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# Subgrouping Individuals with Generalized Social Phobia: A Classification Based on the Pattern of Attentional Bias

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# SUBGROUPING INDIVIDUALS WITH GENERALIZED SOCIAL PHOBIA: A CLASSIFICATION BASED ON THE PATTERN OF ATTENTIONAL BIAS

By

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ABSTRACT

SUBGROUPING INDIVIDUALS WITH GENERALIZED SOCIAL PHOBIA:

A CLASSIFICATION BASED ON THE PATTERN OF ATTENTIONAL BIAS

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Findings on the pattern of attentional biases in social phobia are mixed. Specifically, some support hypervigilance, some support avoidance, and others evidence an even more complex pattern of vigilance-avoidance. Despite the seemingly contradictory directions of attentional allocation, vigilance and avoidance do not need to be mutually exclusive. They may instead exist within the same person over an extended temporal course of processing. The primary aim for the current study was to examine whether individuals with generalized social phobia characterized by hypervigilant vs. avoidant patterns of attention bias would display different profiles of social anxiety symptoms and their related cognitive and emotional variables. In accordance with existing attention bias subtyping studies, the social threat vigilant group included those with mean attention bias scores > 0 on a dot-probe task, and the social threat avoidant group was comprised of individuals with mean attention bias scores < 0.

Results of the current study revealed that the social threat vigilant group reported marginally significantly higher symptom levels than the social threat avoidant group on a standard measure of social anxiety, indicating that vigilant forms of attention bias may be associated with slightly higher levels of social anxiety symptoms. In terms of extended cognitive processing, those with attentional bias towards threat at 500 ms on the dot-probe task seem to show a vigilant pattern over a 30-sec period using eye-tracking technology. Additionally, social threat avoidant individuals spoke for a shorter duration on a videotaped speech task in front of a live audience. In conclusion, this study provides important information that characterizes vigilant and avoidant patterns of attentional bias in terms of both clinical characteristics and patterns of extended attention processing.

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# Introduction

## Definition of Social Phobia

Social Phobia (SP) is characterized by a marked and persistent fear of social or performance situations that results in significant functional impairment (DSM-IV-TR, APA, 2000). Individuals with SP often avoid entering social or performance situations (e.g. public speaking, attending parties) or will otherwise endure them with great distress. The onset of SP is typically in the teenage years, though childhood onset is not uncommon. The course of SP is chronic, but may fluctuate depending on levels of stress and life events. SP ranks as the fourth most common psychological condition in the United States (Kessler et al., 2005), and has a lifetime prevalence rate of 12.1% with a past-year prevalence rate of 7.1% (Ruscio et al., 2008).

## Impairment and Costs Associated with Social Phobia

Individuals with SP experience significant impairment in role functioning at work, and in one's family and romantic relationships (Wittchen, Fuetsch, Sonntag, & Leibowtzi, 2000). SP has been associated with delayed entry into marriage (Forthofer, Kessler, Story, & Gotlib, 1996), feelings of social isolation (Olfson et al., 2000), as well as a number of other deleterious consequences including lower socio-economic status (Schneier et al., 1992), lower educational attainment (Kessler, 2003), underemployment (Bruch, Fallon, & Heimberg, 2003), and poor quality of life (Stein & Kean, 2000). Individuals with SP are also more likely to have comorbid psychological disorders such as depression, substance abuse, and other anxiety disorders (Ruscio et al., 2008; Schnier et al., 1992), and might be at increased risk for suicidal ideation and attempts (Cougle, Keough, Riccardi, Sachs-Ericsson, 2009). Despite experiencing significant disability as a result of social anxiety,

researchers have estimated that as many as 80% of individuals with SP do not seek treatment, and treatment seekers wait an average of 12 years (Grant et al., 2005).

**Cognitive-Behavioral Models of Social Phobia**

Cognitive models of social phobia propose that in the presence of a social-evaluative threat, individuals focus their attention towards internal stimuli (Clark & Wells, 1995). This can include behavioral (e.g. avoiding eye contact, trembling), cognitive (e.g. thoughts about poor performance, feelings of rejection), and physical symptoms of anxiety (e.g. sweating, heart racing). Individuals with SP will simultaneously process this information and compare it against their own mental representation, or self-schema about their behavior or appearance in social situations. When an individual determines that there is a discrepancy between the standard set for themselves and their perceived negative performance, an anxiety response ensues. Thus, this entire process occurs mostly within the individual, and without much input from one's external environment.

Additionally, an individual with SP will allocate attentional resources towards external indicators of negative evaluation (e.g. threatening facial expressions) (Rapee & Heimberg, 1997). Further, when attentional resources become focused on signs of threat and negative evaluation while simultaneously processing input from one's internal state, one tends to exaggerate those features and experience heightened levels of anxiety. Therefore, according to this cognitive-behavioral model, after vigilant scanning of one's environment for potential indicators of threat, individuals with SP subsequently avoid threatening cues in the environment in order to reduce the distress and anticipatory anxiety associated with fear of negative evaluation.

**Information Processing Bias in Social Phobia**

As reviewed in cognitive-behavioral models of social phobia, information processing bias is considered to be a central contributor to the maintenance of SP symptoms. These biases can take many forms and occur at varying stages of processing in the presence of actual or anticipated social threat. Mathews (1990) discussed the function of anxiety and excessive worry in how one interprets cues in one's environment. He commented that anxious individuals are particularly sensitive to threat cues, and in order to avoid potential danger, they will be faster to detect and process these cues. Consequently, this tendency for anxious individuals to selectively attend to threatening cues in one's environment can serve as a cognitive vulnerability factor for anxiety disorders to emerge. This occurrence is consistent with Clark et al.'s model which suggests that individuals with SP selectively detect and recall cues from their environment about perceived social danger or disapproval which later influences negative evaluations of oneself and one's performance in a social situation.

There has been an increasing amount of information bias research aimed at investigating the cognitive mechanisms underlying SP. According to Clark and Wells's (1995) model, individuals with SP exhibit reduced processing of their external environment, and when they do process external cues, they do so in a biased manner. For example, Stopa and Clark (2000) found that individuals with SP were more likely than other anxious control subjects to interpret ambiguous social situations as threatening, and to attribute these events to an enduring negative characteristic of themselves. Furthermore, participants in this study interpreted mildly negative social situations as having catastrophic consequences to one's self-perceptions or one's future. Additionally,

individuals with SP show an increased tendency to detect (Veljaca & Rapee, 1998) and recall potentially negative social cues (Lundh & Ost, 1996) such as critical audience behaviors or novel facial stimuli. Collectively, the literature indicates that several factors appear to contribute to biased cognitive processing.

**Evidence for the Role of Attention Bias in Social Phobia: Attention Retraining**

Evidence that supports cognitive theories of SP is accumulating indicating that visual attentional biases (ABs) may be a causal maintenance factor. Recently, researchers in the field have started to generate experimental data that change in ABs results in improvement in SP symptoms, using attentional bias modification (ABM) paradigms. Several researchers have demonstrated that reducing AB for threat can reduce clinical symptoms among those with social anxiety (Amir, Weber, Beard, Bomyea, & Taylor, 2008; Amir et al., 2009; Schmidt, Richey, Buckner, & Timpano, 2009; Hereen, Lievens, & Philippot, 2011). For example, one investigation showed that individuals with social phobia responded with symptom reduction and greater likelihood of remission of diagnoses to a program that induced attentional disengagement (i.e., established a contingency between the probe and a neutral face) from threatening stimuli using a modified probe detection task with a presentation duration of 500ms (Schmidt et al., 2009). A similar study using words instead of faces was conducted that examined an attention training program designed to promote early-stage (500ms) disengagement from threatening stimuli, which also proved efficacious in the treatment of social anxiety (Amir et al., 2009). Amir and colleagues' (2008) single-session ABM program that trained attention away from threatening facial stimuli also produced less AB to threat and

reduced levels of anxiety, as indicated by self-report measures and in response to a public speaking challenge.

Hereen et al. (2011) used a word-based Posner spatial cueing task to promote attentional disengagement from threatening faces and found that those in this condition evidenced better outcomes on a speech performance task. Similarly, Heeren et al. (2012) extended these findings and found evidence that ABM techniques aiming to train participants' attention towards nonthreatening faces using a dot-probe task produced reductions in self-reported anxiety and physiological reactivity, and reduced performance on a speech task. Considering these findings, it appears that vigilant attentional processing at early stages contributes to the maintenance of social anxiety symptoms. These findings based on attention modification paradigms suggest that AB is a critical (potentially causal) variable in the maintenance of SP, which affirms the theoretical and clinical significance of investigating AB in SP.

**Patterns of Attention Bias: Review of the Findings**

Often overlooked is the issue that the pattern of AB in social anxiety has been poorly integrated and summarized. Findings on the time course of attentional processing are mixed (Amir et al., 2003; Mogg, Philippot, & Bradley, 2004; Chen, Ehlers, Clark, & Mansell, 2002; Garner, Mogg, & Bradley, 2006), and it appears as though the nature of the stimuli (lexical vs. pictorial) and its presentation (duration and paradigm) can influence the results obtained from these experiments. Specifically, some support hypervigilance, some support avoidance, and others evidence an even more complex pattern of vigilance-avoidance.

### *Evidence of Attentional Vigilance*

Numerous studies have demonstrated patterns of attentional vigilance among individuals with high levels of anxiety (Bradley, Mogg, Falla, & Hamilton, 1998) and those with diagnosable anxiety disorders such as generalized anxiety disorder (Mathews & Macloed, 1986; Bradley, Mogg, Millar, & White, 1995). In particular, there is strong empirical evidence supporting a pattern of attentional vigilance among individuals with SP (Asmundson & Stein, 1994; Pishyar, Harris, & Menzies, 2004; Gamble & Rapee, 2010, Sposari & Rapee, 2007).

Individuals with SP have demonstrated an AB towards social-threat words when compared with neutral or physical-threat words on a dot-probe task (Asmundson & Stein, 1994). Researchers have also found that under conditions of perceived social threat, individuals with SP will demonstrate vigilance for facial stimuli using a letter-probe computer task (Sposari & Rapee, 2007). Using face-based dot-probe tasks, researchers have found that individuals with high levels of social anxiety selectively attend towards threatening faces, both when presented as pairs of faces in a forward position, and as profile images facing each other (Pishyar et al., 2004).

Gamble et al. (2010) also found evidence of attentional vigilance using eye-tracking technology, in which individuals with SP fixated more on angry versus neutral faces during the first 500ms of a 5000ms facial viewing task with no biases in subsequent processing. Additionally, individuals with SP who are under conditions of anticipated social threat (i.e., a speech performance task) will attend towards facial stimuli rather than non-evaluative stimuli (i.e., household objects) presented for 500ms on a dot-probe task.

