Spring 5-19-2016

Slowed Temporal Disengagement from Ambiguous Information in Trait Anxiety

Tiffany Arango
CUNY Hunter College

Slowed Temporal Disengagement from Ambiguous Information in Trait Anxiety

by

Tiffany Arango

Submitted in partial fulfillment

of the requirements for the degree of

Master of Arts in

Psychology, Hunter College

City University of New York

2016

Thesis Sponsor:

May 10th, 2016 ____________________ Date

Mariann Weierich, PhD ________________________________ Signature of First Reader

May 10th, 2016 ____________________ Date

Tracy Dennis, PhD ________________________________ Signature of Second Reader

Acknowledgements

I would like to extend my appreciation to my thesis sponsor, Dr. Mariann Weierich, for her support and guidance. I would not be on the path I am today without her mentorship. I would also like to thank Dr. Tracy Dennis for her helpful feedback. A special thanks to the CAP Lab for the countless peer reviews, advice and great times we shared. This thesis is dedicated to my mom, who has always been my biggest fan. Thank you so much for all your love and support.

Abstract

Trait anxiety is the predisposition to perceive situations as threatening and to react anxiously; social and affective context might be associated with delayed disengagement from perceived threatening situations. Higher trait anxiety has been associated with slower spatial disengagement from negative and neutral social information. However, less is known about temporal attention in the social context, especially the effect of trait anxiety on temporal disengagement from social scene information. To investigate the relation between trait anxiety and temporal disengagement from social affective images, 54 participants completed a disengagement task and self-report questionnaires on trait anxiety, state anxiety, depressed mood, and perceived stress. We hypothesized that higher trait anxiety would be associated with slower temporal disengagement from social compared to non-social images. Contrary to our hypothesis, trait anxiety was only associated with delayed disengagement from neutral non-social images, and did not predict above and beyond state anxiety. Further research should distinguish between the influence of trait and state anxiety on the allocation of attention to affective information.

Keywords: trait anxiety, temporal disengagement, affective

Slowed temporal disengagement from ambiguous information in trait anxiety

Trait anxiety is the tendency to perceive situations as threatening, and to react in an anxious manner (Spielberger et al., 1983). Faster spatial orienting to affective information (e.g., Calvo & Avero, 2005), and slower spatial disengagement from negative social information has been associated with trait anxiety (e.g., Mogg et al., 2008). Less is known about the relation between trait anxiety and temporal disengagement from affective information, particularly social compared to non-social information. Delayed temporal disengagement can have consequences in real life because rapid detection of threat is important. Differential attention to social information might affect how people perceive and interpret social situations. We investigated the relation between trait anxiety and temporal disengagement from affective social and non-social scenes using self-report measures and a computerized attention task.

Anxiety is an affective response to a situation that is perceived as threatening (e.g., Spielberger et al., 1983), and often includes subjective feelings of apprehension, tension, worry and elevated physiological arousal. Unlike trait anxiety, which is described as a stable characteristic, state anxiety is transient and refers to how you feel in the moment. Higher state anxiety is common in non-clinical populations, especially in social interactions that are perceived as threatening (e.g., Horikawa & Yagi, 2012). People with higher trait anxiety perceive more situations as threatening and experience state anxiety more frequently. Experiencing consistent state anxiety might prime maladaptive allocation of attention, and could in turn affect how people selectively attend to and disengage from visual information. Given that people inherently attribute affective meaning to attended information, and this affective information can vary in social context, it is important to examine how trait anxiety might differentially affect attention to social and non-social information.

The visual system processing capacity is limited, and for this reason, attention is intrinsically selective (e.g., Desimone & Duncan, 1995). Attention can occur as a function of space and time, and we disengage from objects to receive information about the environment. Disengagement of attention across time within a fixed spatial location is a mechanism known as temporal disengagement (e.g., Chun & Potter, 1995). Temporal attention refers to the orientation to and disengagement from visual information over time, which can be estimated by the onset of stimuli presentations (e.g., Chun & Potter, 1995). Temporal disengagement allows us to examine delayed disengagement from visual percepts without taking account the time it takes to spatially disengage from one stimulus to another.

Previous studies examining the relation between trait anxiety and attention have focused on the maladaptive spatial allocation of attention. Trait anxiety has been associated with faster orienting to negative pictures compared to neutral pictures (IAPS; e.g., Calvo & Avero, 2005), and increased orienting to angry and fearful faces relative to neutral faces (e.g., Mogg et al., 2007). Moreover, higher state anxiety has been associated with faster alerting to target information following fearful and neutral faces (e.g., Dennis et al., 2008). What we select to attend to is largely driven by the interaction between a particular goal (e.g., looking for a friend) and salient, sensory features in the environment (e.g., color of friend's shirt) (e.g., Desimone & Duncan, 1995; Chun & Potter, 2001). Some visual events are given higher priority for perceptual representation and attended to preferentially (e.g., Chun & Potter, 2001). This is adaptive for rapid detection of threat, but in the absence of actual threat, filtering extraneous information is necessary for continued perceptual processing of pertinent information. Given that people with higher trait anxiety perceive more situations as threatening, they might be more sensitive to social cues as means to evaluate potential threat.

Trait anxiety has also been associated with slower spatial disengagement from negative and neutral faces compared to positive faces (Mogg et al., 2008), as well as fearful faces relative to other affective faces (Georgious et al., 2005). Taken together with evidence supporting faster orientation to negative social information, this suggest that once selectively attended to, people with higher trait anxiety display increased difficulty spatially disengaging from an affectively social stimulus that is perceived as threatening.

