistent with prior research positing a delayed disengagement model of attentional bias regarding threat (e.g., Fox, Russo, Bowles, & Dutton, 2001). According to the delayed disengagement model, all individuals initially orient toward potential threat cues. Subsequent to initial orienting of attention, some individuals take longer to disengage attention from threat-related stimuli. In other words, it is not that attention is differentially drawn *to* threat-relevant stimuli but rather that some individuals have a difficult time disengaging attention *from* threat cues subsequent to initial orienting of attention. Emerging evidence suggests delayed disengagement is particularly evident in trait anxious individuals (e.g., Fox, Russo, & Dutton, 2002).

The pattern of attention to disgust faces appears congruent with a delayed disengagement model of social anxiety. First, HSA individuals do not differ from LSA individuals in initial attention to disgust faces (0-500 ms). In other words, all participants initially orient toward this potential threat cue. However, from 500-1500 ms, LSA individuals disengage from disgust faces at a faster rate than HSA individuals as evidenced by the significantly greater slope of disengagement demonstrated by the LSA individuals relative to the HSA individuals. Importantly, these data emerged even after controlling for trait anxiety and depressive symptomatology, suggesting this pattern of attentional bias is not better accounted for by theoretically relevant conditions that tend to co-occur with social anxiety.

The pattern of attention observed for happy faces lends further support to a disengagement model of social anxiety by providing specificity. Contrary to the findings for disgust faces in the first 2000 ms, HSA individuals do not appear to differ from LSA individuals in their pattern of attention allocation for happy faces. These findings suggest that delayed

disengagement observed for HSA individuals in regards to disgust faces reflects an attentional processing of social *threat* (versus social cues in general). Interestingly, HSA individuals were significantly less likely to initially fixate on happy faces when compared to LSA individuals. However, the lack of significant differences between LSA and HSA individuals found across the time blocks suggests that the potential threat of a smiling face was quickly assessed as non-threatening.

The current findings need to be considered in light of several limitations that point to promising new areas of research in the area of attentional bias among socially anxious individuals. First, due to the cross-sectional nature of these analyses, causal inferences between attentional bias and social anxiety cannot be made. Future research is warranted to determine whether delayed disengagement from social threat serves a causal role in the development of social anxiety or if HSA individuals develop delayed disengagement in an effort to cope with social anxiety reactions. Second, although the use of photographic faces serves as a proxy measure of actual social threat, the generalizability of these findings may be limited. Future work should determine if socially anxious individuals demonstrate delayed disengagement while engaging in social anxiety-provoking situations. Third, the present study examined a non-referred group rather than a clinical sample. While the high SIAS ratings made by several participants suggests the sample included individuals with clinically significant social anxiety, future work should focus on whether the results observed in the present study generalize to individuals with SAD. Fourth, the present investigation used only one type of threat (i.e., social threat). Although the present investigation controlled for threat of socially irrelevant cues by matching the range of threat to that of faces, future studies should investigate whether socially anxious individuals demonstrate difficulty disengaging from all threat or whether this disengagement is specific to socially-relevant threat cues.

Taken together, the findings of the present investigation suggest a vigilance-avoidance model does not account for the attentional processing of socially anxious individuals. Rather, based on the current findings, we propose a delayed disengagement model of social anxiety. According to this model, socially anxious individuals demonstrate marked delay in disengagement of social threat cues (e.g., disgusted faces) but not social cues in general (e.g., happy faces). Moreover, delayed disengagement of social threat appears relatively specific to social anxiety, as this effect emerged after controlling for trait anxiety and depressive symptomatology. A better

understanding the role of attentional processes in social anxiety may ultimately lead to the use of this information to develop targeted prevention and treatment programs aimed at ameliorating social anxiety symptomatology.

FOOTNOTES

[1]The data were also examined using clinically meaningful cut scores to differentiate LSA and HSA. To streamline the results section, these analyses are presented in Appendix A, rather than in the body of the text.

[2]Greenhouse-Geisser corrections (with adjusted degrees of freedom) were applied when necessary (Mauchley's Sphericity Test < .05).

Table 1.
Demographic variables.

	1	2	3	4	5	6
1. SIAS	-	-	-	-	-	-
2. Age	.07	-	-	-	-	-
3. Gender	.01	-.18	-	-	-	-
4. Race	-.04	-.02	.07	-	-	-
5. Employment	.07	.15	-.27	.11	-	-
6. Overall GPA	.14	.18	-.10	-.29*	-.06	-
Mean or %	27.63	20.02	66%	12.7%	72.3%	2.53
SD	11.50	3.51	female	non-Caucasian	unemployed	1.16

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 2.
Correlations Among Variables of Interest.

	1	2	3	4	5
1. SIAS	-	-	-	-	-
2. BDI	.18	-	-	-	-
3. STAIT	.18	.54***	-	-	-
4. disgust faces	-.22	-.13	-.13	-	-
5. happy faces	-.29**	-.13	-.03	.63***	-
Mean	.50	.46	.53	3.11	2.85
SD	.51	.50	.50	1.84	1.72

* Correlation is significant at the 0.10 level (2-tailed).
** Correlation is significant at the 0.05 level (2-tailed).
*** Correlation is significant at the 0.01 level (2-tailed).

Table 3.
Univariate within-subjects effects of variables of interest on proportion of mean fixation time.

	F	*df*	*p*
Time	4.58***	3.07, 110.38	.00
Time X BDI	1.06	3.07, 110.38	.37
Time X STAIT	.38	3.07, 110.38	.77
Time X Social Anxiety Condition	.71	3.07, 110.38	.55
Valence	2.74	1.00, 36.00	.11
Valence X BDI	.15	1.00, 36.00	.70
Valence X STAIT	.47	1.00, 36.00	.50
Valence X Social Anxiety Condition	.13	1.00, 36.00	.72
Time X Valence	4.91***	3.22, 115.76	.00
Time X Valence X BDI	1.08	3.22, 115.76	.36
Time X Valence X STAIT	.96	3.22, 115.76	.42
Time X Valence X Social Anxiety Condition	1.52	3.22, 115.76	.21

* $p < .10$
** $p < .05$
*** $p < .01$

Table 4.
Univariate within-subjects effects of variables of interest on proportion of mean fixation time.

	F	*df*	*p*
Disgust faces			
Time	7.03***	2.33, 83.90	.00
Time X BDI	.52	2.33, 83.90	.63
Time X STAIT	.74	2.33, 83.90	.50
Time X Social Anxiety Condition	2.20	2.33, 83.90	.11
Happy Faces			
Time	3.04**	3.90, 144.23	.01
Time X BDI	1.56	3.90, 144.23	.19
Time X STAIT	.61	3.90, 144.23	.66
Time X Social Anxiety Condition	.15	3.90, 144.23	.96

* $p < .10$
** $p < .05$
*** $p < .01$

Table 5.
Simple effects analyses of the differences in fixation time between HSA and LSA at each time block for each face type.