### *Evidence of Attentional Avoidance*

Foa and Kozak (1986) discussed cognitive avoidance strategies within the context of exposure. They stated that, in the presence of a fear-invoking stimulus, individuals will engage in efforts to distract themselves from or distort incoming information that they perceive as threatening. Furthermore, Mogg, Mathews, & Weinman (1987) discussed the process whereby anxious individuals demonstrate poorer recall of negative as opposed to positive words, indicating cognitive avoidance of processing threatening material. This connection between exposure to threat and cognitive avoidance is of great theoretical importance due to the presence of avoidance in SP, as well as other anxiety disorders.

Likewise, Mansell and colleagues found support for attentional avoidance using a dot-probe task such that under conditions of social-evaluative threat, socially anxious individuals showed an AB away from negative faces at 500ms presentation duration (Mansell, Clark, Ehlers, & Chen, 1999). Chen et al. (2002) examined attentional processing among individuals with SP and found that patients with SP preferentially attended to household objects and away from facial expressions at 500 ms stimulus durations. The authors note that this form of attentional avoidance contributes to the maintenance of SP by preventing one from learning that others may be responding in a positive manner to one's social behaviors. This avoidance of others' faces can also lead individuals with SP to be perceived as bored or uninterested during social interactions.

### *The Vigilance-Avoidance Hypothesis*

Given the disparate findings in the literature between vigilant and avoidant processing, it is of theoretical and clinical importance to attempt to integrate these results. Consequently, researchers have proposed a vigilance-avoidance model of cognitive

processing. One of the first studies that produced evidence for a vigilance-avoidance model was conducted by Amir and colleagues, where they examined how individuals with generalized SP made decisions about sentences ending in homographs with socially threatening connotations (Amir, Foa, & Coles, 1998). Investigators found that those with generalized SP were slower at responding to socially-threatening homographs when there was a short delay between the presentation of the priming sentence and the cue word (i.e., participants were automatically hypervigilant of threat), but when there was a longer delay, the individuals were faster at responding to cue words following socially relevant homographs (i.e., participants engaged in strategic avoidance).

Additionally, in a study that employed eye-tracking technology, investigators found that high levels of anxiety were associated with initial orienting toward (i.e., probability of first fixation, longer gaze duration) emotional pictures during the first 500ms, and observed subsequent avoidance of harm stimuli (i.e., probability of last fixation, reduced gaze duration) during the last 1000ms of the task (i.e., between 2000ms and 3000ms) (Calvo & Avero, 2005). Authors proposed that the function of this cognitive processing style is to regulate internal distress associated with exposure to threat. Another group of researchers found that attentional resources were first allocated towards threatening stimuli as evidenced by faster initial fixations on emotional faces, but were later characterized by shorter gaze durations indicating that these stimuli were subsequently avoided once detected (Garner, Mogg, & Bradey, 2006). Other eye-tracking studies have also found that the visual scanpaths of socially phobic individuals indicate patterns of hyperscanning for face stimuli, particularly for angry faces, but avoidance of the eyes, which may be perceived as particularly threatening (Horley, Williams, Gonsalvez, &

Gordon, 2003; Horley, Williams, Gonsalvez, & Gordon, 2004). A study examining the time course of attentional processing provided evidence that among those with high fears of negative evaluation, individuals showed a greater likelihood of initial fixation (at 0-500ms, and 500-1000ms), but this pattern reversed at 1000-1500ms (Wieser, Pauli, Weyers, Alpers, & Muhlberger, 2009).

Overall, there is growing evidence suggesting that ABs in SP may take the form of early vigilance followed by attentional avoidance at later processing stages. Bogels & Mansell (2004) propose that attentional vigilance may be initially demonstrated when it is ambiguous as to whether or not a social threat is present, but avoidance will predominate during later stages, when the individual is already experiencing negative evaluation, and when there is a non-social stimulus present. Thus, despite the seemingly paradoxical directions of attentional allocation, vigilance and avoidance do not need to be mutually exclusive. They may instead exist within the same person over an extended temporal course of processing.

**Limitations of Existing Studies: Improving Attention Bias Research in Social Phobia**

There are a few important issues that need to be considered to further improve the AB research in SP. First, existing AB research has addressed only a limited range of attentional processing among individuals with social anxiety. For instance, there is a paucity of research that examines later stages of information processing (i.e., beyond 500ms). It is important to examine the full pattern of extended attentional processing in SP to gain a more comprehensive picture.

Second, although there is significant variation in AB across individuals, existing studies were almost exclusively based on *group-level* analysis of AB in SP. This is believed to have led the field to be unaware of meaningful variations of AB across individuals, and assume that all individuals with SP would be, for example, vigilant toward social threat if that is the average pattern of the group. At this juncture, it is critical to address the possibility that subgrouping based on patterns of AB may lead to a better understanding of how socially anxious individuals perceive and respond to threat. AB also exists along a continuum (Bar-Haim, 2010), suggesting individuals may differ in terms of the nature and magnitude of AB: some may show vigilance, some may show avoidance, some may show a combination of both, and others may even show no signs of biased attentional processing. Typically, all of these meaningful variations are collapsed into a single group-average score to determine the overall pattern of AB as either vigilance or avoidance.

To date, there are only two known published studies exploring the potential utility of creating subgroups of individuals with SP based on the pattern of AB (i.e., threat-avoidant vs. threat-vigilant; Price, Tone, & Anderson, 2011; Calamaras, Tone, & Anderson, 2012). Price et al., (2011) found support for the notion that different patterns of AB (avoidant vs. vigilant) were associated with different outcomes in response to virtual reality exposure therapy for SP. Additionally, Calamaras, et al. (2012) found that those characterized by vigilant attentional processing (i.e., mean AB scores > 0 on a dot-probe task) pre-cognitive-behavioral therapy for SP became less vigilant following cognitive-behavioral treatment, and those with avoidant patterns of attention (i.e., mean AB scores < 0) became less avoidant.

Considering the literature on AB subgrouping is in its nascent stages, there are important questions that should be addressed to enhance the research on AB among individuals with SP. It is also possible that individuals' clinical symptom profiles vary as a function of the type or intensity of AB. In this same vein, extended cognitive processing may differ as a function of the AB identified at early stages (i.e., 500ms). It is essential to examine the extended time course of attentional processing to allow for observation of attentional shifts between stimuli. Understanding specific patterns of attentional processing over an extended time course is expected to provide important information about how this dynamic cognitive process is associated with pathological social fears in the presence or anticipation of social evaluative threat.

Taken together, evidence from the literature suggests that AB varies among individuals with SP. In addition, although AB is important to examine further, not everyone with SP displays AB. Furthermore, even if they exhibit biased attentional processing, the specific pattern may vary across individuals. Thus, it is important to examine how the pattern of AB is linked to the phenomenology and processes of SP.

**Study Aims and Hypotheses**

The primary aim for the current study was to examine whether individuals with SP (generalized type showing significant fears across multiple social contexts) characterized by hypervigilant vs. avoidant patterns of AB would display different profiles of social anxiety symptoms and their related cognitive and emotional variables. To this end, analysis of an existing database that was built as part of a larger study was conducted to examine the sustained pattern of attention processing associated with social anxiety. Participants were classified into social-threat vigilant (STV) and social-threat

avoidant (STA) groups based on their early-stage pattern of attentional processing measured at 500ms using a dot-probe paradigm (which has been the most common method of assessing attentional bias in social anxiety). Considering the importance of early (i.e., 500ms) AB observed in the maintenance of social anxiety symptoms through several attention retraining studies, it was expected that different patterns of early ABs may differentially characterize subsequent cognitive and emotional processes and symptoms. Through this archival data analytic work, the following specific hypotheses were tested.

First, with respect to the overall severity of social anxiety symptoms, it was predicted that the STV group would show higher levels of social anxiety than the STA group. This hypothesis was based on the AB modification literature that finds evidence showing that training individuals' attention away from threat reduces symptoms of SP (e.g., Amir et al., 2009). These findings are also consistent with the treatment implications proposed by Rapee and Heimberg (1997) stating that according to the cognitive-behavioral model of SP, directing attention away from socially threatening cues could directly reduce anxiety symptoms.

Second, with respect to the pattern of social anxiety symptoms, it was predicted that the STV group would score higher on measures related to hypervigilant bodily or fearful emotional reactions such as physiological and observable symptoms (i.e., Appraisal of Social Concerns – Observable Symptoms subscale, Social Phobia Inventory – Physiological Arousal and Fear Reactions subscales; Liebowitz Social Anxiety Scale – Fear subscale). Additionally, the STA group would score higher on subscales related to

avoidance behaviors (i.e., Liebowitz Social Anxiety Scale – Avoidance subscale and Social Phobia Inventory – Avoidance subscale).

Third, with respect to the pattern of extended cognitive processing, it was hypothesized that the STV group would show greater signs of vigilant patterns of extended cognitive processing (i.e., for a 30-sec period) such as (a) greater overall number of fixations toward negative faces, (b) greater durations of fixations toward negative faces, and (c) return of vigilant fixations toward negative faces. In contrast, it was predicted that the STA group may show a contrasting pattern whereby individuals fixate less on threatening stimuli both in terms of number and duration of fixations. This is an important topic because it guided us in examining whether the earlier AB captured by a "snapshot" approach (i.e., dot-probe task) would maintain its hypervigilant or avoidant pattern for subsequent extended attentional processing. Importantly, it was predicted that while examining extended cognitive processing, initial vigilance might be linked to a continuing vigilant pattern of AB (i.e., lack of decrease in fixations) whereas the avoidant subgroup may show a continuous decrease in fixations over time. Alternatively, as discussed previously, there is a pattern suggested in the literature of "vigilance-avoidance"; if this holds true, then attentional vigilance followed by avoidance may be observed.

Fourth, it was predicted that speech performance would vary with respect to the pattern of AB. It was hypothesized that STV relative to STA individuals would evaluate their own behavioral performance more poorly because of the more hypervigilant perception of one's own anxiety symptoms and impaired speech performance. In contrast,

with respect to more objective speech ratings by trained observers, we hypothesized that the two groups would not significantly differ.

Lastly, without a priori hypotheses, a variety of relevant demographic and clinical variables were explored to examine any potential differences between the two AB groups, including age, gender, level of educational attainment, marital status, and Axis-I comorbidity.

## Method

### Participants – Existing Data

The current sample included 45 individuals diagnosed with generalized social phobia. The sample was comprised of 19 males and 26 females, with an average age of 29.09 (SD= 12). Participants self-identified as White (n=35, 77.8%), Black (n=9, 20%), Asian (n=2, 4.4%), Pacific Islander (n=1, 2.2%), and Native American/ Alaskan Native (n=1, 2.2%). In terms of level of educational attainment, 12 individuals (26.7%) had earned a high school diploma, 22 (48.9%) had completed some college, 10 (22.2%) had earned a Bachelor's Degree, and 1 (2.2%) had earned a doctoral or professional degree.

Participants were included in the main study if they (a) met DSM-IV-TR criteria for SP diagnosis on the Mini International Neuropsychiatric Interview and the Web-based social anxiety test; and, (b) scored > 19 on the 18-item Social Phobia Inventory (or the 3-item Mini-Social Phobia Inventory, total score ≥ 6). Exclusion criteria included: alcohol or substance abuse, current cognitive-behavioral treatment for SP, history of bipolar disorder or psychotic disorder, organic mental disorder, anomalous eye conditions that render the individual unfit for eye-tracking data collection (e.g., excessive blinking, lazy eye), and medication or dosage change within past month.