Attention to social information is important for daily interactions, since people preferentially attend to social cues (e.g., Kret et al., 2013) in order to evaluate the context of a situation. Differential attention to social information might affect what people selectively attend to, and in turn affect how they interpret social situations. Trait anxiety has been associated with negative interpretations of ambiguous words (e.g., Matthews et al., 1989) and social events (e.g., MacLeod & Cohen, 1993). Additionally, social anxiety has been associated with a greater tendency to identify neutral faces as negative (e.g., Cooney et al., 2006). Consequently, the more negative interpretations made, the more threat is perceived in the environment, and social context might be intrinsic to maladaptive attention to affective information. Cognitive components of trait anxiety, like worry and apprehension, are often about social evaluation (e.g., Eysenck &Van Berkum, 1992). Thus, delayed temporal disengagement from affectively social stimuli could prolong anxious states and affect social interactions.

In this study, we examine one mechanism of temporal allocation to affective information in trait anxiety: delayed temporal disengagement from social and non-social scenes. In normative visual processing, the identification of a first target (T1) impairs the detection of a second target (T2), when it follows the first by 150-500 ms window; this perceptual cost to target detection is known as the attentional blink (AB) (e.g., Chun & Potter, 1995; Broadbent & Broadbent, 1987;

Raymond, Shapiro, & Arnell, 1992). Previous studies have used a rapid task visual presentation task (RSVP) (Eriksen & Collins, 1969; Eriksen & Spencer, 1969) to measure the temporal allocation of attention to and disengagement from visual percepts, and the proximity of a second target to the first target affects the magnitude of the AB. Multiple theories suggest the detection of a second stimulus is inhibited when it follows the first stimulus because of attentional capacity constraints (e.g., Chun & Potter, 1995; Raymond, Shapiro, & Arnell, 1992). The delayed detection of a second target can also be influenced by the affective state of the perceiver. For example, people with higher harm avoidance (i.e., personality trait characterized by excessive worry) displayed delayed disengagement from affective pictures compared to people with lower harm avoidance (e.g., Most et al., 2005).

Affective information leads to a larger attentional blink (e.g., Arnell et al., 2007; Mathewson et al., 2008). For example, delayed temporal disengagement following sexually arousing words (Arnell et al., 2007) and semantically taboo words (Mathewson et al., 2008), has been observed. More recent literature has focused on the degree to which the affective value of target stimuli influences temporal disengagement in trait anxiety. However, previous studies do not address how people with higher trait anxiety attend to complex social and non-social information.

Previous studies have examined delayed disengagement from affective targets in anxiety, using words and faces, but there have been mixed findings. An attenuated AB following fearful faces in trait anxiety (Fox et al., 2005) and negative words in state anxiety, has been observed (Arend & Botella, 2002). One interpretation of these results is that anxious people process negative words (e.g., Arend & Botella, 2002) and fearful faces more efficiently (e.g., Fox et al., 2005). However, in other studies state anxiety was associated with delayed disengagement from negative words (Barnard et al., 2005). These results suggest that people with higher state anxiety display difficulty temporally disengaging from negatively valenced words.

Mixed findings for temporal disengagement from affective information in anxiety might be a function of the type of perceptual stimuli used. For instance, semantic processing might manifest differently on the allocation of attention in anxiety. The attentuated blink following face images (i.e., Fox et al., 2005) was specific to fearful facial expressions, and in fact, an enhanced blink was observed following happy faces in people with high relative to low trait anxiety. One interpretation of these results is that anxious people experience difficulty disengaging from social information even if it is positive in valence. Additionally, the former study used neutral faces as distractor stimuli (i.e., non-target stimuli). Neutral facial expressions are ambiguous and often identified as negative in people with higher trait anxiety, and thus might prime a person to differentially attend to subsequent negative information.

Attention to facial expressions is important in daily interactions because it is a way to receive and transmit emotional information. Nonetheless, a single face is just one type of social percept, and does not address the extent to what people attend to on a daily basis. Whether increased difficulty disengaging from affective information in trait anxiety is specific to social cues, or to general negative or affective (including non-social) information, is not clearly delineated. Pictures with complex scene information that vary in affect and social context might be a more ecologically valid stimulus set. According to the two-stage theory of temporal attention (Chun & Potter, 1995; Chun & Potter, 1995b), when stimuli are presented in a stream, individual items are first processed for semantic value. That is, a person can quickly extract perceptual and conceptual information about a percept based on structural organization and knowledge of prototypical exemplars. Studies on scene perception support this notion: people can perceive and infer the conceptual gist (e.g., people celebrating) of a scene within 100 ms (e.g., reviewed by Oliva, 2005; Oliva & Schyns, 1997). Semantic representations are vulnerable to decay and interference, and thus, attentional resources are allocated to maintain conceptual representation in working memory (Chun & Potter, 1995; Chun & Potter, 1995b). However, working memory processes are subject to a delay of a few hundred ms (reviewed by Oliva, 2005). Trait anxiety is associated with deficits in the ability to update or maintain working memory (e.g., Eysenck et al., 2007). Taken together, people with higher trait anxiety might take longer to update working memory processes, and thus, display delayed temporal disengagement relative to people with lower trait anxiety.

The aim of this study is to examine temporal disengagement from social and non-social information in trait anxiety. We use trait anxiety as a proxy measurement of how perpetual state anxiety over time might prime a person to attend to his/her environment differently. We hypothesized that people with higher trait anxiety would display delayed disengagement from social scenes compared to non-social scenes. We also examined whether the effects of trait anxiety on disengagement from social information is a function of valence. We used a rapid serial presentation task to measure temporal disengagement and questionnaires to assess trait anxiety, state anxiety, and other related constructs.

Methods

Participants

We recruited 60 Hunter College students from the introductory psychology subject pool. Participants included 35 women (58%) and 25 men (42%), ranging from age 18-58 (M = 21.8, SD = 6.9). Twenty-two participants identified as Asian/Pacific Islander (37%), 20 as White (33%), 6 as Hispanic (10%), 4 as Multiple Ethnicities (7%), 3 as Black (5%), 3 as Middle

Eastern (5%) and 2 as "Other Ethnicity" (3%). We granted participants one introductory psychology course credit for their participation.