	F	*df*	*p*
Disgust Faces			
0-500 ms	.01	1, 36	.91
500-1000 ms	3.65*	1, 36	.06
1000-1500 ms	2.16	1, 36	.15
1500-2000 ms	2.39	1, 36	.13
2000-2500 ms	.05	1, 36	.82
2500-3000 ms	.44	1, 36	.51
Happy Faces			
0-500 ms	.57	1, 37	.46
500-1000 ms	1.13	1, 37	.29
1000-1500 ms	.08	1, 37	.78
1500-2000 ms	.16	1, 37	.69
2000-2500 ms	.77	1, 37	.39
2500-3000 ms	2.19	1, 37	.15

* $p < .10$
** $p < .05$
*** $p < .01$

Table 6.
Univariate within-subjects effects of variables of interest on proportion of mean number of fixations.

	F	*df*	*p*
Time	6.72***	2.21, 86.11	.00
Time X BDI	.55	2.21, 86.11	.59
Time X STAIT	.61	2.21, 86.11	.56
Time X Social Anxiety Condition	.16	2.21, 86.11	.87
Valence	3.47	1.00, 39.00	.07
Valence X BDI	.41	1.00, 39.00	.53
Valence X STAIT	.71	1.00, 39.00	.40
Valence X Social Anxiety Condition	.01	1.00, 39.00	.91
Time X Valence	8.99***	2.74, 106.71	.00
Time X Valence X BDI	.46	3.22, 115.76	.69
Time X Valence X STAIT	1.03	3.22, 115.76	.38
Time X Valence X Social Anxiety Condition	.92	3.22, 115.76	.43

* $p < .10$
** $p < .05$
*** $p < .01$

Table 7.
Univariate within-subjects effects variables of interest on proportion of mean number fixations.

	F	*df*	*p*
Disgust Faces			
Time	9.41***	1.85, 72.15	.00
Time X BDI	.48	1.85, 72.15	.61
Time X STAIT	.49	1.85, 72.15	.60
Time X Social Anxiety Condition	.56	1.85, 72.15	.56
Happy Faces			
Time	5.94**	3.17, 123.49	.00
Time X BDI	.56	3.17, 123.49	.65
Time X STAIT	1.05	3.17, 123.49	.38
Time X Social Anxiety Condition	.38	3.17, 123.49	.78

* $p < .10$
** $p < .05$
*** $p < .01$

Table 8.
Simple effects analyses of the differences in fixation number between HSA and LSA at each time block for each face type.

	F	*df*	*p*
Disgust Faces			
0-500 ms	.50	1, 39	.49
500-1000 ms	.04	1, 39	.85
1000-1500 ms	2.19	1, 39	.15
1500-2000 ms	2.56	1, 39	.12
2000-2500 ms	.93	1, 39	.34
2500-3000 ms	1.06	1, 39	.31
Happy Faces			
0-500 ms	.39	1, 39	.54
500-1000 ms	2.33	1, 39	.14
1000-1500 ms	.09	1, 39	.77
1500-2000 ms	.47	1, 39	.50
2000-2500 ms	.33	1, 39	.57
2500-3000 ms	2.93	1, 39	.10

* $p < .10$
** $p < .05$
*** $p < .01$

Table 9.
Univariate within-subjects effects of variables of interest on proportion of mean fixation time (0-2000 ms).

	F	*df*	*p*
Time	6.23***	3, 108	.00
Time X BDI	.83	3, 108	.48
Time X STAIT	.40	3, 108	.76
Time X Social Anxiety Condition	.74	3, 108	.53
Valence	.10	1, 36	.76
Valence X BDI	.31	1, 36	.58
Valence X STAIT	.01	1, 36	.92
Valence X Social Anxiety Condition	.15	1, 36	.70
Time X Valence	.73	3, 108	.54
Time X Valence X BDI	.48	3, 108	.70
Time X Valence X STAIT	.51	3, 108	.68
Time X Valence X Social Anxiety Condition	2.56	3, 108	.06

* $p < .10$
** $p < .05$
*** $p < .01$

Table 10.
Univariate within-subjects effects variables of interest on proportion of mean fixation time (0-2000 ms).

	F	*df*	*p*
Disgust Faces			
Time	7.14***	2.56, 92.16	.00
Time X BDI	.62	2.56, 92.16	.58
Time X STAIT	.87	2.56, 92.16	.45
Time X Social Anxiety Condition	3.14**	2.56, 92.16	.03
Happy Faces			
Time	2.10**	3, 111	.10
Time X BDI	.82	3, 111	.49
Time X STAIT	.17	3, 111	.92
Time X Social Anxiety Condition	.08	3, 111	.97

* $p < .10$
** $p < .05$
*** $p < .01$

Table 11.
Simple effects analyses of the differences in fixation time between HSA and LSA at each time block (0-2000 ms) for each face type.

	F	*df*	*p*
Disgust Faces			
0-500 ms	.01	1, 36	.91
500-1000 ms	3.65*	1, 36	.06
1000-1500 ms	2.16	1, 36	.15
1500-2000 ms	2.39	1, 36	.13
Happy Faces			
0-500 ms	.57	1, 37	.46
500-1000 ms	1.13	1, 37	.29
1000-1500 ms	.08	1, 37	.78
1500-2000 ms	.16	1, 37	.69

* $p < .10$
** $p < .05$
*** $p < .01$

Table 12.
Interaction contrasts for each face type (0-2000 ms).

	F	*df*	*p*
Disgust Faces			
0-500 ms to 500-1000 ms	2.10	1, 36	.16
0-500 ms to 1000-1500 ms	.94	1, 36	.34
0-500 ms to 1500-2000 ms	1.24	1, 36	.27
500-1000 ms to 1000-1500 ms	8.94***	1, 36	.01
500-1000 ms to 1500-2000 ms	6.36**	1, 36	.02
1000-1500 ms to 1500-2000 ms	.09	1, 36	.77
Happy Faces			
0-500 ms to 500-1000 ms	.04	1, 37	.84
0-500 ms to 1000-1500 ms	.06	1, 37	.81
0-500 ms to 1500-2000 ms	.02	1, 37	.88
500-1000 ms to 1000-1500 ms	.20	1, 37	.66
500-1000 ms to 1500-2000 ms	.14	1, 37	.71
1000-1500 ms to 1500-2000 ms	.01	1, 37	.91