Participants of the current study were recruited through several methods. First, advertisements were posted on Milwaukee-area Craigslist pages. Second, advertisements appeared on the Anxiety Disorders Laboratory website that listed the details of the study and laboratory contact information. Third, flyers were posted on and around UWM's campus. Fourth, psychology students responded to a departmental online psychology research screening (Social Phobia Inventory), which has its own consent procedure, and was independent of the current study. Those that responded completed an initial telephone screen to rule out any potential exclusion criteria. Those who passed this initial screening were then brought to the lab for a second full-eligibility screening.

## Measures

### *Social Anxiety Symptoms and Related Concerns*

Social Phobia Inventory (SPIN; Connor et al., 2000). The SPIN is a self-report measure of fear and avoidance of social situations and also evaluates the degree of physical discomfort experienced by people with social anxiety. The scale's 17 items include, for example, "being embarrassed and looking stupid are among my worst fears" and "I avoid talking to people I don't know". The SPIN demonstrates adequate test-retest reliability ($r=.89$) and internal consistency ($\alpha=.94$). In addition, the SPIN demonstrates sensitivity to the effects of treatment and can be used as a diagnostic screening instrument for socially phobic individuals.

The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987). The LSAS is a 24-item scale that asks participants to evaluate the degree to which they fear or avoid certain anxiety provoking situations such as "participating in small groups" and "going to a party". The scale demonstrates good internal consistency ($\alpha=.96$), convergent validity

(correlated .77 with the Social Interaction Anxiety Scale), and is sensitive to the effects of treatment.

Appraisals of Social Concern (ASC; Telch et al, 2004). The ASC is a 20-item self-report measure that asks individuals to evaluate the degree to which they would be concerned by a particular outcome (e.g., appearing incompetent) if encountered during a social situation. The ASC contains three subscales: negative evaluation (e.g., people laughing at you), observable symptoms (e.g., trembling), and social helplessness (e.g., people ignoring you). The scale demonstrates good internal consistency (α=.94). Test-retest reliability was also good ($r$ = .82). Authors note the ASC's sensitivity to the effects of treatment when used as an outcome measure to evaluate threat appraisals.

***General Emotional Distress***

State Trait Anxiety Inventory (STAI; Spielberger,1983). The STAI is comprised of one 20-item state scale and one 20-item trait scale. Respondents were asked to rate the degree to which statements such as "I am tense" and "I worry too much over something that really doesn't matter" applies to them. Both state and trait scales are both reliable (State: α=.90-.92; Trait: α=.88-.92) (Spielberger, Gorsuch, & Lushene, 1970) and valid (Spielberger & Vagg, 1984) measures of anxiety symptoms.

The Center for Epidemiological Studies Depression Scale - 10 (CES-D; Radloff, 1977). The CES-D is designed to measure levels of depressive symptoms (e.g., depressed affect, positive affect, somatic symptoms). The scale has demonstrated good internal consistency reliability in a patient sample (α=.90), test re-test correlations in the moderate range, and discriminates well among patient and general population groups.

The Depression Anxiety Stress Scale - 21 (DASS; Lovibond & Lovibond, 1995). The DASS contains three subscales that assesses for symptoms of negative affect including depression, anxiety, and stress. All three subscales have demonstrated good reliability ($\alpha$=.91, .81, .89) and discriminant and divergent validity with other instruments that measure depression and anxiety. There are strong intercorrelations among the subscales, though developers presume this may be due to some underlying vulnerability to experience negative affect. The 21-item version of this measure has demonstrated excellent psychometric properties as well in comparison with the original instrument (Antony, Bieling, Cox, Enns, & Swinson, 1998).

### *Structured Diagnostic Interview*

Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998). The M.I.N.I. is a structured diagnostic interview that includes all DSM Axis-I psychological disorders. Trained interviewers follow a scoring algorithm to produce past and current diagnoses.

## Cognitive Assessment Tasks

### *Dot-probe Task*

There have been numerous studies since the 1980's using modified versions of MacLeod et al.'s (1985) original dot-probe task demonstrating biased attentional processing toward threatening stimuli. AB for the current study was assessed by a word-based dot-probe task. Instructions for the task were both presented on the computer screen and read verbally by the experimenter. In the dot-probe task, a pair of lexical stimuli appeared on the monitor for 500ms; next, a letter probe (E or F) appeared immediately after the offset of the pair stimuli. The participants' task was to detect and

identify the probe by pressing the corresponding key on the computer keyboard (See Figure 1).

Reaction times were calculated by subtracting the response times of trials where the probe replaces threatening stimuli from trials where the probe replaced neutral stimuli. Shorter response times when probes replace threat-related stimuli are indicative of an AB toward threat (Bar-Haim et al., 2007). The dot-probe task used 24 social threat-related words (e.g., stupid, inept) and 24 matched neutral words (e.g., hanger, tile) that were employed in previous research (see Table 1). The neutral words in this task were matched to social anxiety words in terms of length and frequency.

***Eye-tracking Picture Viewing Task***

Recently, investigators have begun to explore patterns of visual attention using eye-tracking technology. This method has an added advantage over the traditional dot-probe paradigm by providing a way to record eye-movements in a more naturalistic way over an extended period of time. Compared with the previously mentioned dot-probe paradigm that offers only a snapshot of AB, eye-tracking records the duration, location, and shifts of the participants eye gaze in real time (Henderson, 2003). Furthermore, this measurement can be recorded simultaneously with other task activities using sophisticated computer software programs. Taken together, this method provides a closer approximation to attention, thus, providing a more ecologically valid way of measuring attention.

With regards to the current study, before the main task began, experimenters adjusted the eye tracker in order to capture the participants' line of gaze and conduct an eye-calibration procedure until the criterion were met for accurate measurement. AB was

assessed using eye-tracking technology and a picture-viewing task consisting of 10 trials. Each trial presented a 30-sec display of four facial expressions (i.e., neutral, happy, angry, and disgusted) from the same actor randomly assigned to either the top right, bottom right, top left or bottom left side of the participant's visual field (see Figure 2). All facial pictures were derived from the Pictures of Facial Affect (POFA) photo set (Ekman & Friesen, 1976). An additional three trials displayed facial expressions from other categories (e.g., fear, sadness) to obscure the purpose of the task. Participants were instructed to view the images freely with no constraints as if they were reading a magazine, which encourages naturalistic attentional processing. During each of the 10 trials, the participants' eye movements were recorded by the eye-tracking device, generating two primary indices that contribute to depicting the pattern of attentional processing (i.e., the total number of fixations, and the total duration of fixations on each face category (see below for more details).

**Procedure**

Following the informed consent procedure, participants underwent a comprehensive assessment battery, including (a) informed consent to participate, (b) a six-point eye-tracking calibration procedure to determine whether or not eye-movements could be accurately recorded using SMI software, and (c) a structured diagnostic interview (M.I.N.I.) to confirm SP status, examine other comorbid conditions, and to rule out exclusionary diagnoses (i.e., significant suicidal ideation or attempts, bipolar disorder, psychotic disorder). If fully-eligible, participants next completed: (a) self-report measures to assess basic demographic features, social anxiety and other related problems, and general emotional distress, b) computer-based AB measurement tasks, and c) a 5-min

videotaped behavioral speech task in front of an audience. This task required participants to speak about a controversial topic (i.e., abortion, gay marriage, gun control, the war in Iraq, seatbelt laws) in front of a live audience comprised of the main experimenter and three speech observers. Participants were compensated for completing the study on an hourly rate ($8/hr).

**Data Analytic Strategies**

In terms of the dot-probe task, if the AB index scores are greater than zero (i.e., faster response times), this indicates attentional vigilance towards threat. In contrast, if the AB index scores are less than zero, (i.e., slower response times), this indicates attentional avoidance of threat. Using the direction of AB scores, individuals with SP were classified into one of two groups. In accordance with existing AB subtyping studies (Price et al., 2011; Calamaras et al., 2012), the STV group included those with mean AB scores greater than 0, and the STA group was comprised of individuals with mean AB scores below 0.

In addition, various eye-tracking indices were examined; each providing unique information about visual attention. First, fixations were defined as eye gaze (X & Y eye position coordinates) concentrated within one degree of visual angle for a minimum duration of 100 ms. An area of interest (AOI) was defined as the area of the image on which eye fixations will be measured and analyzed. The images used were emotional faces with 4 emotions on each display; therefore, on each display, there were 4 AOIs. On the computer monitor (22 inch), each face was displayed in a rectangular patch (width = 12 cm, height = 15 cm). Fixation counts were examined by totaling the number of

fixations for each stimulus category within each 30-sec trial. Total fixation duration was examined by summing all fixation durations for each stimulus category within each trial.

To test the first hypothesis, that the STV group would show overall higher levels of social anxiety than the STA group, t-tests were conducted with LSAS total scores as the dependent variables and AB groups as the independent variables.

The second hypothesis, that other social anxiety symptoms would be differentially related to AB subgroups, was also tested by conducting t-tests. Similarly, various self-report measures were entered as the dependent variables and AB groups, as the independent variables. These analyses were run to determine if there was a difference between AB subgroups with respect to clinical outcome measures. Additionally, analyses of covariance (ANCOVA) were conducted in order to control for covariates that may have influenced the results of the study analyses. In this way, the potential influence of various clinical and demographic features as covariates could be explored.

To test the third hypothesis that the STV and STA groups would differ with respect to the pattern of extended cognitive processing repeated measures analyses were utilized. To assess the full time course of attentional deployment, the 30-sec interval for each trial was sub-divided into 6 segments of 5-sec each [i.e., T1 (0-5 sec), T2 (5-10 sec), T3 (10-15 sec), T4 (15-20 sec), T5 (20-25 sec), T6 (25-30 sec)]. Repeated measures multivariate analyses of variance (MANOVA) were employed with eye movement indices as the dependent measures. The between subjects factor was AB subtype (vigilant vs. avoidant) and the within subjects factors were facial affect and time interval. The results of these analyses were used to determine if there are differences between subgroups when examining attentional processing during various time segments.

The fourth hypothesis, that speech performance would vary among STV and STA groups, was tested using a t-test. Speech scores (i.e., global impression, and total scores) and speech duration were entered as the dependent variables and AB groups as the independent variables. The global impression items (last 3 of the measure) reflect the overall speech performance. Although these items do not provide a range of information about performance, they reveal information about the lingering impact (from overall positive to negative) of the performance. Additionally, total scores were examined as they capture the multifaceted performance experience, and convey more detailed information. Another important performance indicator of the speech task is the length of speech participants were able to maintain. Although they were instructed to speak for 5 minutes, it is quite common in this type of behavioral assessment that participants were not able to speak for the full length. Therefore, the duration of the speech was also compared between groups.