Questionnaires

Participants completed four self-report questionnaires measuring trait anxiety, state anxiety, depressed mood and perceived stress. We used the State-Trait Anxiety Inventory—Trait Version (STAI-T; Spielberger et al., 1983) to measure trait anxiety. The STAI-T is a 20-item scale that measures trait anxiety with scores ranging from 20-80. We used the State-Trait Anxiety Inventory—State Version (STAI-S; Spielberger et al., 1983) to measure state anxiety. The STAI-S is a 20-item scale that measures state anxiety with scores ranging from 20-80. There are no optimal cut-off scores established for either STAI-T or STAI-S, however, cut-off values of 39 to 40 have been suggested for sub-clinical higher anxious populations (Spielberger et al., 1983).

In contrast to the STAI-S, the STAI-T includes items that measure the tendency to worry and feel anxious (e.g., "I worry too much over something that doesn't really matter"; "I take disappointments so keenly that I can't put them out of my mind"). The STAI-S measures current levels of anxiety (i.e., how you feel right now; at this moment), whereas the STAI-T measures how anxious one generally feels with no particular timeframe. Trait anxiety is the enduring predisposition to respond to situations in an anxious manner, and people who are higher in trait anxiety are more likely to experience state anxiety (e.g. Spielberger, 1983). The original administration of the STAI-T questionnaire includes scale anchors of "almost never" to "almost always"; however, our scale ranged from "not at all" to "very much so." The item statements were administered correctly.

We used the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) to measure depressed mood. The BDI-II is a 21-item scale that measures depressed mood in the past week with scores ranging from 0-63. The following cut-off groups have been suggested for the BDI-II—minimal (0-13), mild (14-19), moderate (20-28), and severe (29-63) (Beck, Steer, & Brown, 1996). Depressed mood often occurs concurrently with state and trait anxiety, and scores on the BDI-II and STAI are generally strongly correlated. We used BDI-II scores to determine if depressed mood might account for differences in temporal disengagement.

We used the Perceived Stress Scale (PSS-10 item; Cohen, Kamarck, & Mermelstein, 1983) to measure perceived stress. The PSS-10 is a 10-item scale that measures perceived stress during the past month with scores ranging from 0-40. Given that self-reported perceived stress is associated with anxiety (Bergdahl & Bergdahl, 2002), and induced stress is associated with delayed disengagement from negative information (e.g., Ellenbogen et al., 2002), we used scores from the PSS-10 to determine if perceived stress might account for differences in temporal disengagement.

Stimuli

We used color images as stimuli. Stimuli included 64 positive, 64 negative, 64 neutral scenes, which served as affective distractors. Half the affective distractor scenes were social and half were non-social. Social scenes depicted people (e.g., people arguing), whereas non-social scenes did not include people (e.g., empty office). Stimuli from 192 landscape/architectural scenes, half rotated 90° to the right and half rotated 90° to the left, served as target images. Another 192 upright landscape/architectural scenes were used as other images in the stream. Affective distractors were previously normed along valence (i.e., unpleasant to pleasant) and arousal (i.e., low to high) dimensions. Architectural/landscape images were collected from an online public database (Oliva & Torralba, 2001).

A reflected duplication (i.e., mirror image) for each image was created, resulting in two stimulus sets (i.e., mirrored images versus non-mirrored images). Images were 11.4 cm wide and 8.5 cm high. We rotated architectural/landscape targets before size formatting. All stimuli were edited to remove writing and other distinguishable features (e.g., national emblems) using Adobe Photoshop CS (see Figure 1).

Rapid Serial Visual Presentation task (RSVP)

The RSVP task was programmed using E-Prime 2.0 software and presented on a Dell Precision T3500 desktop monitor. Each RSVP stream consisted of 18 or 20 images presented for 100 ms each (see Figure 2). Target and distractor stimuli were randomly selected for each trial. In each trial, an affective distractor was presented as either the 8^{th} or 10^{th} item in the stream. A rotated target image was presented at a 200, 400, or 700 ms lag (i.e., lag 2, 4, and 7, respectively) after the affective distractor. The other items in the stream were randomly selected landscape/architectural images. Based on preliminary data, we selected lags 2 and 4 as lags more likely to be associated with decreased target accuracy, and lag 7 as least likely to be associated with reduced target accuracy. Lag dependent effects on target accuracy are indicative of the presence and magnitude of the attentional blink phenomenon. To control for perceptual feature effects on target accuracy, we counterbalanced the presentation of mirror and non-mirrored stimulus sets for experimental sessions. To control for target expectancy effects, some trials did not include a target. An affective distractor was presented in every trial including trials with no target. During every experimental block, each affective distractor type was presented 12 times, and a rotated target was presented 12 times at each lag. We randomly selected affective distractors and target images using a random number generator.

Procedure

Participants completed experimental procedures in a private room. After participants provided written consent, a research assistant explained the experimental procedures. A research assistant provided verbal instructions along with instructions displayed on the computer screen. Computer instructions were presented in white letters on a black background in the center of the screen with a viewing distance of 70 cm. Images measured 11.4 cm wide and 8.5 cm high. Participants viewed images on a black background in the center of the screen at a viewing distance of 70 cm. Participants completed 8 practice trials and 192 experimental trials (4 blocks/48 trials each), and indicated the direction of the rotated target if present using the keyboard (i.e., labeled "R" key for right; labeled "L" for left; labeled "0" key for not present). Practice trials did not contain affective distractors or images used in experimental trials. Instructions emphasized that most images were architectural/landscape scenes presented very quickly, and that a rotated architectural/landscape image might appear in some trials. After participants finished the RVSP task, they completed the questionnaires (STAI-S, PSS, BDI-II, STAI-T) and a demographic form. The research assistant debriefed the participant at the end of the experiment.

Results

We excluded participants (n = 8) with less than 60% mean target accuracy on trials with no rotated target from all statistical analyses. False positives on absent rotated target trials suggested participants responded randomly. Practice trials were also excluded. Data from fifty-four participants (65% women) were statistically analyzed using an alpha level of .05 for all statistical tests.