* $p < .10$
** $p < .05$
*** $p < .01$

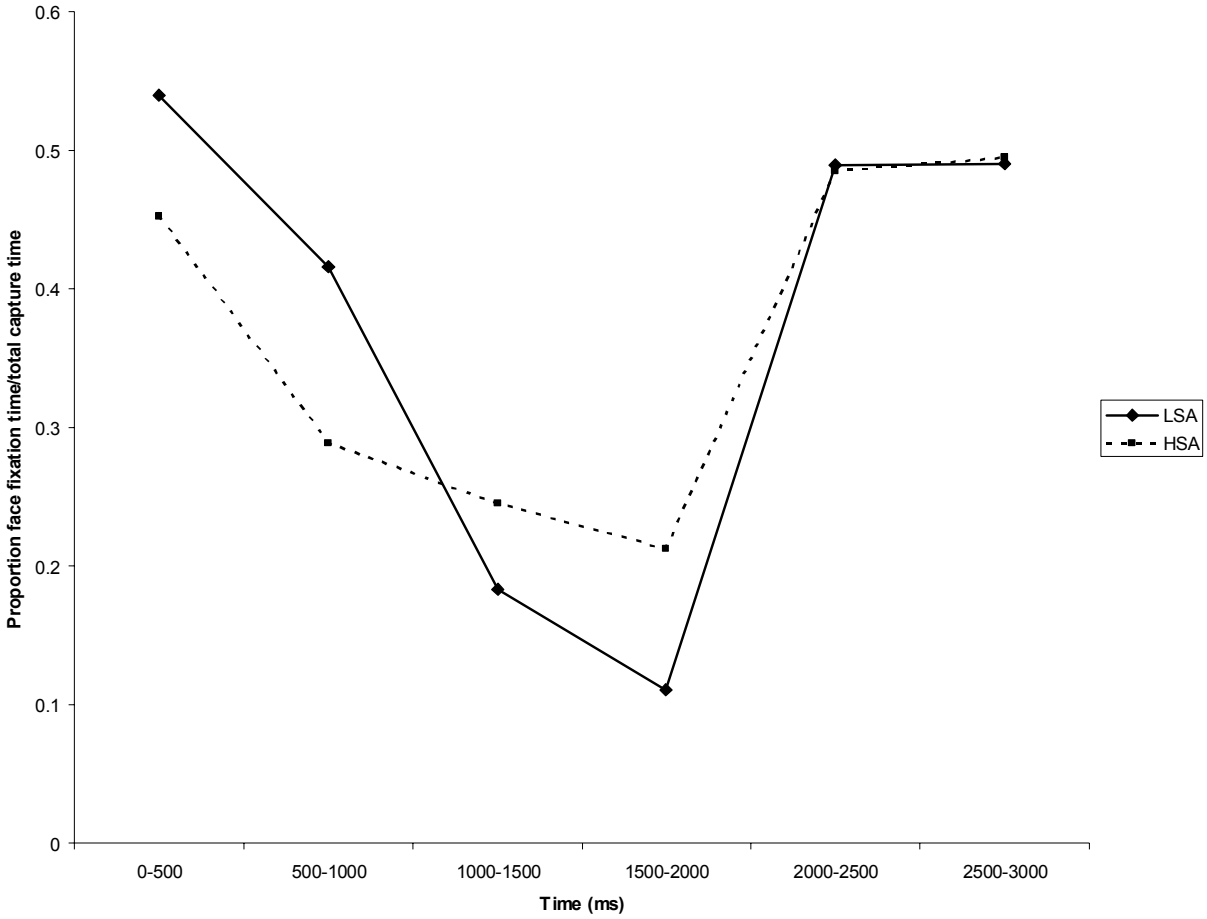

Figure 1. Mean proportion of fixation time on disgust faces grouped by social anxiety condition. *Note:* Covariates appearing in the model are evaluated at the following values: BDI (M = 8.63), STAIT (M = 27.85).

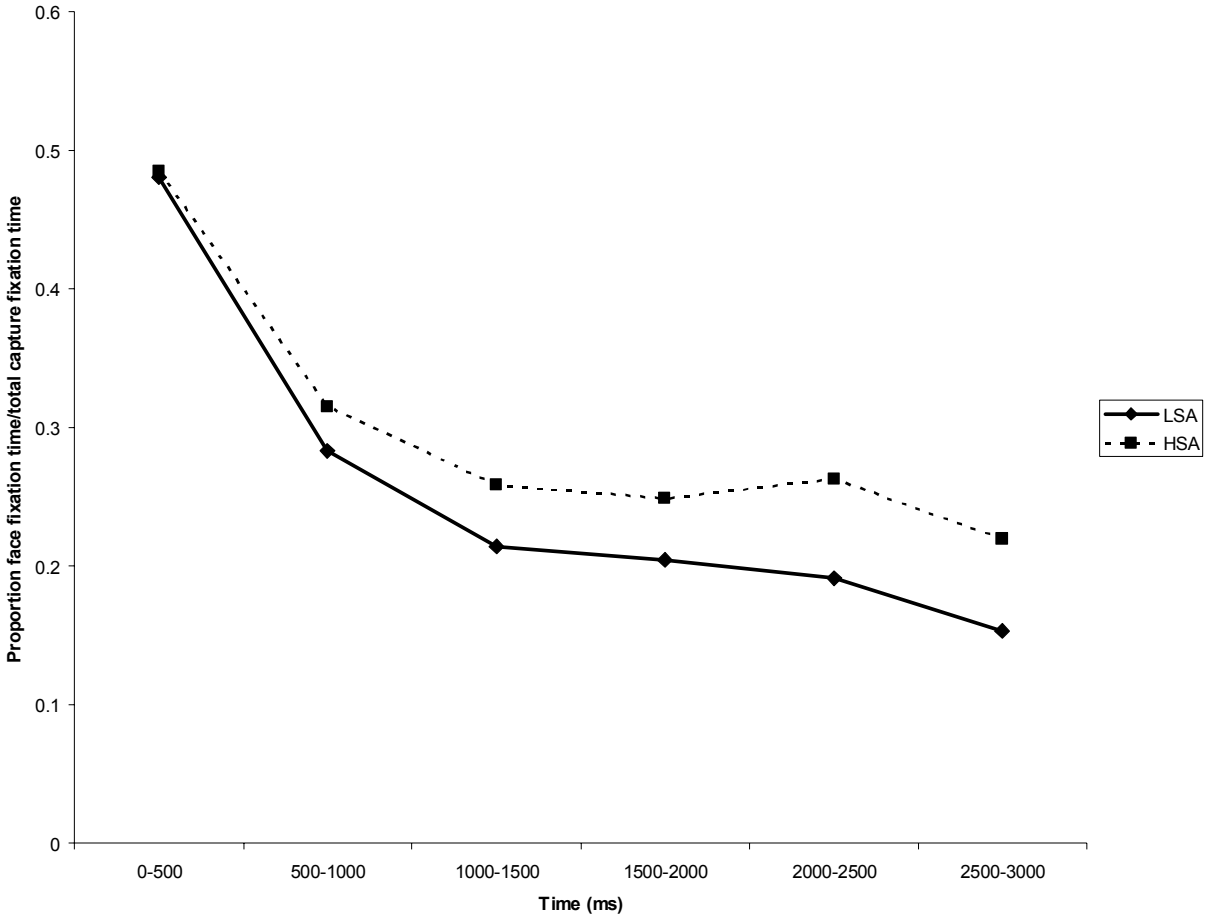

Figure 2. Mean proportion of fixation time on happy faces grouped by social anxiety condition. *Note:* Covariates appearing in the model are evaluated at the following values: BDI (*M* = 8.63), STAIT (*M* = 27.85).