**Power Analysis**

For t-tests (hypotheses 1, 2, and 4), the current sample size (n=45) yields a power of .80 was needed to detect a large effect (d = .80), assuming an alpha of .05 in a one-tailed test. Regarding the repeated MANOVA (hypothesis 3), the current sample yields a power of .95 to detect a large effect size (f = .40), assuming an alpha of .05, six repeated measures (i.e., 6 segments of 30-sec eye-tracking duration), and an estimated correlation among repeated measures of .4. Taken together, with the current sample size, we were sufficiently powered to detect large-sized effects throughout the main analyses of the study. The research was somewhat underpowered to detect medium-sized or smaller effects. However, examination of effect sizes (i.e., Cohen's d and f) would provide

important information to understand the pattern of group differences with respect to various clinical variables and attentional processing indices included in the current study.

## Results

### Group Comparisons on Demographic and Basic Clinical Variables

The demographic and clinical characteristics of the AB groups formed based on the AB scores from the word-based dot-probe task are listed in Table 2. There were 18 individuals in the STA group and 26 individuals in the STV group. There were no significant differences observed between groups on demographic characteristics including age, gender, marital status, education and income.

With respect to psychological treatment history, there was a statistically significant difference between the two AB groups (Fisher's Exact Test = .048; for the two by two frequency table analysis, Fisher's Exact Tests were reported instead of Chi square): the STV group was approximately 4 times more likely to be currently receiving some form of treatment (talk therapy = 67%, drug therapy = 33%) than the STA group. With regard to past treatment seeking, the STV group showed a higher proportion of past treatment seeking (57.7%) than the STA group (27.8%), but this difference was not statistically significant. Thus, overall, it appears that the STV group is more likely to present themselves in treatment settings than the STA group.

With respect to general emotional distress, there were no significant differences between the STA and STV groups on measures of trait anxiety and general levels of depression. In addition, there were no differences between groups in terms of Axis-I diagnostic status. Due to their non-significant group differences, these demographic variables were not used as covariates. However, trait anxiety and depression scores were

included in the main analyses as covariates as the literature has shown that these variables are linked to AB (Mogg & Bradley, 1998; Koster, De Raedt, Leyman, & De Lissnyder, 2010).

**Hypothesis 1 – Difference in Overall Social Anxiety**

To test the first hypothesis that there would be differences in overall levels of social anxiety between the groups, t-tests were conducted using the LSAS total score as the dependent variable and the AB group as the independent variable. Results indicate that there was no significant difference on LSAS-Total between the STV (M = 83.35, SD = 23.03) and STA (M = 70.56, SD = 24.96) groups, though the STV group reported marginally significantly higher symptom levels, $t(42) = -1.751$, $p = .087$, Cohen's $d = 0.55$ (medium effect). An ANCOVA was conducted to control for the effects of general anxiety and depression. Results indicate that covarying with general depression and anxiety symptoms (using the DASS-D and DASS-A subscales) did not change the pattern of group difference among the STA and STV groups, $F(1,40) = 2.48$ $p = .123$, $\eta^2 = .06$ (medium effect).

**Hypothesis II – Hypervigilant Bodily Reactions and Fearful Emotional Reactions vs. Avoidance Behaviors**

To test the second hypothesis, t-tests were conducted using self-reports of vigilant bodily and fearful emotional reactions and self-reports of avoidance behaviors as dependent variables. The independent variables used in this analysis were again AB groups based on the dot-probe task.

***Vigilant Bodily or Fearful Emotional Reaction***

The STV group reported significantly higher symptom levels on the LSAS-Fear scale (M = 44.00, SD = 10.507) when compared with the STA group (M = 37.06, SD = 11.36), $t(42) = -2.086$, $p = .043$, Cohen's $d = .65$ (medium effect). This demonstrates the experience of greater fearful reactions of common social situations in the STV group relative to the STA group. The STV group also scored higher than the STA group on the ASC-Observable Symptoms subscale at a marginally significant level (STV: M = 431.92, SD = 156.38; STA: M = 330.56, SD = 180.15), $t(42) = -1.987$, $p = .054$, Cohen's $d = .62$ (medium effect). This finding suggests that STV individuals showed a somewhat greater tendency for concern over displaying anxious symptoms that are observable to others. However, the STV group's scores were not significantly greater than the STA group scores on the SPIN-Physiological subscale, (STV: M = 8.62, SD = 3.59; STA: M = 7.17, SD = 4.99), $t(42) = -1.122$, $p = .268$ , Cohen's $d = .35$ (small effect), or the SPIN-Fear subscale (STV: M = 15.69 , SD = 4.84; STA: M = 13.89, SD = 5.26), $t(42) = -1.173$, $p = .247$ , Cohen's $d = .37$ (small effect).

***Avoidant Behavior***

The STV and STA groups did not differ significantly on the LSAS-Avoidance subscale, (STV: M = 39.35, SD = 13.12; STA: M = 33.50, SD = 14.06), $t(42) = -1.411$, $p = .166$, Cohen's $d = .44$ (small to medium effect), or the SPIN-Avoidance subscale, (STV: M = 20.04, SD = 4.98; STA: M = 17.22, SD = 5.43), $t(42) = -1.777$, $p = .083$, Cohen's $d = .56$ (medium effect). Importantly, upon looking at the means for each measure, there was a trend such that the STV group scored numerically higher than the STA group on most of the measures.

**Hypothesis III – Differences in Extended Processing Assessed by the Eye-tracking Task**

Repeated Measures ANOVAs were conducted to examine group differences in changes of attentional processing across an extended time course. Time was entered as the within subjects variable and the AB grouping variable was entered as the between subjects variable. For each of the six 5-sec time segments within the 30-sec eye tracking trials, we computed the number of fixations and the duration of fixations on each facial expression. The repeated measures ANOVAs were conducted for each of the 4 facial expressions (i.e., disgust, angry, happy, and neutral).

***Results on the Fixation Count***

Results presented in Table 3 indicate that there was a statistically significant effect of Time for fixation count on disgust faces, $F(5,200) = 6.052$, $p < .001$, $\eta_p^2 = .131$. More importantly, there was a Time X Group interaction effect indicating that over time, the number of fixations varied between the STA and STV groups, $F(5,200) = 2.678$, $p = .023$, $\eta_p^2 = .063$. Follow-up t-tests showed that the STA and STV groups did not differ in fixation counts to disgust faces in any of the six time segments (see Figure 3). However, although both groups displayed a reduction in fixations over time as indicated by paired t-test analyses (T1 vs. T6; STA: $t(15) = 2.57$, $p = .022$, STV: $t(25) = 6.01$, $p<.001$), the STV showed a significant increase in fixation counts from T2 to T3; $t(25) = -2.59$, $p = .016$.

Similarly, there was a significant effect of Time for fixation count on angry faces, $F(5,200) = 4.136$, $p = .001$, $\eta_p^2 = .094$ (see Table 3). Likewise, there was a Time X Group interaction effect for fixation count on angry faces, $F(5,200) = 3.470$, $p = .005$, $\eta_p^2 = .080$,

indicating that over time, there were differences between groups of fixation count on angry faces. Follow-up independent t-tests revealed that the STV group showed a return of their fixation towards angry faces as indicated by greater fixation count at the sixth time segment, $t(40)= -3.49$, $p < .001$ (see Figure 4). Additionally, the number of fixation counts fell significantly for the STA group as indicated by reductions from T1 to T5, $t(15) = 4.77$, $p < .001$ and T1 to T6, $t(15) = 4.89$, $p < .001$. Analysis of fixation count on happy faces revealed no significant differences between groups. When examining fixation count on neutral faces, there was only a significant main effect of Time, $F(5,200) = 2.505$, $p = .032$, $\eta_p^2 = .059$.

***Results on the Duration of Fixations***

Results of Table 3 indicate that there was a significant main effect of Time for the fixation duration on disgust faces, $F(5,200) = 3.33$, $p = .007$, $\eta_p^2 = .077$. Additionally, there was a significant Time X Group interaction for fixation duration on disgust faces, $F(5,200) = 3.612$, $p = .004$, $\eta_p^2 = .083$. This indicates that there were differences between groups on the duration of fixations over time on disgust faces. Specifically, those in the STA group showed significantly reduced fixation duration in the third time segment (T2 vs. T3), $t(15) = 2.18$, $p = .045$; while the STV group demonstrated a sharp return of vigilant processing as indicated by the increased length of duration, $t(40) = -3.06$, $p = .005$ (see Figure 5). There was also a significant Time X Group interaction effect on angry faces, $F(5,200) = 3.659$, $p = .003$, $\eta_p^2 = .084$, indicating that the pattern of temporal change in the duration of fixation on angry faces differed significantly between groups (see Table 3). In particular, the STV group showed a relatively stable pattern of attention throughout the time course, whereas the STA group, in contrast, showed a reduction in

the duration of fixation toward the last segment of the 30-sec period such that the fixation duration at T6 was significantly shorter than that of T1, suggesting avoidance of angry faces, $t(15)= 4.09$, $p = .001$ (see Figure 6).

There was also a Time X Group interaction effect of fixation duration on neutral faces, $F(5,200) = 2.614$, $p = .026$, $\eta_p^2 = .061$ (see Table 3). Again, this indicates that between the AB groups, there was a significant difference of fixation duration on neutral faces. Upon inspection, STV individuals stably maintained their attention on neutral faces and then showed a reduction toward the end of the time course as indicated by the significant decrease of fixation duration from T5 to T6, $t(15) = 4.05$, $p < .001$ (see Figure 7). These findings, in combination with previous findings, indicate that the interaction effect of fixation duration on neutral faces observed among the STV individuals may be the result of these individuals turning their attention toward threatening faces during this time period. This idea is supported by a reduced fixation count from T5 and T6 on happy faces for both STV, $t(15)= 2.25$, $p = .040$ and STA $t(25) = 2.86$, $p = .008$ individuals.

***Controlling for the Influence of General Depression and Anxiety***

We examined the observed Time X Group interaction effects on the disgust and angry faces again with the inclusion of general emotional distress variables as covariates. Results showed that the Time X Group effect from fixation count on the disgust faces still remained significant, $F(5,190) = 1.979$, $p = .038$, $\eta_p^2 = .060$ (see Table 3). Therefore, the observed effects still hold after controlling for depression and anxiety. Likewise, the Time X Group effect for fixation count on angry faces is still significant, $F(5,190) = 3.594$, $p = .004$, $\eta_p^2 = .086$. This indicates that this observed effect is not better accounted for by levels of depression and anxiety. Similarly, the Time X Group

interaction effect on the fixation duration for disgust faces remained significant after controlling for depression and anxiety, $F(5,190) = 3.506$ , $p = .005$, $\eta_p^2 = .084$. In addition, the Time X Group effects from fixation duration on angry faces were still significant, Time X Group: $F(5,190) = 3.826$, $p = .003$, $\eta_p^2 = .091$. Moreover, the time by group effects on neutral faces after controlling for depression and anxiety remained significant as well, $F(5,190) = 2.554$, $p = .029$, $\eta_p^2 = .063$.