Questionnaires

Trait anxiety scores on the STAI-T ranged from 20-75 (M = 40.94, SD = 12.30). State anxiety scores on the STAI-S ranged from 20-64 (*M* = 36.86, *SD* = 10.24). Perceived stress scores on the PSS ranged from 3-33 (*M* = 16.99, *SD* = 6.93), and depressed mood scores on BDI-II ranged from 0-40 (*M* = 10.76, *SD* = 9.14). We conducted bivariate Pearson correlation analyses to examine correlations among the questionnaire scores. There was a moderate association between trait and state anxiety scores (r = .60, $p < .01$). Trait anxiety was strongly associated with depressed mood (r = .84, $p < .01$). We also conducted a Pearson correlation analysis to examine the relation between trait anxiety and perceived stress, and there was a strong association between trait anxiety and perceived stress scores (r = .80, $p < .01$).

Speed of Temporal Disengagement

Lower target accuracy indexed slower temporal disengagement from the affective distractors. Consistent with an attentional blink, target accuracy was lower at lag 2 (*M* = .75, *SEM* = .03) and lag 4 (*M* = .81, *SEM* = .03) compared to lag 7 (*M* = .83, *SEM* = .03). Target accuracy did not differ by affect (negative, *M* = .82, *SEM* = .02; neutral, *M* = .82, *SEM* = .02; positive, *M* = .82, *SEM* = .02). Target accuracy was lower following social compared with non-social distractors (see Figure 3). Additionally, this pattern was consistent at each lag, target accuracy was lower following social distractors than non-social distractors at lag 2 (social, *M* = .70, *SEM* = .03; non-social, *M* = .78, *SEM* = .03) compared to lag 4 (social, *M* = .79, *SEM* = .03; non-social, *M* = .83, *SEM* = .03) and lag 7 (social, *M* = .82, *SEM* = .03; non-social, *M* = .86, *SEM* = .03).

Anxiety and Disengagement of Attention

We conducted Pearson bivariate correlations to examine the possible relations between trait anxiety and disengagement of attention. We calculated differences scores for each participant by subtracting lag 7- lag 2 mean target accuracies for each social and non-social affective distractor category (negative, neutral, positive). All bivariate correlation analyses were performed with these difference scores.

Contrary to the hypothesis, trait anxiety was only associated with lower target accuracy following neutral non-social distracters, $r = -.29$, $p < .05$. Higher trait anxiety was inversely associated with lower difference scores for neutral non-social distractors (see Figure 4). We conducted a follow-up hierarchical multiple regression analysis to test whether trait anxiety was a significant predictor of slower temporal disengagement from neutral non-social images when controlling for state anxiety. In the hierarchical model, state anxiety, measured by STAI-S, was entered as first predictor, and trait anxiety, measured by STAI-T, was entered as second predictor. When controlling for state anxiety, trait anxiety no longer predicted disengagement from neutral non-social images (see Table 1).

There was a trend association between state anxiety and target accuracy following social distracters, $r = .23$, $p = .10$. State anxiety was associated with faster disengagement following positive social distractors, $r = .31$, $p < .05$, and a follow-up hierarchical multiple regression analysis was conducted to test whether state anxiety was a predictor of faster temporal disengagement from positive social images when controlling for trait anxiety. State anxiety did not predict disengagement from positive social images when controlling for trait anxiety (see Table 2).

Temporal Disengagement from Affect

To examine whether there were any significant differences among temporal disengagement from affective social and non-social images, we conducted a repeated measures ANOVA with lag (200 ms, 400 ms, 700 ms), affect (negative, neutral, positive), and social (social, non-social) as the within subject factors. Consistent with an overall attentional blink, there was main effect of Lag, F(2, 106) = 30.47, $p < .001$, $\eta p^2 = .37$, driven by lower accuracy at early lags. There was no main effect of Affect, F(2,106) = .05, $p = .95$, $\eta p^2 = .00$. There was a main effect of Social type; target accuracy was lower following social compared with non-social distractors, F(1, 53) = 31.06, $p < .001$, $\eta p^2 = .37$. The Lag by Affect interaction was significant, F(3.44, 182.35) = 3.18, $p < .05$, $\eta p^2 = .06$; accuracy was higher when a target followed a negative and neutral distractor by 400 ms (see Figure 5). The assumption of sphericity was violated in the Mauchly's test, $\chi^2(9) = 27.56$, $p = .001$, and a Huynh-Feldt correction was used. The Affect by Social interaction was not significant, F(2, 106) = .94, $p = .40$, $\eta p^2 = .02$. However, the Lag by Social interaction was significant, F(1.788, 94.757) = 3.69, $p < .05$, $\eta p^2 = .07$; target accuracy was lower following social distractors compared to non-social distractors, and this pattern was consistent across lags. The assumption of sphericity was violated in the Mauchly's test, $\chi^2(2) = 3.51$, $p = .013$, and a Huynh-Feldt correction was used.

To examine whether trait anxiety had any effect on temporal disengagement from affective social and non-social images, we conducted a repeated measures ANOVA with lag (200 ms, 400 ms, 700 ms), affect (negative, neutral, positive), and social (social, non-social) as the within subject factors and trait anxiety as a covariate. When controlling for trait anxiety, there was still a main effect of Lag, F(2,104) = 4.17, $p < .05$, $\eta p^2 = .10$ and Social type, F(1,52)= 4.86, $p < .05$, $\eta p^2 = .10$. However, the Lag by Affect interaction was no longer significant, F(3.45, 179.22) = 1.33, $p = .26$, $\eta p^2 = .03$ (see Figure 6). The assumption of sphericity was violated Mauchly's test, $\chi^2(9) = 30.65$, $p = .001$, and a Huynh-Feldt correction was used. The Lag by Social interaction was no longer significant, F(1.808, 94.006) = .21, $p = .79$, $\eta p^2 = .00$. The Lag by Trait Anxiety interaction was not significant F(2, 104) = .32, $p = .73$, $\eta p^2 = .01$, as well as the Affect by Trait Anxiety interaction, F(2, 104) = .40, $p = .68$, $\eta p^2 = .01$. Additionally, the Social by Trait Anxiety interaction was not significant, F(1,52) = .42, p = .52, ηp^2 = .01.