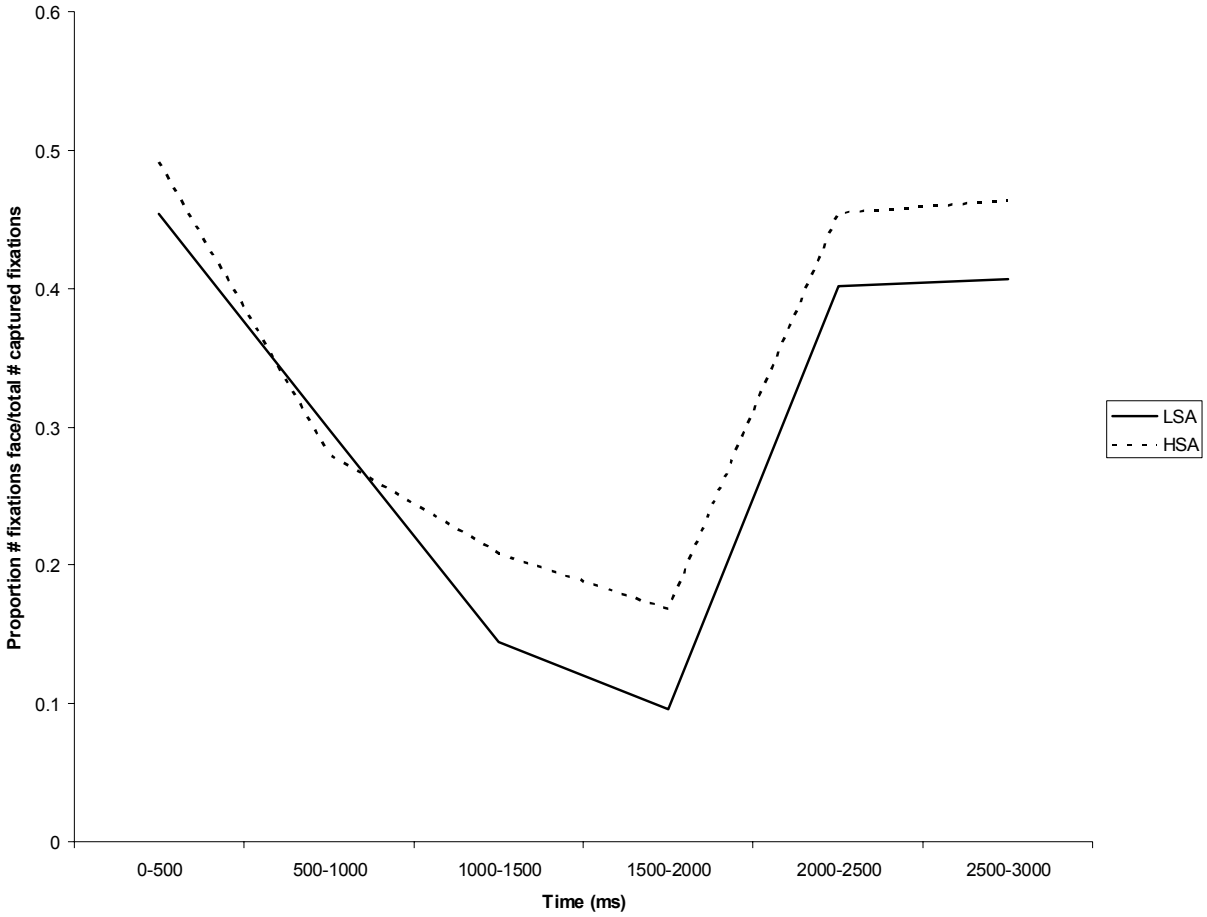

Figure 3. Mean proportion of number of fixations on disgust faces grouped by social anxiety condition.

Note: Covariates appearing in the model are evaluated at the following values: BDI (*M* = 8.63), STAIT (*M* = 27.85).

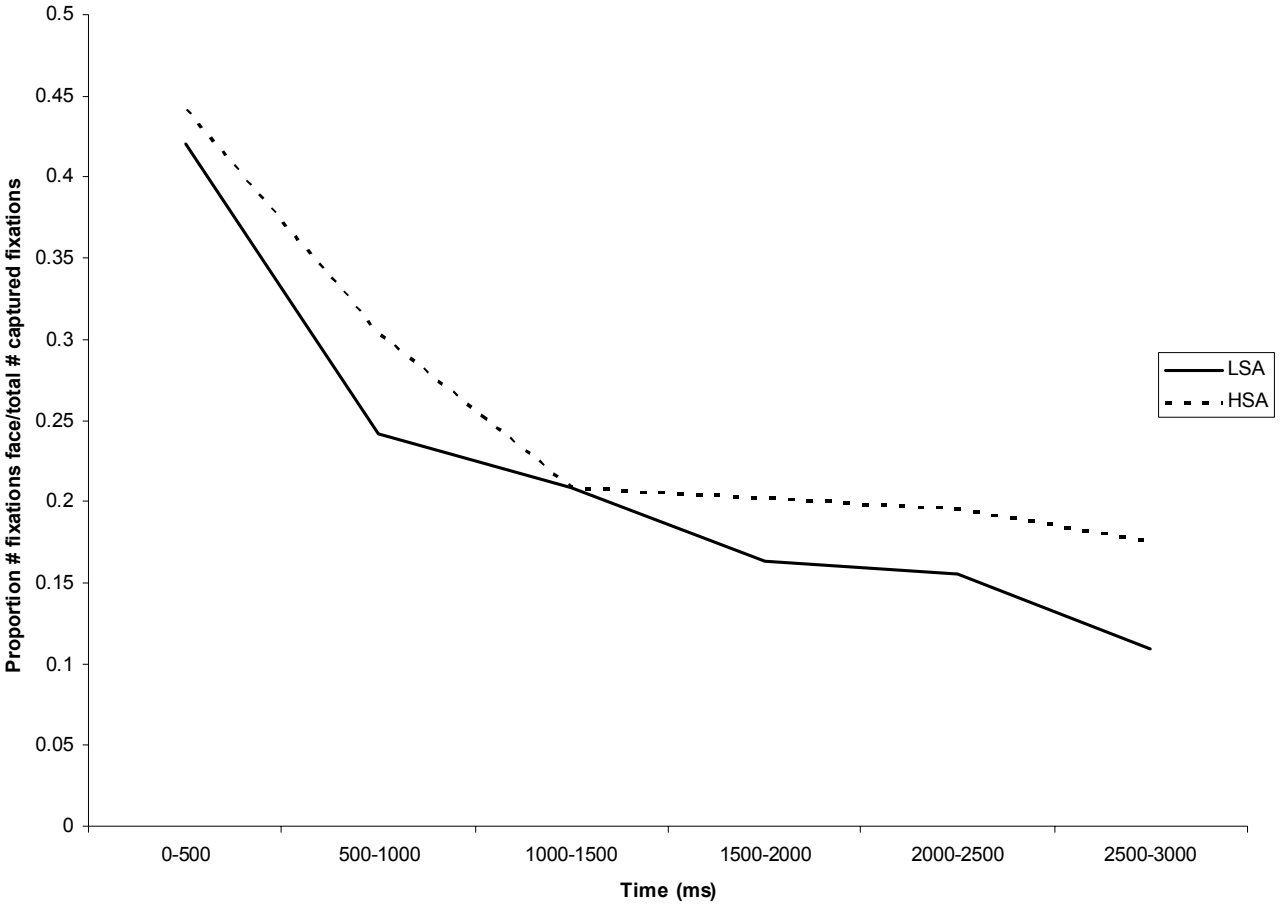

Figure 4. Mean proportion of number of fixations on happy faces grouped by social anxiety condition.
Note: Covariates appearing in the model are evaluated at the following values: BDI (*M* = 8.63), STAIT (*M* = 27.85).