**Speech Performance**

Listed in Table 4 are the T-tests and Mann-Whitney U-tests that were conducted in order to examine group differences in terms of speech performance (for skewed, non-normally distributed variables, we conducted the non-parametric Mann-Whitney U tests instead of t-tests). With regards to the participants' self-rated performance, there were no differences between the STA and STV groups. Upon examining staff ratings, there was a marginal trend such that the STV group received overall better performance scores than the STA group based on the observer ratings ($p = .097$). There were no significant differences observed on the staff total scores between groups. With respect to the duration of the speech, the STV group was able to speak significantly longer than the STA group (*Mann-Whitney* U = 115.50, $p = -.039$).

## Discussion

The topic of AB subgrouping is in its earliest stages in the current field. Therefore, much is to be learned about the specific symptom profiles that characterize those with vigilant versus avoidant patterns of attention. With this in mind, the primary aim of the study was to determine if individuals with SP will display different symptom profiles based on AB patterns. This was achieved by creating two subgroups characterized by

either vigilant or avoidant attentional processing using data collected from the most widely used assessment tool for attentional bias (i.e., dot-probe task). Furthermore, the secondary aims of this research included examining patterns of extended cognitive processing, and exploring demographic and other clinical variables to examine potential group differences.

To achieve these aims, the following hypotheses were tested in the current study.

**(I) The STV group will demonstrate higher levels of social anxiety compared to the STA group.**

It was important when examining differences among AB subgroups to consider the overall level of social anxiety experienced by individuals within each group. Differences on this key SP outcome measure ultimately reflect the severity of this condition. The data showed that there were no significant differences among both the STV and STA groups. However, the STV group reported marginally significantly higher symptom levels than the STA group, indicating that vigilant forms of AB may be associated with slightly higher levels of social anxiety. The effect size for this finding suggested that if a larger sample were to be attained in a future study, this would increase the likelihood an effect would be detected, which would be in line with the attention bias literature that suggests socially anxious individuals possess an AB toward threat (Amir et al., 2008; Amir et al., 2009).

**(II) The STV group will score higher on measures related to hypervigilant bodily reactions and fearful emotional reactions and the STA group will score higher on measures related to avoidance behaviors.**

The overall pattern of findings regarding Hypothesis II find partial support for the notion that those with vigilant forms of AB are more attuned to their own bodily reactions and experience overall higher fear levels in regards to social threat. Specifically, the finding that the STV group reported higher fear levels provides evidence for greater fear reactions towards social or performance situations. This finding is shown by reports of higher fear levels among the STV group regarding anticipating entering social situations.

Additionally, the STV group displayed a tendency to experience more observable symptoms of anxiety, relative to the STA group. This fits with Rapee and Heimberg's (1997) cognitive model of SP which states that when individuals become hypervigilant in the presence of social-evaluative threat, they become more aware of their own symptoms of anxiety. In this vein, evidence from the current study connects attentional vigilance with reported vigilance for symptoms such as being tense or sweating. Moreover, this provides support for the notion that those with vigilant patterns of AB experience a heightened sensitivity to these symptoms when compared with those who have avoidant forms of AB. The implication of this phenomenon is that, depending on the pattern of underlying attentional processes, individuals with SP may experience a varying degree of a heightened and impairing awareness of their own anxiety.

The lack of evidence supporting Hypothesis II regarding physiological and fear symptoms using the SPIN may reflect the nature of the instructions. For this instrument, participants are instructed to respond based on how much the statements applied to their actual experiences over the past week (not their anticipation of such experiences). Thus, it is possible that the process of vigilance is more closely tied with the perceived

likelihood of entering a social situation, and less relevant for past events. With regards to avoidant behavior, the trend for those with vigilant patterns of processing to score higher on these measure may indicate that these individuals are more aware of their impairment in this area.

**(III) The STV group will show vigilant patterns of processing when examining extended patterns of cognitive processing, and the STA group will show avoidant patterns of processing when examining extended patterns of cognitive processing, OR we may observe vigilant followed by avoidant processing during an extended time course.**

When examining group differences among AB group and time interval on disgust faces, there was a significant interaction effect, though follow-up analyses did not reveal differences across the specific time points. The two-way interaction effect between AB group and time interval on angry faces provided evidence that early vigilant processing was associated with a vigilant style of attentional processing over an extended time course. This was indicated by a return in the number of fixations on angry faces among individuals in the STV group during the last 5 seconds of the eye-tracking task. The avoidant group, in contrast, showed attention reduction in the number of fixations, consistent with avoidance of threat. These findings together provide evidence for some degree of continuity between early and late-stage patterns of attentional processing. No group differences emerged among non-social threat facial stimuli (i.e., happy and neutral faces) with respect to the number of fixation counts. This may indicate that socially-threatening stimuli may be most useful in elucidating differences in attentional processing among AB groups.

Further in support of Hypothesis III, there was a significant interaction for fixation duration on disgust faces. Specifically, individuals in the STV group demonstrated attentional vigilance as indicated by the increased fixation duration midway through the time course. In contrast, the STA group evidenced a reduction in fixation duration midway through the time course. Looking at fixation duration, the same patterns were observed that indicate an interaction effect on angry faces characterized by a return in vigilant attention in the STV group, and a significant decline in the duration of fixation among the STA group.

In addition, results from analyses of fixation duration on neutral faces reveal an interesting pattern that hints at the more complete picture of processing when considering the full display of multiple facial expressions. Specifically, it was found that STV individuals demonstrated relatively stable, then reduced fixation durations on neutral faces. These findings, in combination with previous findings, indicate that the interaction effect of fixation duration on neutral faces observed among the STV individuals may be the result of these individuals turning their attention toward threatening faces during this time period.

**(IV) The STV group will report poorer performance on the speech task.**

Analyses addressing Hypothesis IV found partial support for differences between AB groups in terms of speech-task performance. Contrary to prediction, no significant differences were observed between the STA and STV groups on self or research staff member ratings. Rather, significant differences between groups emerged on the measurement of speech duration such that the STV group spoke significantly longer than the STA group. These findings suggest the possibility that, relative to hypervigilant

individuals, avoidant individuals may be less capable of sustaining their engagement on a social-evaluative task circumstance due to a greater behavioral tendency to withdraw or escape from such situations. In contrast, a hypervigilant type of attentional processing may not necessarily impair their behavioral performance in the context of social evaluation to a greater extent as compared with the avoidant type of attentional processing.

**Conclusions**

Intriguing is the evidence supporting the relationship between early or "snap-shot" AB, and the pattern of extended cognitive processing. Results of the current study seem to indicate that those with AB towards threat at 500ms seem to show a similar pattern of attentional processing later in the process. This connection informs the field of AB research by providing support for the notion that these biases influence moment-to-moment information processing in a way that extends beyond initial responding to social-threat stimuli. Furthermore, the differential pattern of eye gaze change over time between the two groups appeared to be rather independent of the influence of general depression and anxiety. This finding is important considering the high concordance between social anxiety and general anxiety and depression (Ruscio et al., 2007).

Additionally, it was important to explore the potential differences between AB groups on various demographic and clinical variables. Overall, there were no significant differences between demographic variables indicating that the AB subgroups were similar according to these basic characteristics. Additionally, there were not differences in terms of comorbid psychiatric diagnosis. This provides evidence that the AB groups were similar according to the range of additional diagnoses when examining a population

of individuals with SP. One important exception was that the hypervigilant individuals were more likely to be treatment-seeking compared to the avoidant individuals. It may be that more vigilant attentional allocations toward socially threatening cues are related to a greater awareness of the severity of one's own social anxiety issues and the need for improvement. Alternatively, the avoidant group may be likely to be more withdrawing and avoidant in the context of treatment seeking, which also necessarily includes some forms of social interactions with treatment providers. This is an important finding with clinical implication that a certain group of individuals with attentional avoidance may be more reluctant to seek treatment. These differences in treatment-seeking warrant further research.

Taken together, this research contributes to the AB literature by directly examining the two most often discussed as well as debated forms of AB in SP. Research has continued to accumulate in support of both attentional vigilance and attentional avoidance, but limited research has been conducted with the goal of exploring both patterns simultaneously, let alone their relations with other clinical variables. Therefore, the present study adds valuable knowledge regarding the potential utility of dividing groups of individuals with SP based on the AB pattern (STA vs. STV). As follows, the results of this project have significant theoretical implications. Theoretically, this study improves our cognitive theories of SP by providing evidence characterizing the specific patterns of AB among those with two different forms of AB. The identification of AB subgroups may lead to a more comprehensive understanding of the information-processing biases involved in SP and shed light on some of the inconsistent findings evidenced in the literature.

This study also used advanced methodological techniques to examine a more complete picture of attentional processing. Most AB research utilizes only dot-probe tasks, which do not capture the dynamic process of natural attentional processing. Thus, the use of eye-tracking technology added knowledge about the more realistic patterns of attention.

In terms of the present study's implications clinically, differences between AB subgroups might reflect distinct processes that necessitate alternate psychological interventions. If it is found that STV and STA subgroups are characterized by different social anxiety symptoms profiles, depending on initial patterns of AB, individuals with SP may receive different forms of psychological intervention. For example, it may be the case that attention training paradigms work better for those with attentional vigilance (i.e. those who demonstrate a STV subtype of AB) as indicated by findings demonstrating improvement with this group of SP individuals by disengaging their attention from threat (Amir, 2009). In contrast, STA individuals may be better suited for more standard psychological interventions such as exposure-based behavior therapy in order to run counter to their inherent avoidant action tendencies. Taken together, this line of work could result in important research that examines AB subtypes as a potential therapeutic moderator for SP individuals.

There were a few limitations that should be noted. First, a relatively small sample was divided into two AB groups, but a larger sample may have yielded more significant results. As discussed previously, there were alternative ways to create AB subgroups with the current data. For instance the current statistical analyses could have been conducted including only those individuals in the top and bottom 25% in terms of AB scores;

however, we did not perform this analysis due to the small sample size. Additionally, although the current analyses are limited by the existing database, it may be interesting to examine whether AB grouping remains stable over time, or can be predicted by changes in behavioral symptoms of social anxiety.

Future research should consider the more applied clinical applications when designing AB subtyping research. Along these lines, additional research examining differences in treatment response for individuals with vigilant versus avoidant AB may be useful in exploring the effects of these biases when applying standard cognitive-behavioral interventions such as exposure and cognitive restructuring. Further, future investigations may also explore the effects of attention training among individuals that possess vigilant or avoidant types of AB. For example, it may be the case that STV individuals are more likely to benefit from training attentional disengagement from stimuli, whereas SA individuals may benefit from attentional training towards threat. Bogels & Mansell (2004) briefly discussed mechanisms of change in attention training and proposed that is possible for ABM to reduce both vigilance and avoidance by encouraging threat reappraisal and improving attentional control.