To examine whether state anxiety had any effect on temporal disengagement from affective social and non-social images, we conducted a repeated measures ANOVA with lag (200 ms, 400 ms, 700 ms), affect (negative, neutral, positive), and social (social, non-social) as the within subject factors and state anxiety as a covariate. State anxiety did not have effect on temporal disengagement from affective social and non-social images. There was no main effect of Lag, F(2,116) = .13, p = .88, ηp^2 = .00. There was no main effect of Affect, F(2,116) = 2.72, p = .07, ηp^2 = .05 or Social type, F(1,58) = .260, p = .61, ηp^2 = .00. There were no significant interactions.

Discussion

Contrary to our hypothesis, trait anxiety was only associated with delayed disengagement from neutral non-social information. This finding was inconsistent with previous literature demonstrating slowed disengagement from negative affective scenes (e.g., Most et al., 2005), and delayed spatial disengagement from negative and neutral faces (e.g., Mogg, 2008). However, differential attention to and disengagement from social and non-social scenes, rather than facial expressions, has not been thoroughly explored. The level of social context might differential influence what is perceived as threatening in trait anxiety.

Higher trait anxious people might display increased difficulty disengaging from neutral non-social information, because they perceive neutral information as potentially threatening and ambiguous in the absence of social cues. Higher anxious individuals might overtly scan the environment for potential threat, which supports the notion of vigilance and faster allocation of attention to affectively threatening information, and trait anxiety has been associated with faster orienting to affective information (e.g., Calvo & Avero, 2005). Regardless of the initial spatial shift of attention, information that is perceived as threatening can still continue to be processed even if the information is no longer present. Thus, the lack of social cues might make it more difficult to identify potential threat, and influence the temporal delay in processing neutral non-social scenes despite its irrelevance to the task.

However, trait anxiety did not predict temporal disengagement from affective information above and beyond state anxiety. A person's current state anxiety might account for the effect of trait anxiety on temporal disengagement. Given that trait anxiety is characterized by the predisposition to experience state anxiety, it is important to parse out any effect trait anxiety has on attention, from a person's current state anxiety. The predisposition to experience trait anxiety is indicative of how likely a person will respond anxiously to a potential threatening situation, and thus how attention might differ.

Consistent with an attentional blink, people were slower to disengage from affective information at earlier lags. Support for attentional blink phenomenon in normative visual processing is robust. Previous studies have used dual-target RSVP paradigms to examine the underlying mechanisms of delayed temporal disengagement (e.g., Raymond et al., 1992; MacLean & Arnell, 2012). The identification of a first stimulus impairs the identification of a second stimulus when it follows the first within a specific timeframe (e.g., Raymond et al., 1992), however, the detection of an affective distractor can also induce impaired identification of a subsequent stimulus (e.g., Most et al., 2005). Our behavioral results illustrate a trajectory similar to the canonical attentional blink curve while using a single-target paradigm. The detection of the affective image was enough to induce slowed disengagement, and this was a function of the valence and social context of the distractor.

The behavioral results demonstrated a significant lag by affect interaction as indexed by faster disengagement from negative and neutral distractors compared to positive distractors at lag 4. When trait anxiety was entered as a covariate this interaction was no longer significant, as the speed of disengagement from positive distractors slightly increased, and therefore, decreasing the difference between affect factors. One interpretation of these results is that people in general process negative and neutral information more efficiently, and this pattern was still consistent in trait anxiety. This might suggest delayed disengagement from negative and neutral information previously observed in previous studies, might be a function of spatial shifts that occur later in attentional processing. We did not examine facilitation of affective information by measuring detection of affective distractors (i.e., T1) in trait anxiety. Investigating facilitated detection of affective distractors could have provided support for vigilance-avoidance of threat in trait anxiety, which proposes highly anxious people attend to information perceived as threatening quickly and subsequently avoid that information as it evokes anxiety.

State anxiety was associated with faster disengagement from positive social images. Similarly, faster spatial disengagement from positive facial expressions has been associated with social anxiety (e.g., Chen et al., 2012). According to AB theoretical frameworks (e.g., Chun & Potter, 1995; Olivers & Meeter, 2008), when stimuli are presented in rapid succession, information is processed early for semantic and conceptual representation, and the more salient the stimulus the less likely it will be masked by preceding and subsequent stimuli (Olivers & Meeter, 2008). Some studies on rapid scene perception suggest that people can extract the conceptual gist of a scene (i.e., “black dog in a park”) as quickly as 100 ms (e.g., Fei-Fei et al., 2007). This could potentially explain the behavioral results observed in this study. People with higher state anxiety might disengage from positive social information faster because of more obvious non-threatening conceptual features (i.e., open-mouth smiling face). However, when controlling for trait anxiety, state anxiety no longer predicated an effect on temporal disengagement. Regardless, these behavioral results could still be related to the small effect trait anxiety had on disengagement from positive distractors. Anxiety in general might be associated with more efficient processing of affective information as means of evaluating potential threat.

Social and non-social context differentially influences how people temporally disengage from affective information. In general, people were slower to disengage from social compared to non-social scenes. People preferentially attend to social information especially faces and eyes (e.g., Kret et al., 2013; Birmingham, Bischof, & Kingstone, 2008), as social cues offer pertinent informtation on how to respond in social interactions. When viewing a complex scene with a person present, people disproportionately attended to the person compared to other objects and background information in the scene (e.g., Fletcher-Watson et al., 2008). Taken together with previous research on the association between trait anxiety and delayed spatial disengagement from negative and neutral faces (e.g., Mogg et al., 2008; Georgious et al., 2005), we anticipated slower temporal disengagement from social affective information.