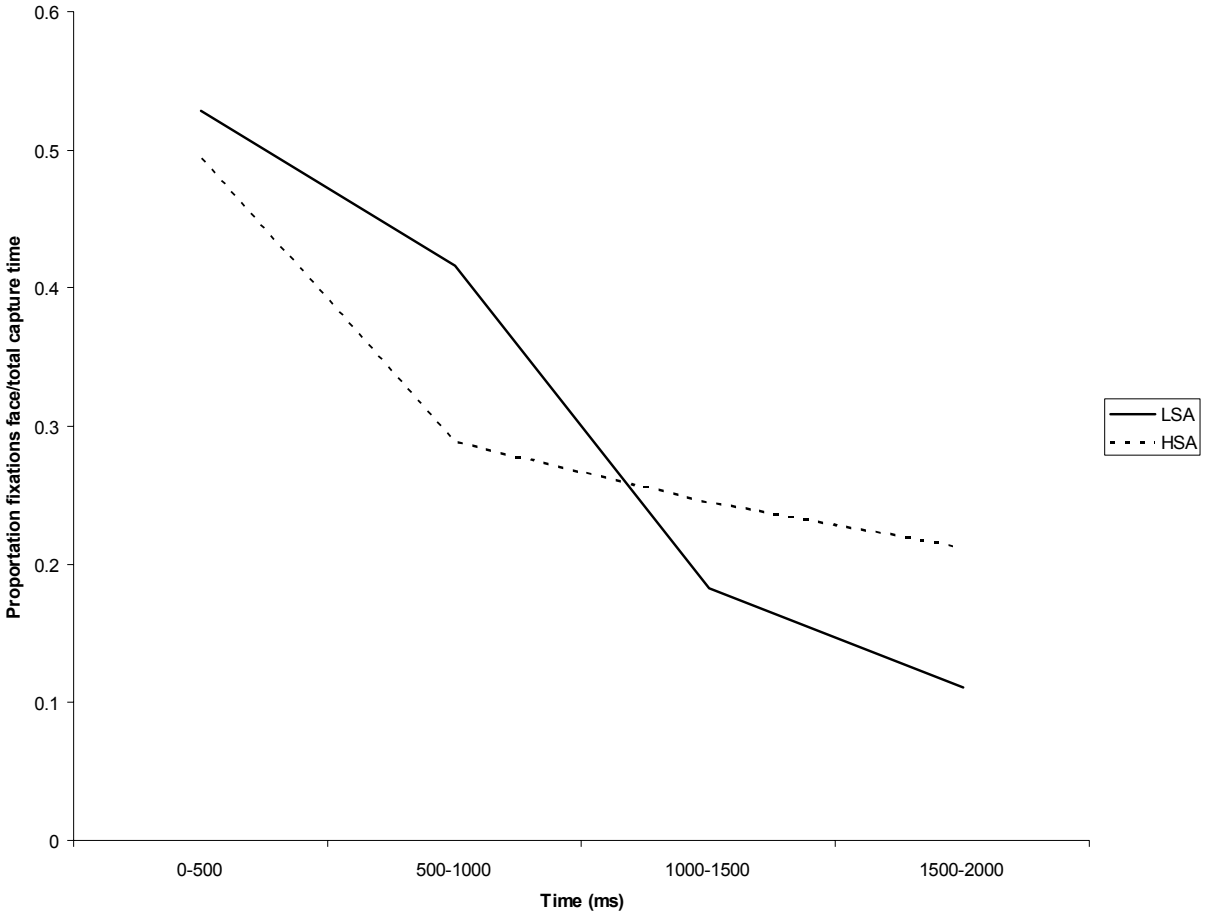

Figure 5. Mean proportion of fixation time on disgust faces grouped by social anxiety condition (0-2000 ms).
Note: Covariates appearing in the model are evaluated at the following values: BDI (*M* = 8.63), STAIT (*M* = 27.85).

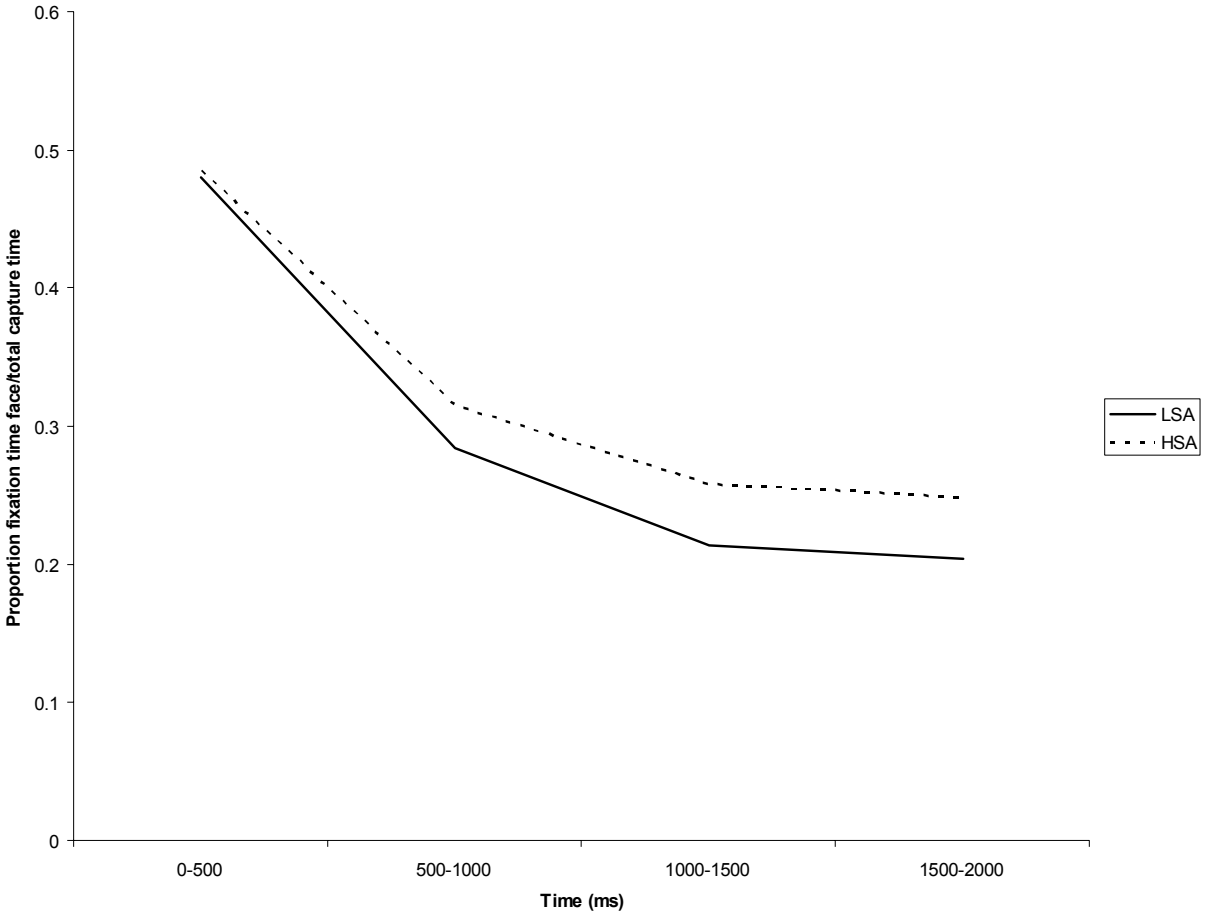

Figure 6. Mean proportion of fixation time on happy faces grouped by social anxiety condition (0-2000 ms).
Note: Covariates appearing in the model are evaluated at the following values: BDI (*M* = 8.63), STAIT (*M* = 27.85).