In summary, AB is considered to be a putative maintenance factor of SP. Therefore, it was important to further explore the differences in information processing among individuals with SP. The current study provides evidence that individuals with SP can be categorized according to AB subtype. Consistent with expectations, participants who were either classified as vigilant or avoidant of social threat display differences in terms of clinical variables such as social anxiety and fear symptoms, as well as indicators of avoidance in terms of both self-report and real-life behaviors as evidenced by speech

task performance. Most importantly, the findings from this study add to the extant literature on patterns of attentional processing in SP during an extended time course. The linkage between early and late-stage vigilant and avoidant patterns of attention adds theoretical support for the notion that biased processing in SP is characterized by both vigilance and avoidance. Therefore, in accordance with emerging evidence for a vigilance-avoidance pattern, the results of the current study are consonant with previous findings that depending on the particular stage of processing, patterns of threat processing may vary.

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# Appendix A - Tables

Table 1.

*Stimulus Words Used in the Dot Probe Task*

| Social Anxiety Words | Neutral Words |
|---|---|
| Inadequate | Commercial |
| Stupid | Barrel |
| Shy | Pin |
| Inferior | Charcoal |
| Worthless | Quotation |
| Weak | Hand |
| Inept | Stairs |
| Nervous | Digital |
| Tense | Sandy |
| Clumsy | Carton |
| Foolish | Whisper |
| Incompetent | Centralized |
| Mock | Glue |
| Scorn | Image |
| Criticize | Furniture |
| Ridicule | Trumpet |
| Ignore | Beverage |
| Detest | Border |
| Despise | Beeper |
| Disapprove | Biographer |
| Reject | Pepper |
| Contempt | Download |
| Belittle | Cardigan |
| Disdain | Mileage |

Table 2.

*Basic Demographic and Clinical Characteristics (N=44)*

| | STA (n=18) | STV (n=26) | T, Chi-squared, or Fisher's Exact Test | *p* |
|---|---|---|---|---|
| | Mean (SD) | Mean (SD) | | |
| Age | 29 (13.899) | 29.5 (10.904) | t = -.134 | .894 |
| Marital Status | | | $X^2$ = 4.470 | .484 |
| *Never Married* | 83.3% (n=15) | 69.2% (n=18) | | |
| *Married* | 11.1% (n=2) | 15.4% (n=4) | | |
| *Widowed* | 5.6% (n=1) | 0% (n=0) | | |
| *Divorced/Annulled* | 0% | 15.4% (n=4) | | |
| Gender | | | t = -.137 | .891 |
| *Male* | 44.4% (n=8), | 42.3% (n=11) | | |
| *Female* | 55.6% (n=10) | 75.7% (n=15) | | |
| Education | | | $X^2$ = 1.467 | .690 |
| *High School Diploma* | 27.8% (n=5) | 23.1% (n=6) | | |
| *Some College* | 55.6% (n=10) | 46.2% (n=12) | | |
| *Bachelor's Degree* | 16.7% (n=3) | 26.9% (n=7) | | |
| *Doctoral or Professional Degree* | 0% (n=0) | 3.8% (n=1) | | |
| Income | | | $X^2$ = 4.615 | .465 |
| *< 10,000* | 38.9% (n=7) | 34.6% (n=9) | | |
| *10,000-20,000* | 33.3% (n=6) | 11.5% (n=3) | | |
| *21,000-30,000* | 11.1% (n=2) | 15.4% (n=4) | | |
| *31.000-50,000* | 11.1% (n=2) | 23.1% (n=6) | | |
| *51,000-100,000* | 5.6% (n=1) | 11.5% (n=3) | | |
| *> 100,000* | | 3.8% (n=1) | | |
| Therapy | | | | |
| *Past Tx* | 27.8% (n= 5) | 57.7% (n=15) | Fisher's Exact Test | .125 |
| *Talk Tx* | 22.2% (n=4) | 57.7% (n=15) | | |
| *Drug Tx* | 16.7% (n=3 ) | 30.8% (n=8) | | |
| *Other* | 0% (n=0) | 3.8% (n=1) | | |
| *Current Tx* | 5.6% (n=1) | 23.1% (n=6) | Fisher's Exact Test | .048 |
| *Talk Tx* | 0% (n=0) | 15.4% (n=4) | | |
| Drug Tx | 5.6% (n=1) | 7.7% (n=2) | | |
| Other Tx | 0% (n=0) | 0% (n=0) | | |
| Trait Anxiety | | | | |
| *STAI-T* | 54.94 (8.26) | 58.04 (10.07) | t = -1.075 | .288 |
| *DASS-A* | 13.67 (8.87) | 16 (10.12) | t = -.790 | .434 |
| Depression | | | | |
| *CESD* | 13.50 (6.57) | 16 (5.87) | t = -1.323 | .193 |
| *DASS-D* | 17.11 (12.04) | 18.62 (10.97) | t = -.430 | .670 |
| Comorbidity | | | | |
| *MDD* | 38.9 % (n=7) | 34.6% (n=9) | Fisher's Exact Test | .509 |
| *GAD* | 44.4% (n=8) | 38.5% (n=10) | Fisher's Exact Test | .332 |
| *Additional Anxiety* | 66.7% (n=12) | 50% (n=13) | Fisher's Exact Test | .216 |

Table 2.

*Basic Demographic and Clinical Characteristics (N=44)* (Continued)

*Note*. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant; STAI-T = State-Trait Anxiety Inventory – Trait Scale; DASS-A = Depression Anxiety Stress Scale – Anxiety Subscale; CESD = Center for Epidemiological Studies – Depression Subscale; DASS-D = Depression Anxiety Stress Scale – Depression Subscale; MDD = Major Depressive Disorder; GAD = Generalized Anxiety Disorder, Additional Anxiety = Any additional anxiety disorder diagnosis other than SP.

Table 3. *Differences in Extended Processing during the Eye-Tracking Task*

| | STA (n=16) | | | | | | STV (n=26) | | | | | | *F*-test, *p* values, and $\eta_p^2$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time Segments[a] | T1 | T2 | T3 | T4 | T5 | T6 | T1 | T2 | T3 | T4 | T5 | T6 | Time | Group | TimeXGroup |
| Fixation Counts | | | | | | | | | | | | | | | |
| Disgust | 2.79 (.73) | 3.09 (1.5) | 2.28 (1.69) | 2.35 (1.10) | 2.53 (1.50) | 1.98 (1.19) | 3.21 (.73) | 2.47 (.82) | 3.01 (1.13) | 2.55 (.92) | 2.40 (1.11) | 1.94 (.95) | *F*=6.052<br>*P*<.001<br>$\eta_p^2$=.131 | *F*=.153<br>*p*=.698<br>$\eta_p^2$=.004 | *F*=2.678<br>***p*=.023**<br>$\eta_p^2$=.063 |
| Angry | 3.38 (1.36) | 2.61 (1.11) | 2.53 (.99) | 2.73 (1.34) | 2.11 (.95) | 1.88 (.71) | 3.00 (.79) | 2.82 (.85) | 2.38 (.86) | 2.54 (1.20) | 2.56 (1.17) | 3.03 (1.18) | *F*=4.136<br>*p*=.001<br>$\eta_p^2$=.094 | *F*=.880<br>*p*=.354<br>$\eta_p^2$=.022 | *F*=3.470<br>***p*=.005**<br>$\eta_p^2$=.080 |
| Happy | 3.28 (.75) | 3.09 (1.28) | 3.29 (1.02) | 3.13 (1.20) | 3.35 (1.18) | 2.68 (1.16) | 3.34 (.86) | 3.32 (1.10) | 3.16 (1.15) | 3.22 (1.69) | 3.54 (1.84) | 3.11 (1.66) | *F*=1.371<br>*p*=.237<br>$\eta_p^2$=.033 | *F*=.222<br>*p*=.640<br>$\eta_p^2$=.006 | *F*=.363<br>*p*=.873<br>$\eta_p^2$=.009 |
| Neutral | 3.06 (1.14) | 2.73 (1.53) | 2.77 (1.56) | 2.63 (1.32) | 2.52 (1.78) | 2.82 (2.10) | 3.24 (.80) | 2.83 (.89) | 2.62 (1.21) | 2.75 (1.13) | 2.72 (1.13) | 2.01 (.86) | *F*=2.505<br>*p*=.032<br>$\eta_p^2$=.059 | *F*=.044<br>*p*=.834<br>$\eta_p^2$=.001 | *F*=1.612<br>*p*=.158<br>$\eta_p^2$=.039 |
| Fixation Duration | | | | | | | | | | | | | | | |
| Disgust | 894.45 (320.54) | 1036.59 (559.06) | 735.00 (479.00) | 753.44 (294.23) | 864.87 (500.04) | 748.40 (481.09) | 1072.95 (272.83) | 861.33 (306.38) | 1104.12 (409.81) | 913.04 (399.06) | 860.41 (415.84) | 704.22 (343.71) | *F*=3.33<br>*p*=.007<br>$\eta_p^2$=.077 | *F*=.891<br>*p*=.351<br>$\eta_p^2$=.022 | *F*=3.612<br>***p*=.004**<br>$\eta_p^2$=.083 |
| Angry | 1028.81 (429.13) | 866.98 (384.44) | 940.15 (460.54) | 1043.24 (456.54) | 822.55 (420.98) | 664.81 (317.79) | 949.12 (296.92) | 1013.60 (400.71) | 878.35 (415.30) | 900.57 (395.59) | 915.72 (389.54) | 1099.88 (490.04) | *F*=.762<br>*p*=.578<br>$\eta_p^2$=.019 | *F*=.655<br>*p*=.423<br>$\eta_p^2$=.016 | *F*=3.659<br>***p*=.003**<br>$\eta_p^2$=.084 |
| Happy | 1052.26 (413.21) | 1067.99 (627.22) | 1221.01 (767.44) | 1212.01 (880.31) | 1250.13 (724.15) | 1066.13 (783.82) | 1134.15 (302.70) | 1202.64 (484.44) | 1149.09 (411.32) | 1179.33 (591.76) | 1343.35 (677.67) | 1117.93 (604.18) | *F*=1.582<br>*p*=.167<br>$\eta_p^2$=.038 | *F*=.075<br>*p*=.785<br>$\eta_p^2$=.002 | *F*=.414<br>*p*=.839<br>$\eta_p^2$=.010 |
| Neutral | 938.41 (312.24) | 888.85 (475.09) | 1010.66 (543.28) | 801.09 (428.62) | 852.55 (510.39) | 994.16 (628.97) | 1026.28 (240.94) | 1015.14 (365.26) | 952.48 (505.83) | 1032.12 (614.47) | 1031.13 (457.83) | 715.72 (332.62) | *F*=.679<br>*p*=.640<br>$\eta_p^2$=.017 | *F*=.229<br>*p*=.635<br>$\eta_p^2$=.006 | *F*=2.614<br>***p*=.026**<br>$\eta_p^2$=.061 |

*Note*. [a] 5-sec Time Segments (0 to 30 sec): T1 (0-5 sec), T2 (5-10 sec), T3 (10-15 sec), T4 (15-20 sec), T5 (20-25 sec), T6 (25-30 sec); STA = Social-Threat Avoidant; STV = Social-Threat Vigilant

Table 4.