Additionally, only the valence and social context was taken into consideration when selecting images as affective distractors. Even though the stimulus set did incorporate images of different arousal, future research should control for arousal as an attribute. Future studies should continue to explore the effect of anxiety on the attention to and disengagement from affective scenes in order to distinguish the influence affect (i.e., valence and arousal) has on the maladaptive allocation of attention.

There might be few reasons why our results did not support our hypothesis. Previous studies on attention and anxiety focus on face processing versus complex scenes, and attention to social information might operate differently in scene perception. Additionally, we examined rapid temporal detection of affective scenes (i.e., 100 ms), and previous studies have focused on the maladaptive spatial allocation. Thus, difficulty disengaging from affective information in trait anxiety might be specific to spatial shifts of attention. Future studies should continue to examine maladaptive disengagement from complex scenes versus images of individual objects or faces. Scene images provide naturalistic snapshots of real-world scenarios, and could offer a more cohesive understanding of how a person with higher anxiety might operate in the world.

A limitation of this study was that we presented targets at only three separate lags after the affective distractors, with two lags most likely to fall within the AB and one lag likely to fall outside the typical AB. Future studies using RSVP to examine temporal allocation of attention should incorporate additional lags to further elucidate the effect trait or state anxiety might have on disengagement, as well as the duration of the AB. In the present study, the observed power and effect sizes were low, which could be due to the sampling size. Moreover, given that this was a non-clinical sampling population, there was a lack of variance in anxiety, perceived stress and depressed mood scores, as expected. Most participants fell within the normative range for trait, as well as state anxiety. A larger sampling population with greater individual variability could potentially elucidate the role trait or state anxiety has on maladaptive visual processing.

References

Arend, I., & Botella, J. (2002). Emotional stimuli reduce the attentional blink in sub-clinical anxious subjects. *Psicothema*, *14*(2), 209-214. Retrieved from http://unioviedo.net

Arnell, K. M., Killman, K. V., & Fijavz, D. (2007). Blinded by emotion: target misses follow attention capture by arousing distractors in RSVP. *Emotion*, *7*(3), 465. doi:10.1037/1528-3542.7.3.465

Beck, A.T., Steer, R.A., & Brown, G.K. (1996). *Manual for the Beck Depression Inventory–II.* San Antonio, TX: Psychological Corporation.

Bergdahl, J., & Bergdahl, M. (2002). Perceived stress in adults: prevalence and association of depression, anxiety and medication in a Swedish population. *Stress and Health*, *18*(5), 235-241. doi:10.1002/smi.946

Berggren, N., & Derakshan, N. (in press). Attentional control deficits in trait anxiety: Why you see them and why you don't. *Biological Psychology, 92(3), 440-446.* doi:10.1016/j.biopsycho.2012.03.007

Birmingham, E., Bischof, W. F., & Kingstone, A. (2008). Gaze selection in complex social scenes. *Visual Cognition*, *16*(2-3), 341-355. doi:10.1080/13506280701434532

Broadbent, D. E., & Broadbent, M. H. (1987). From detection to identification: Response to multiple targets in rapid serial visual presentation. *Perception & psychophysics*, *42*(2), 105-113. doi:10.3758/BF03210498

Calvo, M. G., & Avero, P. (2005). Time course of attentional bias to emotional scenes in anxiety: Gaze direction and duration. *Cognition & Emotion*, *19*(3), 433-451. doi:10.1080/02699930441000157

Chen, N. T., Clarke, P. J., MacLeod, C., & Guastella, A. J. (2012). Biased attentional processing of positive stimuli in social anxiety disorder: an eye movement study. *Cognitive behaviour therapy*, *41*(2), 96-107. doi:10.1080/16506073.2012.666562

Chun, M. M., & Potter, M. C. (1995). A two-stage model for multiple target detection in rapid serial visual presentation. *Journal of Experimental psychology: Human perception and performance*, *21*(1), 109. doi:10.1037/0096-1523.21.1.109

Chun, M. M., & Potter, M. C. (2001). The attentional blink and task switching within and across modalities. *The limits of attention: Temporal constraints in human information processing*, 20-35. doi:10.1093/acprof:oso/9780198505150.003.0002

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24,* 385-396.

Dennis, T. A., Chen, C. C., & McCandliss, B. D. (2008). Threat-related attentional biases: an analysis of three attention systems. *Depression and anxiety*, *25*(6), E1. doi: 10.1002/da.20308

Derakshan, N., Ansari, T. L., Hansard, M., Shoker, L., & Eysenck, M. W. (2009). Anxiety, inhibition, efficiency, and effectiveness: An investigation using the antisaccade task. *Experimental Psychology*, *56*(1), 48-55. doi:10.1027/1618-3169.56.1.48

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*, *111*(2), 225-236. doi:10.1037/0021-843X.111.2.225

Desimone, R., & Duncan, J. (1995). Neural mechanisms of selective visual attention. *Annual Review of Neuroscience, 18,* 193-222. doi: 10.1146/annurev.ne.18.030195.001205

Dux, P. E., & Marois, R. (2009). The attentional blink: A review of data and theory. *Attention,* *Perception, & Psychophysics*, *71*(8), 1683-1700. doi:10.3758/APP.71.8.1683

Ellenbogen, M. A., Schwartzman, A. E., Stewart, J., & Walker, C. D. (2002). Stress and selective attention: The interplay of mood, cortisol levels, and emotional information processing. *Psychophysiology*, *39*(6), 723-732. doi:10.1111/1469-8986.3960723

Eriksen, C.W., & Collins, J.F. (1969). Visual perception rate under two conditions of search. *Journal of Experimental Psychology*, *80*(3), 489-492. doi:10.1037/h0027428

Eriksen, C.W., & Spencer, T. (1969). Rate of information processing in visual perception: Some results and methodological considerations. *Journal of Experimental Psychology*, *79*(2), 1-16. doi:10.1037/h0026873