APPENDIX A.
ADDITIONAL ANALYSES

To further examine attentional processes among individuals with and without social anxiety, a clinically meaningful cut score was utilized to determine social anxiety condition. Previous research has found 1 SD above a community mean be able to identify approximately 80% social anxiety disorder (Heimberg et al., 1992) and was therefore used as a clinically meaningful cut score for the present sample. Using this clinical cut-off score participants were divided into clinically high (CHSA; n=13) and clinically low social anxiety groups (CLSA; n=33). Zero-order correlations were computed to provide an initial examination of the relationships among social anxiety, trait anxiety, depression, and initial fixation (Table 13). Social anxiety was negatively correlated with initial fixation on disgust faces (r = -.30, p < .05), but not correlated with initial fixation on happy faces (r = -.11, p > .05). Initial fixation for either face regardless of valence was not correlated with depression and trait anxiety scores.

A 2 (Valence: Disgust Faces, Happy Faces) X 6 (Time: 0-500 ms, 500-1000 ms, 1000-1500 ms, 1500-2000 ms, 2000-2500 ms, 2500-3000 ms) X 2 (Condition: CHSA, CLSA) mixed-model ANCOVA was conducted with repeated measures on the first two factors and depression and trait anxiety continuous scores entered as covariates to ensure any observed effects occurred above and beyond that attributable to these theoretically relevant variables (Table 14)[2]. Contrary to the vigilance-avoidance model, this model did not show a significant Time X Valence X Condition three-way interaction, F(3.24, 116.65) = .61, p > .10. The specific study hypotheses were examined using separate Time X Condition ANCOVAs for each face type (Table 15). Depression and trait anxiety scores remained in each ANCOVA as covariates. Contrary to the vigilance-avoidance model, the Time X Condition interaction did not reach significance for disgust faces, F(2.42, 87.23) = .28, p > .10, or for happy faces, F(3.91, 144.54) = .30, p > .10. Given the study hypotheses regarding specific differences posited between conditions at each time block, the simple effects were examined between LSA and HSA across all time blocks for each face type. As evidenced by Table 16, there were no significant simple effects at any time block for disgust faces or for happy faces.

Table 13.
Correlations among social anxiety, trait anxiety, depression, and initial fixations per face valence.

	1	2	3	4	5
6. SIAS	1.00	.46***	.41***	-.30**	-.11
7. BDI	.46***	1.00	.58***	-.13	-.05
8. STAIT	.41***	.58***	1.00	-.12	-.02
9. disgust faces	-.30**	-.13	-.12	1.00	.63***
10. happy faces	-.11	-.05	-.02	.63***	1.00

* $p < .10$
** $p < .05$
*** $p < .01$

Table 14.
Univariate within-subjects effects variables of interest on proportion of mean fixation time.

	df	*F*	*p*
Time	3.10, 111.74	4.43**	.01
Time X BDI	3.10, 111.74	1.09	.36
Time X STAIT	3.10, 111.74	.54	.66
Time X Social Anxiety Condition	3.10, 111.74	.08	.97
Valence	1, 36	1.99	.17
Valence X BDI	1, 36	.17	.68
Valence X STAIT	1, 36	.45	.51
Valence X Social Anxiety Condition	1, 36	.10	.76
Time X Valence	3.24, 116.65	3.76**	.01
Time X Valence X BDI	3.24, 116.65	1.04	.38
Time X Valence X STAIT	3.24, 116.65	.90	.45
Time X Valence X Social Anxiety Condition	3.24, 116.65	.61	.62

* $p < .10$
** $p < .05$
*** $p < .01$

Table 15.
Univariate within-subjects effects variables of interest on proportion of mean fixation time.

	df	*F*	*p*
Disgust Faces			
Time	2.42, 87.23	5.66***	.00
Time *BDI	2.42, 87.23	.48	.66
Time * STAIT	2.42, 87.23	.79	.48
Time * Social Anxiety Condition	2.42, 87.23	.28	.80
Happy Faces			
Time	3.91, 144.54	3.01	.02
Time *BDI	3.91, 144.54	1.62	.17
Time * STAIT	3.91, 144.54	.66	.62
Time * Social Anxiety Condition	3.91, 144.54	.30	.87

* $p < .10$
** $p < .05$
*** $p < .01$

Table 16.
Simple effects analyses of the differences in fixation time between HSA and LSA at each time block for each face type.

	df	*F*	*p*
Disgust Faces			
0-500 ms	1, 36	.06	.80
500-1000 ms	1, 36	.32	.58
1000-1500 ms	1, 36	.74	.39
1500-2000 ms	1, 36	.30	.59
2000-2500 ms	1, 36	.06	.81
2500-3000 ms	1, 36	.08	.78
Happy Faces			
0-500 ms	1, 37	1.39	.25
500-1000 ms	1, 37	1.91	.17
1000-1500 ms	1, 37	.07	.79
1500-2000 ms	1, 37	.01	.93
2000-2500 ms	1, 37	.69	.41
2500-3000 ms	1, 37	.76	.39

* $p < .10$
** $p < .05$
*** $p < .01$

APPENDIX B.
INFORMED CONSENT

Consent To Psychological Research
Physiological Reactivity in Response to Visual Stimuli

I, _____, being 18 years of age or older, freely and voluntarily and without undue inducement or any element of force, fraud, deceit, duress, or other form of constraint or coercion, consent to be a participant in the above named research project, to be conducted at the Florida State University by Julia D. Smith, M.A., a graduate student in psychology. Listed below are the procedures to be followed in this research and their purposes, any risks, discomfort, and benefits associated with participation in this study, and the measures which will be taken to ensure confidentiality of the information obtained.

Procedures for the research: I understand that if I participate in the project I will be asked to fill out questionnaires about my current mood. I understand that I will also participate in a task in which I will look at pictures on a computer screen while wearing a headband that is involved in collecting data regarding ocular responses. The total time commitment would be approximately 30 minutes. If I participate I will receive ½ participation credit.

Potential risks or discomforts: **I understand there is minimal risk involved in this study. I have the right to refuse or discontinue participation at any time. If I decide to stop participation, I will still be entitled to the 1/2 credit.**

Potential benefits to you or others: **I have not been given any guarantee that I will benefit from my participation in this study. I may develop a better understanding of research methodology and will be providing researchers with valuable insight.**

Confidentiality: **I understand my participation is totally voluntary and I may stop participation at any time. All my answers to the questions will be kept confidential to the fullest extent allowed by law. My name will not appear on any of the results. No individual responses will be reported. Only group findings will be reported. My confidentiality will be protected to the full extent allowed by law. Consent forms will be stored in a location separate from the experimental materials and destroyed on or before December 31, 2015. All information will remain confidential to the fullest extent allowed by law.**

I understand that this consent may be withdrawn at any time without prejudice, penalty or loss of benefits to which I am otherwise entitled. I have been given the right to ask any inquiry concerning the study. Questions, if any, have been answered to my satisfaction. I understand that I may contact Julia Smith, Florida State University, Department of Psychology, (850) 645-1766, or her supervisor, Norman B. Schmidt, Ph.D., 850-644-1707, for answers to questions about this research or my rights. Group results will be sent to me upon my request. I understand that if I have any questions about my rights as a participant in this research, or if I feel I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633.