*Differences among Groups on Speech Ratings*

| | STA (n=16) Mean(SD) | STV (n=24) Mean(SD) | T or Mann-Whitney U | P values |
|---|---|---|---|---|
| Speech Rating | | | | |
| *Self* | | | | |
| *Total* | 29.93(13.26) | 28.96(11.67) | .239 | .812 |
| *Global* | 4.06(3.80) | 3.83(3.02) | .212 | .833 |
| *Staff* | | | | |
| *Total* | 41.48(4.83) | 44.58(7.03) | -1.535 | .133 |
| *Global* | 3.87(1.51) | 4.95(2.22) | -1.701 | .097 |
| Duration | | -1.911 | Mann-Whitney U = 115.50, Z = -2.06 | .039 |

*Note*. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant

Appendix B - Figures

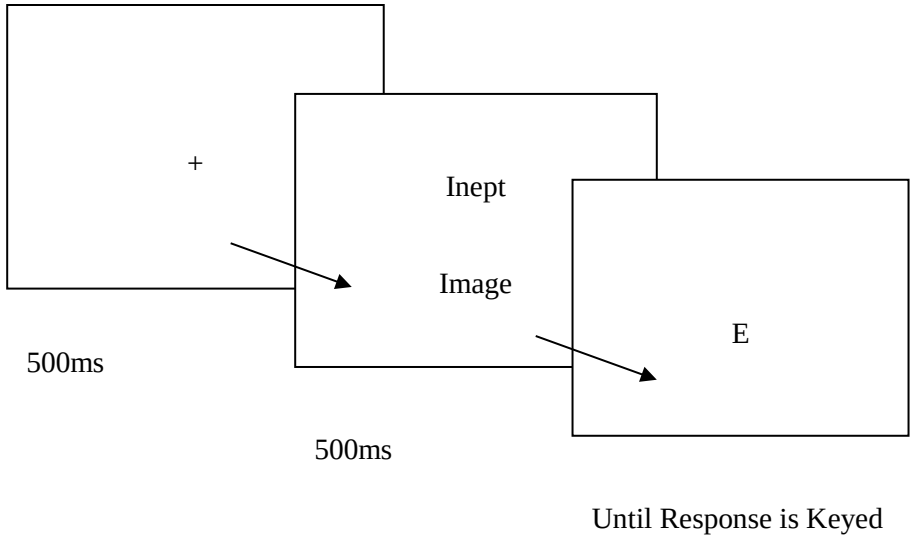


*Figure 1*. Procedure of the Dot-Probe Task

*Figure 2*. Example Screen Shot from the Eye-Tracking Task

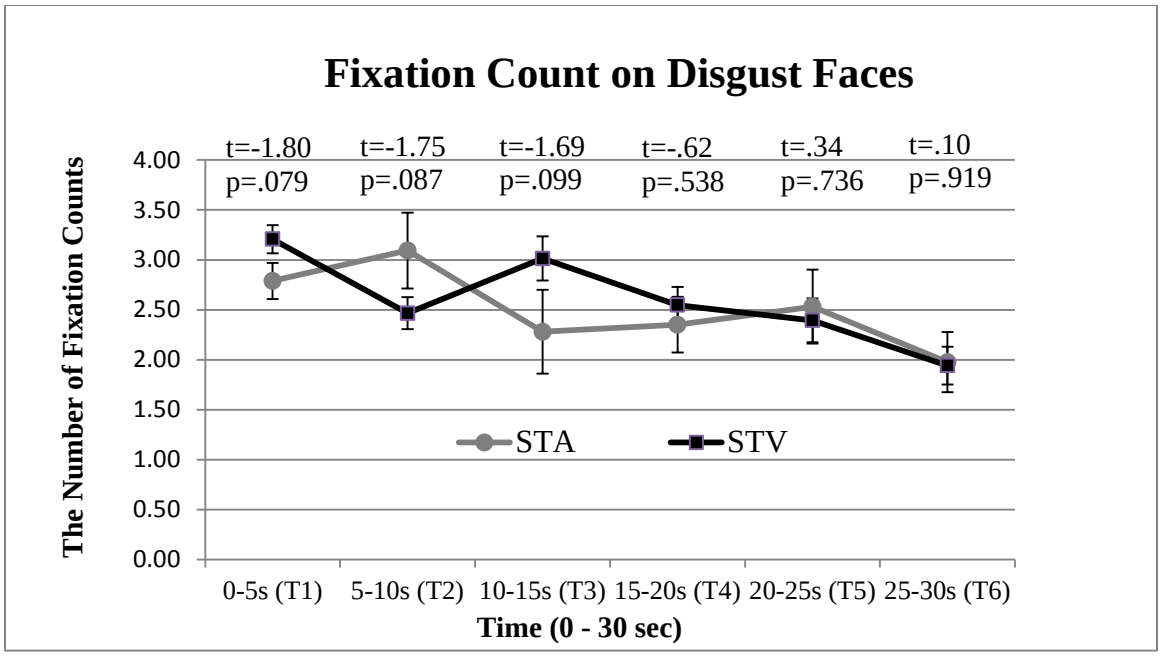


*Figure 3*. Fixation Count on Disgust Faces. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant. STA paired t-test results: T1 vs. T2 [*t*(15)=-.80, *p*=.436]; T2 vs. T3 [*t*(15)=1.84, *p*=.086]; T3 vs. T4 [*t*(15)=-.23, *p*=.823]; T4 vs. T5 [*t*(15)=-.53, *p*=.605]; T5 vs. T6 [*t*(15)=1.676, *p*=.114]; T1 vs. T3 [*t*(15)=1.21, *p*=.245]; T1 vs. T4 [*t*(15)=1.62, *p*=.126]; T1 vs. T5 [*t*(15)=.67, *p*=.511]; **T1 vs. T6 [*t*(15)=2.57, *p*=.022].** STV paired t-test results: **T1 vs. T2 [*t*(25)=3.93, *p*=.001]; T2 vs. T3 [*t*(25)=-2.59, *p*=0.16]**; T3 vs. T4 [*t*(25)=1.78, *p*=.087]; T4 vs. T5 [*t*(25)=.75, *p*=.460]; **T5 vs. T6 [*t*(25)=2.10, *p*=.046]**. T1 vs. T3 [*t*(25)=.79, *p*=.437]; **T1 vs. T4 [*t*(25)=3.50, *p*=.002]**; **T1 vs. T5 [*t*(25)=3.60, *p*=.001]**; **T1 vs. T6 [*t*(25)=6.01, *p*<.001]**.

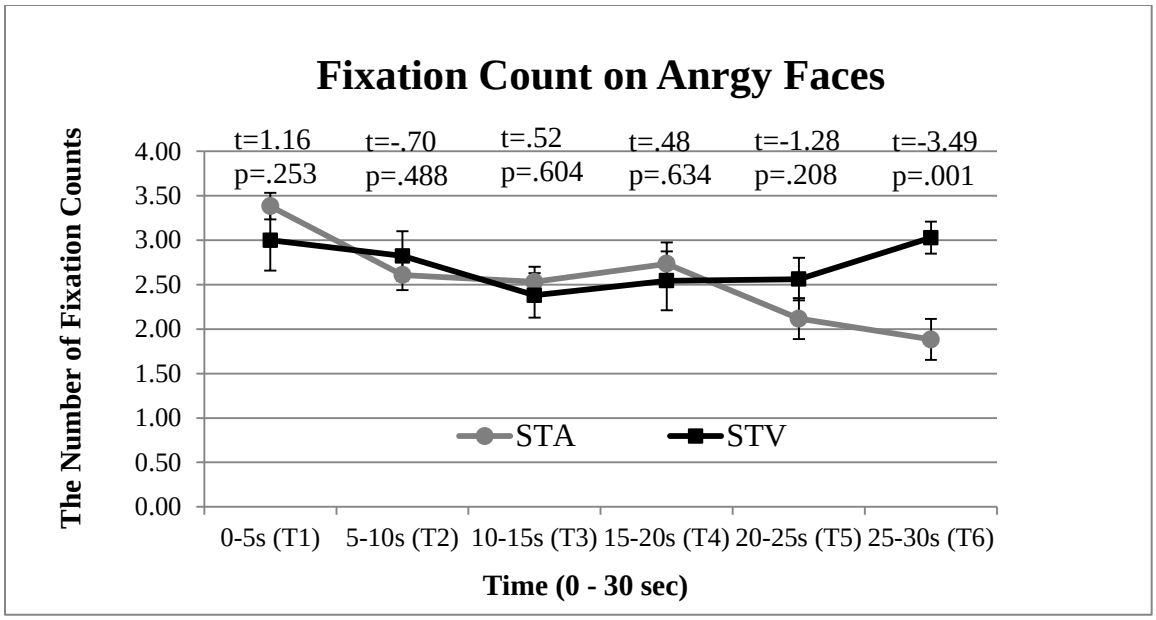


*Figure 4*. Fixation Count on the Angry Faces. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant. STA paired t-test results: T1 vs. T2 [*t*(15)=1.58, *p*=.134]; T2 vs. T3 [*t*(15)=.24, *p*=.810]; T3 vs. T4 [*t*(15)=-.51, *p*=.615]; T4 vs. T5 [*t*(15)=1.78, *p*=.096]; T5 vs. T6 [*t*(15)=1.03, *p*=.321]. T1 vs. T3 [*t*(15)=1.99, *p*=.065]; T1 vs. T4 [*t*(15)=1.44, *p*=.171]; **T1 vs. T5 [*t*(15)=4.77, *p*<.001]**; **T1 vs. T6 [*t*(15)=4.89, *p*<.001]**. STV paired t-test results: [T1 vs. T2 [*t*(25)=.84, *p*=.409]; **T2 vs. T3 [*t*(25)=2.17, *p*=.040]**; T3 vs. T4 [*t*(25)=-.52, *p*=.607]; T4 vs. T5 [*t*(25)=-.08, *p*=.938]; T5 vs. T6 [*t*(15)=-1.68, *p*=.105]. **T1 vs. T3 [*t*(25)=2.72, *p*=.012]**; T1 vs. T4 [*t*(25)=1.94, *p*=.064]; T1 vs. T5 [*t*(25)=2.03, *p*=.053]; T1 vs. T6 [*t*(25)=-.12, *p*=.904].