Endler, N. S., & Kocovski, N. L. (2001). State and trait anxiety revisited. *Journal of Anxiety Disorders*, *15*(3), 231-245. doi:10.1016/S0887-6185(01)00060-3

Eysenck, M. W., Mogg, K., May, J., Richards, A., & Mathews, A. (1991). Bias in interpretation of ambiguous sentences related to threat in anxiety. *Journal of abnormal psychology*, *100*(2), 144. doi:10.1037/0021-843X.100.2.144

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion*, *6*, 409-434. doi:10.1080/02699939208409696

Eysenck, M. W., Derakhshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*(2), 336-353. doi:10.1037/1528-3542.7.2.336

Georgiou, G., Bleakley, C., Hayward, J., Russo, R., Dutton, K., Eltiti, S., & Fox, E. (2005). Focusing on fear: Attentional disengagement from emotional faces. *Visual cognition*, *12*(1), 145-158. doi:10.1080/13506280444000076

Fei-Fei, L., Iyer, A., Koch, C., & Perona, P. (2007). What do we perceive in a glance of a real-world scene? *Journal of vision*, *7*(1), 10. doi:10.1167/7.1.10

Fletcher-Watson, S., Findlay, J. M., Leekam, S. R., & Benson, V. (2008). Rapid detection of person information in a naturalistic scene. *Perception*, *37*(4), 571-583. doi:10.1068/p5705

Henderson, J. M., & Hollingworth, A. (1999). High-level scene perception. *Annual review of psychology*, *50*(1), 243-271. doi:10.1146/annurev.psych.50.1.243

Horikawa, M., & Yagi, A. (2012). The relationships among trait anxiety, state anxiety and the goal performance of penalty shoot-out by university soccer players. *Plos ONE*, *7*(4), 1-5. doi:10.1371/journal.pone.0035727

Fox, E., Russo, R., & Georgiou, G. A. (2005). Anxiety modulates the degree of attentive resources required to process emotional faces. *Cognitive, Affective, & Behavioral Neuroscience*, *5*(4), 396-404. doi:10.3758/CABN.5.4.396

Jan, B., & Maud, B. (2002). Perceived stress in adults: prevalence and association of depression, anxiety and medication in a Swedish population. *Stress & Health: Journal of the International Society for the Investigation of Stress*, *18*(5), 235-241. doi:10.1002/smi.946

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of general psychiatry*, *62*(6), 593-602. doi:10.1001/archpsyc.62.6.593

Koster, E. H., Raedt, R. D., Verschuere, B., Tibboel, H., & De Jong, P. J. (2009). Negative information enhances the attentional blink in dysphoria. *Depression and Anxiety*, *26*(1), 16-22. doi:10.1002/da.20420

MacLeod, C., & Cohen, I. L. (1993). Anxiety and the interpretation of ambiguity: a text comprehension study. *Journal of Abnormal Psychology*, *102*(2), 238. doi:10.1037/0021-843X.102.2.238

MacLean, M. H., & Arnell, K. M. (2010). Personality predicts temporal attention costs in the attentional blink paradigm. *Psychonomic Bulletin & Review*, *17*(4), 556-562. doi:10.3758/PBR.17.4.556

MacLean, M. H., & Arnell, K. M. (2012). A conceptual and methodological framework for measuring and modulating the attentional blink. *Attention, Perception, & Psychophysics*, *74*(6), 1080-1097. doi:10.3758/s13414-012-0338-4

Martens, S., & Wyble, B. (2010). The attentional blink: Past, present, and future of a blind spot in perceptual awareness. *Neuroscience & Biobehavioral Reviews*, *34*(6), 947-957. doi:10.1016/j.neubiorev.2009.12.005

Mathews, A., Richards, A., & Eysenck, M. (1989). Interpretation of homophones related to threat in anxiety states. *Journal of abnormal psychology*, *98*(1), 31. doi:10.1037/0021-843X.98.1.31

Mathewson, K. J., Arnell, K. M., & Mansfield, C. A. (2008). Capturing and holding attention: The impact of emotional words in rapid serial visual presentation. *Memory & Cognition*, *36*(1), 182-200. doi: 10.3758/MC.36.1.182

Mogg, K., Garner, M., & Bradley, B. P. (2007). Anxiety and orienting of gaze to angry and fearful faces. *Biological psychology*, *76*(3), 163-169. doi:10.1016/j.biopsycho.2007.07.005

Mogg, K., Holmes, A., Garner, M., & Bradley, B. P. (2008). Effects of threat cues on attentional shifting, disengagement and response slowing in anxious individuals. *Behaviour research* *and therapy, 46*(5), 656-667. doi:10.1016/j.brat.2008.02.011

Moriya, J., & Tanno, Y. (2011). Processing of task-irrelevant natural scenes in social anxiety. *Acta Psychologica, 138*(1), 162-170. doi:10.1016/j.actpsy.2011.05.019

Most, S. B., Chun, M. M., Widders, D. M., & Zald, D. H. (2005). Attentional rubbernecking: Cognitive control and personality in emotion-induced blindness. *Psychonomic Bulletin & Review*, *12*(4), 654-661. doi:10.3758/BF03196754

Oehlberg, K. A., Revelle, W., & Mineka, S. (2012). Time-course of attention to negative stimuli: Negative affectivity, anxiety, or dysphoria?. *Emotion*, *12*(5), 943-959.