I have read and understand this consent form.

_____ _____

(Participant) (Date)

APPENDIX C.
INSTITUTIONAL REVIEW BOARD APPROVAL

Florida State
UNIVERSITY

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2763
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM (for change in research protocol)

Date: 2/21/2005

To:
Julia Smith
MC 1270

Dept: PSYCHOLOGY DEPARTMENT

From: John Tomkowiak, Chair John Tomkowiak M.D.

Re: Use of Human subjects in Research
Project entitled: Physiological Reactivity in Responce to Visual Stimuli

The memorandum that you submitted to this office in regard to the requested change in your research protocol for the above-referenced project have been reviewed and approved. Thank you for informing the Committee of this change.

A reminder that if the project has not been completed by 10/12/2005, you must request renewed approval for continuation of the project.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is IRB00000446..

cc: Norman Schmidt
APPLICATION NO. 2004.721

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BIOLOGICAL SKETCH

CIRRICULUM VITAE
NOVEMBER 2005

Julia D. Smith, M.A.
(also known as **Julia D. Buckner, M.A.**)
Anxiety and Behavioral Health Clinic
Florida State University
Department of Clinical Psychology
Tallahassee, FL 32306
850-645-1766
juliesmith@psy.fsu.edu

Education:
Florida State University, Tallahassee, FL, 2003-Present.
Major Area: Clinical Psychology
Major Professor: N.B. Schmidt, Ph.D.
Degree: Master of Science

Teachers College, Columbia University, New York, NY, 2001-2002.
Major Area: Clinical Psychology
Major Professor: George A. Bonanno, Ph.D.
Degree: Master of Arts

Kenyon College, Gambier, Ohio, 1993-1997.
Major Areas: Psychology and Drama
Degree: Bachelor of Arts

Submitted Grants:

NRSA Individual Fellowship Application. Social anxiety and problematic cannabis use.
Submitted to: National Institutes of Health (8/4/05)
Direct Costs: 24 month fellowship

Awards/Grants:

Florida State University Congress of Graduate Students Conference Presentation Grant, November 2005.
Anxiety and Behavioral Health Clinic Conference Presentation Grant, March 2005.
Florida State University Congress of Graduate Students Conference Presentation Grant, March 2005.
Florida State University Congress of Graduate Students Conference Presentation Grant, November 2004.
Florida State University Congress of Graduate Students Conference Presentation Grant, March 2004.
Best Scientific Presentation, the Society of Behavioral Medicine Annual Meeting, Seattle, WA, March 2001.

Manuscripts published/in press (peer-reviewed journals):

Schmidt, N.B. & **Smith, J.D.** (2005). Do medications matter in the context of cognitive behavior therapy for Panic Disorder? *Journal of Cognitive Psychotherapy, 19,*347-354.

Schmidt, N.B., Eggleston, A.M., Trakowski, J., & **Smith, J.D.** (2005). Effects of coping on response to

CO_2 challenge in panic disorder. *Behaviour Research and Therapy, 43,* 1311-1319.

Buckner, J.D., Schmidt, N.B., Bobadilla, L., & Taylor, J. (in press). Social Anxiety and Problematic Cannabis Use: Evaluating the Moderating Role of Stress Reactivity and Perceived Coping. *Behaviour Research and Therapy.*

Zvolensky, M. J., Bernstein, A., Sachs-Ericcson, N., Schmidt, N. B., **Buckner, J.D.**, & Bonn-Miller, M. O. (in press). Cannabis use, abuse, and dependence and panic attacks in a representative sample. *Journal of Psychiatric Research.*

Manuscripts published (newsletters):

Smith, J.D. & Schmidt, N.B. (2004). Accessibility to efficacious treatments: Developing computerized self-help treatments. *Florida Psychologist, 55*, 24-25.

Smith, J.D., Woolaway-Bickel, K., & Schmidt, N.B. (2004). Treating panic disorder: Medications, psychosocial treatments, and combined approaches. *The Clinical Psychologist, 57,* 14-19.

Richey, J.A., **Smith, J.D.**, Oliver, M. Brown, M. Quevedo, J., Botero, N, Chisholm, T.L. & Schmidt, N.B. (2004, Winter). Empirically Validated Therapies – "Myths" and Reality: A Reply to Koocher (2004). *Florida Psychologist, 55*, 24-25.
Reprinted in:
Kansas Psychologist, 30, 8-10.
Iowa Psychologist, 50, 9-13.
BC Psychologist (2005, Summer), 6-7.

Manuscripts under review:

Buckner, J.D., Mallott, M.A., Schmidt, N.B., & Taylor, J. (under review). Peer Influence and Gender Differences in Problematic Cannabis Use Among Individuals with Social Anxiety.

Buckner, J.D., Eggleston, A.M., & Schmidt, N.B. (under review). Drinking Motives and Situation Specific Alcohol Consumption Mediate the Relationship between Social Anxiety and Alcohol Related Problems.

Smith, J.D., Joiner, T.E., Jr., Pettit, J.W., Lewinsohn, P.M., & Schmidt, N.B. (under review). Implications of the DSM's emphasis on sadness and anhedonia in major depressive disorder.

Schmidt, N.B., Richey, J.A., Cromer, K., & **Buckner, J.D.** (under review). Discomfort Intolerance: Evaluation of a Potential Risk Factor for Anxiety Pathology.

Books in preparation

Buckner, J.D., Castro, Y., Holm-Denoma, J., & Joiner, T.E. (in prep). *Mental Health Services for Diverse Populations: An Empirical Approach.*

Manuscripts in preparation:

Buckner, J.D., Schmidt, N.B., Mallott, M.A., Lopez, T., Cromer, K., Holm-Denoma, J., Merrill, K., & Van Orden, K.A., & Joiner, T.E., Jr., (in prep). Imaginal motivation-enhancement techniques increase treatment adherence in patients with anxiety disorders.

Buckner, J.D., Schmidt, N.B., Lang, A.R., & Lewinsohn, P.M. (in prep). Specificity of Social Anxiety Disorder as a Risk Factor for Alcohol and Cannabis Dependence: A Longitudinal Investigation.

Buckner, J.D., Cromer, K., Schmidt, N.B., Zvolensky, M.J. & Sachs-Ericcson, N., (in prep). Specificity of Social Anxiety Disorder as a Risk Factor for Alcohol Dependence in a Representative Sample.