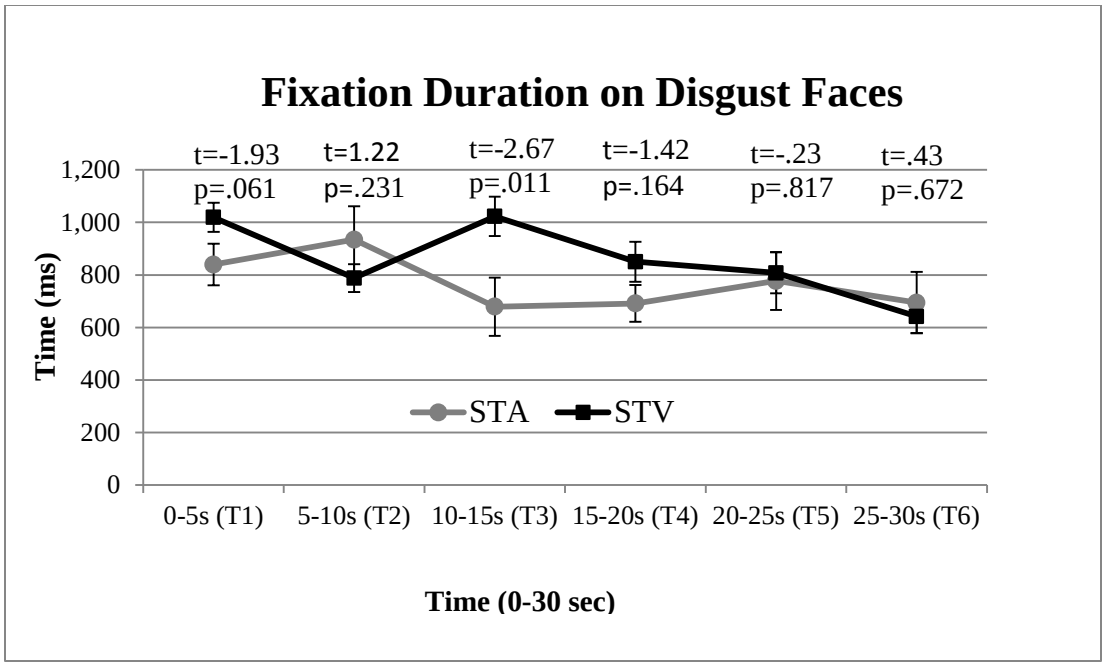


*Figure 5*. Fixation Duration on the Disgust Faces. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant. STA paired t-test results: T1 vs. T2 [*t*(15)=-.90, *p*=.383]; **T2 vs. T3 [*t*(15)=2.18, *p*=.045]**; T3 vs. T4 [*t*(15)=-.14, *p*=.895]; T4 vs. T5 [*t*(15)=-.83, *p*=.421]; T5 vs. T6 [*t*(15)=.76, *p*=.458]. T1 vs. T3 [*t*(15)=1.30, *p*=.215]; T1 vs. T4 [*t*(15)=1.87, *p*=.081]; T1 vs. T5 [*t*(15)=.55, *p*=.592]; T1 vs. T6 [*t*(15)=1.51, *p*=.152]. STV paired t-test results: **T1 vs. T2 [*t*(25)=3.40, *p*=.002]**; **T2 vs. T3 [*t*(25)=-3.06, *p*=.005]**; T3 vs. T4 [*t*(25)=1.76, *p*=.091]; T4 vs. T5 [*t*(25)=.554, *p*=.584]; **T5 vs. T6 [*t*(15)=2.27, *p*=.032]**. T1 vs. T3 [*t*(25)=-.05, *p*=.962]; T1 vs. T4 [*t*(25)=2.58, *p*=.016]; T1 vs. T5 [*t*(25)=2.69, *p*=.012]; **T1 vs. T6 [*t*(25)=5.10, *p*<.001]**.

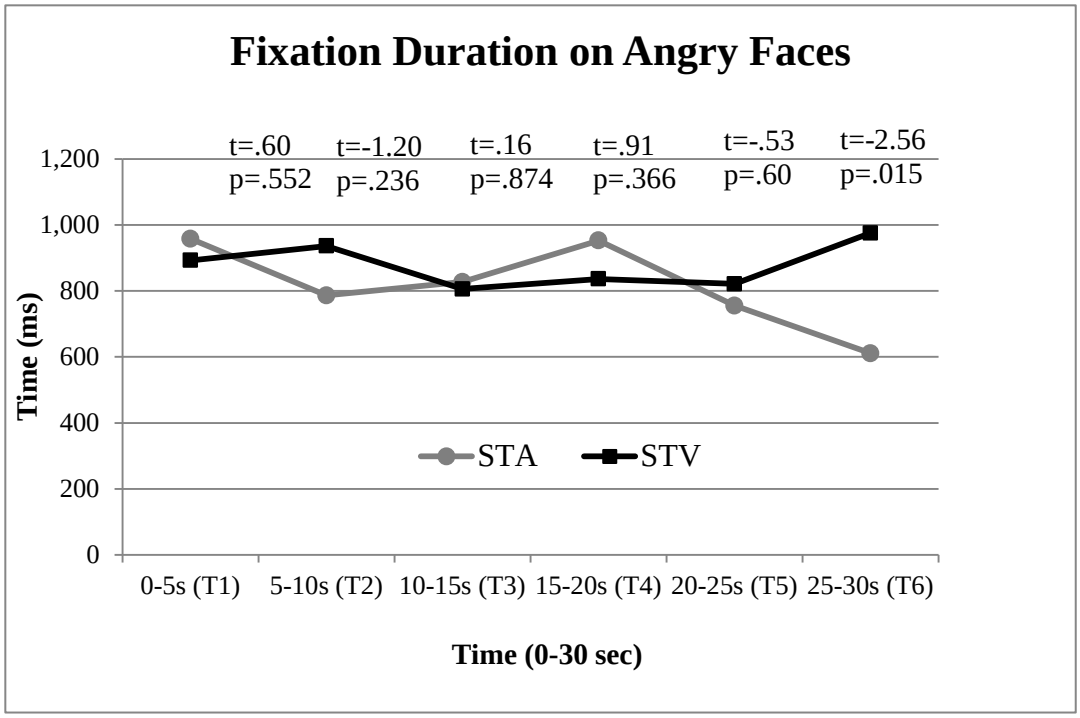


*Figure 6*. Fixation Duration on the Angry Faces. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant. STA paired t-test results: T1 vs. T2 [*t*(15)=1.27, *p*=.224]; T2 vs. T3 [*t*(15)=-.38, *p*=.713]; T3 vs. T4 [*t*(15)=-.94, *p*=.362]; T4 vs. T5 [*t*(15)=1.92, *p*=.074]; **T5 vs. T6 [*t*(15)=1.77, *p*=.097]**. T1 vs. T3 [*t*(15)=.93, *p*=.368]; T1 vs. T4 [*t*(15)=.05, *p*=.964]; T1 vs. T5 [*t*(15)=2.10, *p*=.053]; **T1 vs. T6 [*t*(15)=4.09, *p*=.001]**. STV paired t-test results: T1 vs. T2 [*t*(25)=-.52, *p*=.611]; T2 vs. T3 [*t*(25)=1.62, *p*=.117]; T3 vs. T4 [*t*(25)=-.27, *p*=.789]; T4 vs. T5 [*t*(25)=.19, *p*=.854]; T5 vs. T6 [*t*(15)=-1.70, *p*=.101]. T1 vs. T3 [*t*(25)=1.05, *p*=.302]; T1 vs. T4 [*t*(25)=.73, *p*=.475]; T1 vs. T5 [*t*(25)=1.05, *p*=.303]; T1 vs. T6 [*t*(25)=-.86, *p*=.398].

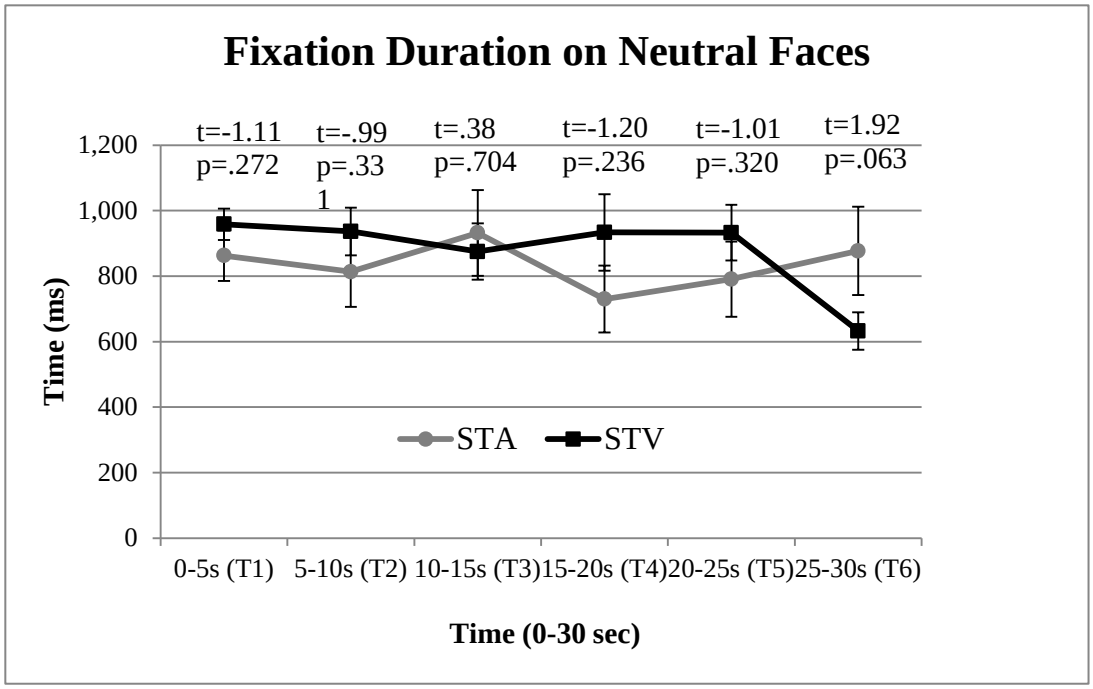


*Figure 7*. Fixation Duration on the Neutral Faces. STA = Social-Threat Avoidant; STV = Social-Threat Vigilant. STA paired t-test results: T1 vs. T2 [*t*(15)=.56, *p*=.586]; T2 vs. T3 [*t*(15)=-1.30, *p*=.217]; T3 vs. T4 [*t*(15)=2.10, *p*=.055]; T4 vs. T5 [*t*(15)=-.58, *p*=.571]; T5 vs. T6 [*t*(15)=-.67, *p*=.512]. T1 vs. T3 [*t*(15)=-.65, *p*=.527]; T1 vs. T4 [*t*(15)=1.51, *p*=.153]; T1 vs. T5 [*t*(15)=.70, *p*=.492]; T1 vs. T6 [*t*(15)=-.12, *p*=.909]. STV paired t-test results: T1 vs. T2 [*t*(25)=.28, *p*=.781]; T2 vs. T3 [*t*(25)=.70, *p*=.494]; T3 vs. T4 [*t*(25)=-.45, *p*=.656]; T4 vs. T5 [*t*(25)=.01, *p*=.993]; **T5 vs. T6 [*t*(15)=4.05, *p*=<.001]**. T1 vs. T3 [*t*(25)=.91, *p*=.370]; T1 vs. T4 [*t*(25)=.22, *p*=.828]; T1 vs. T5 [*t*(25)=.25, *p*=.803]; **T1 vs. T6 [*t*(25)=3.84, *p*=.001]**.