Jakobsons, L. & **Buckner, J.D.** (in prep). The assessment, diagnosis, and treatment of Hispanic/Latino Clients. In **J.D. Buckner**, Y.Castro, J.Holm-Denoma, & T.E. Joiner (Eds.). *Mental Health Services for Diverse Populations: An Empirical Approach.*

Hollar, D., Wingate, L., Waesche, M.C., Castro, Y., Holm-Denoma, J., & **Buckner, J.D.** (in prep). The assessment, diagnosis, and treatment of African American clients. In **J.D. Buckner**, Y.Castro, J.Holm Denoma, & T.E. Joiner (Eds.). *Mental Health Services for Diverse Populations: An Empirical Approach.*

Professional Oral Presentations:

Smith, J.D., & Schmidt, N.B. (2005, March). *Unified CBT for Anxiety: False Safety-Behavior Elimination Therapy (F-SET)*. Paper presented at the annual meeting of the Anxiety Disorders Association of America, Seattle, WA.

Smith, J.D., Schmidt, N.B., Bobadilla, L., & Taylor, J. (2005, March). *Social Anxiety and Cannabis Use: Evaluating the Moderating Role of Stress Reactivity and Perceived Coping*. Paper presented at the annual meeting of the Anxiety Disorders Association of America, Seattle, WA.

Smith, J.D., Schmidt, N.B., Bobadilla, L., & Taylor, J. (2005, February). *Social Anxiety and Cannabis Use: Evaluating the Moderating Role of Stress Reactivity and Perceived Coping*. Paper presented at the monthly meeting of the Department of Clinical Psychology, Florida State University, Tallahassee, FL.

Professional Poster Presentations:

Smith, J.D., Schmidt, N.B., & Eggleston, A.M. (2005, November). *Drinking Motives and Situation Specific Alcohol Consumption in Individuals with Social Anxiety.* Poster session accepted to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Washington, DC.

Smith, J.D., Schmidt, N.B., & Lewinsohn, P.M. (2005, November). *Social Anxiety and Cannabis Use: Evaluating the Moderating Role of Intrapersonal and Familial Risk Factors.* Poster session accepted to be presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Washington, DC.

Smith, J.D., Schmidt, N.B., & Eggleston, A.M. (2005, April). *Social Anxiety and Problematic Drinking: Mediating Roles of Drinking Motives and Situations*. Poster session presented at the annual Florida State University Department of Psychology Graduate Research Day, Tallahassee, FL.

Smith, J.D., Schmidt, N.B., Bobadilla, L., & Taylor, J. (2004, Fall). Perceived Coping Moderates the Relationship Between Social Anxiety and Cannabis Use [Abstract]. *Anxiety Disorders: A Quarterly Report*, 11.

Smith, J.D., Schmidt, N.B., Bobadilla, L., & Taylor, J. (2004, November). *Perceived coping moderates the relationship between social anxiety and cannabis use.* Poster session presented at the annual

meeting of the Association for the Advancement of Behavior Therapy, Anxiety Disorders Special Interest Group, New Orleans, LA.

Smith, J.D., Joiner, T.E., Lewinsohn, P.M., Pettit, J.W., & Schmidt, N.B. (2004, November). *Implications of the DSM's Emphasis on Depressed Mood and Anhedonia in Major Depressive Disorder.* Poster session presented at the annual meeting of the Association for the Advancement of Behavior Therapy, New Orleans, LA.

Smith, J.D., Schmidt, N.B., & Eggleston, A.M. (2004, March). *Effects of Coping Strategies on CO_2 Challenge Induced Fear Among Patients with Panic Disorder*. Poster session presented at the Anxiety Disorder Association of America Annual Meeting, Miami, FL.

Weiss, A., DuHamel, K., Barrett, T., Seremetis, S., **Smith, J.**, Barnes, A., Rakowski, W., Jandorf, L., Thompson, H., Manne, S., Hurley, K., Winkel, G., Itzkowitz, S., & Redd, W. (2001, March). *Increasing Colorectal Cancer Screening Compliance in Average Risk Individuals.* Poster session presented at the Society of Behavioral Medicine Annual Meeting, Seattle, WA.

Weiss, A., DuHamel, K., **Smith, J.**, Barrett, T., Minian, N., Barnes, A., Michener, J., Thompson, H., Manne, S., Redd, W., Rakowski, W., & Winkel, G. (2001, March). *Barriers and Promoters of Colorectal Cancer Screening in African-Americans.* Poster session presented at the Society of Behavioral Medicine Annual Meeting, Seattle, WA.

Weiss, A., DuHamel, K., Barrett, T., Seremetis, S., **Smith, J.**, Barnes, A., Rakowski, W., Jandorf, L., Thompson, H., Manne, S., Hurley, K., Winkel, G., Itzkowitz, S., & Redd, W. (2001, February). *Increasing Colorectal Cancer Screening Compliance in Average Risk Individuals*. Paper presented at Grand Rounds, Mount Sinai School of Medicine, New York, NY.

Reviews:

Ad Hoc Reviewer, *Journal of Cognitive Psychotherapy*, August, 2004.

Teaching/Supervisory Experience:

Fall 2003-Fall 2005	Primary Supervisor, Directed Individual Study, Department of Psychology, Florida State University.
Summer 2005	Guest Lecturer, *Substance-Related Disorders*, Abnormal Psychology, Department of Psychology, Florida State University.

Membership in Professional Associations:

1999 American Psychological Association (Student Associate)
Division 50 (Addictive Behaviors)
2004 Anxiety Disorders Association of America (Student Associate)
2004 Association of the Advancement of Behavior Therapy
Anxiety Disorders Special Interest Group (Student Member)
Addictions Special Interest Group (Student Member)

Departmental/University Service:

2005-2006	Student Advisory Committee, Department of Clinical Psychology, Florida State University.
2004-2005	Graduate Student Advisory Committee, Florida State University.

2004-2005	Student Advisory Committee, Department of Clinical Psychology, Florida State University.
2003-2004	Interview Weekend Committee, Department of Clinical Psychology, Florida State University.

Professional Research Positions:

August 2003-Present	Researcher, Florida State University, Tallahassee, FL.
December 2002-May 2003	Research Supervisor, Yale University, New Haven, CT.
May 2002-May 2003	Research Associate, Yale University School of Medicine, New Haven.
September 2001-July 2002	Research Assistant, Teachers College, Columbia University, New York.
September 2001-January 2002	Research Assistant, Teachers College, Columbia University, New York.
August 2000-July 2001	Project Coordinator/Research Assistant, New York State Psychiatric Institute, Columbia University, New York.
September 2000-June 2001	Project Coordinator, Derald H. Ruttenberg Cancer Center, Mount Sinai School of Medicine, New York.
Summer 1996	Research Assistant, Massachusetts Department of Public Health, Office Of Statistics and Evaluation, Women's Health Unit, Boston.
1994-1995	Research Assistant, Kenyon College, Gambier, OH.

Professional Clinical Positions:

March 2005-Present	Psychological Trainee, Anxiety and Behavioral Health Clinic, Florida State University, Tallahassee, FL.
August 2004-Present	Psychological Trainee, Florida State University Psychology Clinic, Tallahassee, FL.
July 1999-September 2000	Telephone Counselor, Victim Services Hotlines, New York, NY.
June 1999-January 2000	Telephone Counselor, Samaritans Suicide Hotline, New York, NY.