Olatunji, B., Ciesielski, B., Armstrong, T., Zhao, M., & Zald, D. (2011). Making something out of nothing: neutral content modulates attention in generalized anxiety disorder. *Depression and Anxiety*, *28*(5), 427-434. doi:10.1002/da.20806 doi:10.1037/a0027227

Oliva, A., & Schyns, P. G. (1997). Coarse blobs or fine edges? Evidence that information diagnosticity changes the perception of complex visual stimuli. *Cognitive psychology*, *34*, 72-107. Retrieved from http://cogprints.org

Oliva, A. (2005). Gist of the scene. *Neurobiology of attention*, *696*(64), 251-258. Retrieved from http://cvcl.mit.edu

Olivers, C. N., & Meeter, M. (2008). A boost and bounce theory of temporal attention. *Psychological review*, *115*(4), 836. doi:10.1037/a0013395

Olivers, C. L. (2007). The time course of attention: It is better than we thought. *Current Directions in Psychological Science, 16*(1), 11-15. doi:10.1111/j.1467-8721.2007.00466.x

Raymond, J. E., Shapiro, K. L., & Arnell, K. M. (1992). Temporary suppression of visual processing in an RSVP task: An attentional blink? *Journal of Experimental Psychology: Human Perception and Performance*, *18*(3), 849. doi:10.1037/0096-1523.18.3.849

Sadeh, N., & Bredemeier, K. (2011) Individual differences at high perceptual load: The relation between trait anxiety and selective attention. *Cognition & Emotion 25*(4), 747-755. doi:10.1080/02699931.2010.500566

Shapiro, K. L., Raymond, J. E., & Arnell, K. M. (1994). Attention to visual pattern information produces the attentional blink in rapid serial visual presentation. *Journal of Experimental Psychology: Human perception and performance*, *20*(2), 357. doi:1037/0096-1523.20.2.357

Shapiro, K. L., Raymond, J. E., & Arnell, K. M. (1997). The attentional blink. *Trends in Cognitive Sciences*, *1*(8), 291-296. doi:10.1016/S1364-6613(97)01094-2

Spielberger, C.D., Gorsuch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). *Manual for the State-Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

Van Dam, N. T., Earleywine, M., & Altarriba, J. (2012). Anxiety attenuates awareness of emotional faces during rapid serial visual presentation. *Emotion*, *12*(4), 796-806. doi:10.1037/a0024648oe

Visser, T. A., Bischof, W. F., & Di Lollo, V. (2004). Rapid serial visual distraction: Task-irrelevant items can produce an attentional blink. *Perception & Psychophysics, 66*(8), 1418-1432. doi:10.3758/BF03195008

Weierich, M. R., Treat, T. A., & Hollingworth, A. (2008). Theories and measurement of visual attentional processing in anxiety. *Cognition and Emotion*, *22*(6), 985-1018. doi: 10.1080/02699930701597601

Yantis, S., & Jonides, J. (1984). Abrupt visual onsets and selective attention: Evidence from visual search. *Journal of Experimental Psychology: Human Perception and Performance, 10,* 601-621. doi:10.1037/0096-1523.16.1.121

Yiend, J., & Mathews, A. (2001). Anxiety and attention to threatening pictures. *Quarterly Journal of Experimental Psychology*, *54*(3), 665-681. doi:10.1080/713755991

Table 1.

Hierarchical Regression Analyses Predicting Temporal Disengagement from Negative Non-social Images in State Anxiety and Trait Anxiety

Disengagement from Negative Non-social Images			
Predictor	R^2	β	p
Step 1			
STAI- S	.05	-.10	.68
Step 2			
STAI-T	.09	-.25	.14

Table 2.

Hierarchical Regression Analyses Predicting Temporal Disengagement from Positive Social Images in Trait Anxiety and State Anxiety

Disengagement from Negative Non-social Images			
Predictor	R^2	β	p
Step 1			
STAI- T	.02	-.03	.84
Step 2			
STAI-S	.07	.28	.07

Figure 1. Examples of stimuli used in the RSVP task; from left to right, scenes shown are landscape, negative social, negative non-social, neutral social, neutral non-social, positive social, positive non-social, left rotated target, and right rotated target.

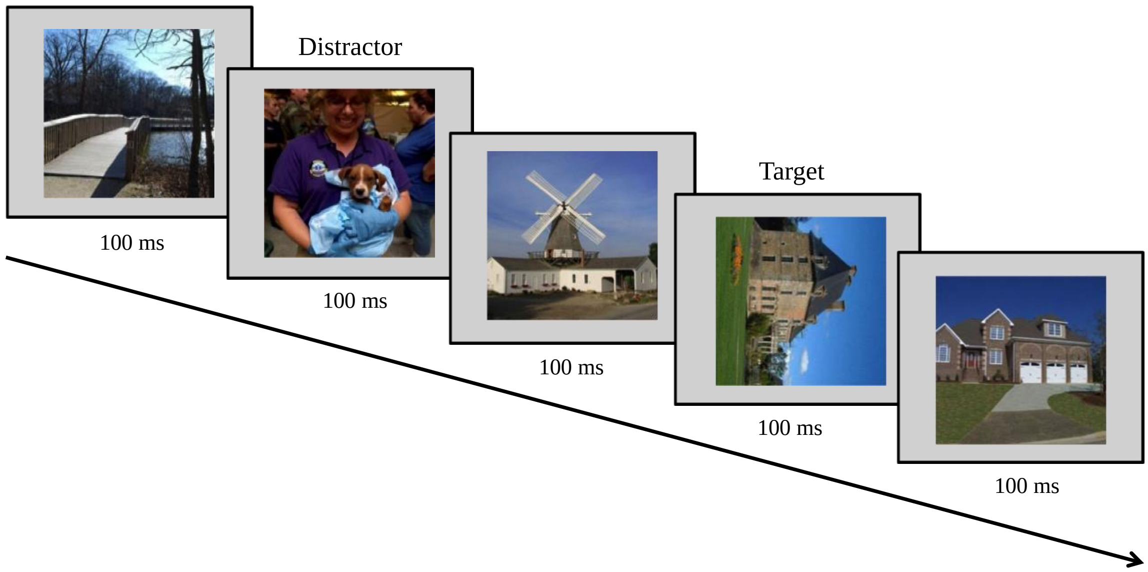

Figure 2. Single trial of RSVP stream, with the target at Lag 2

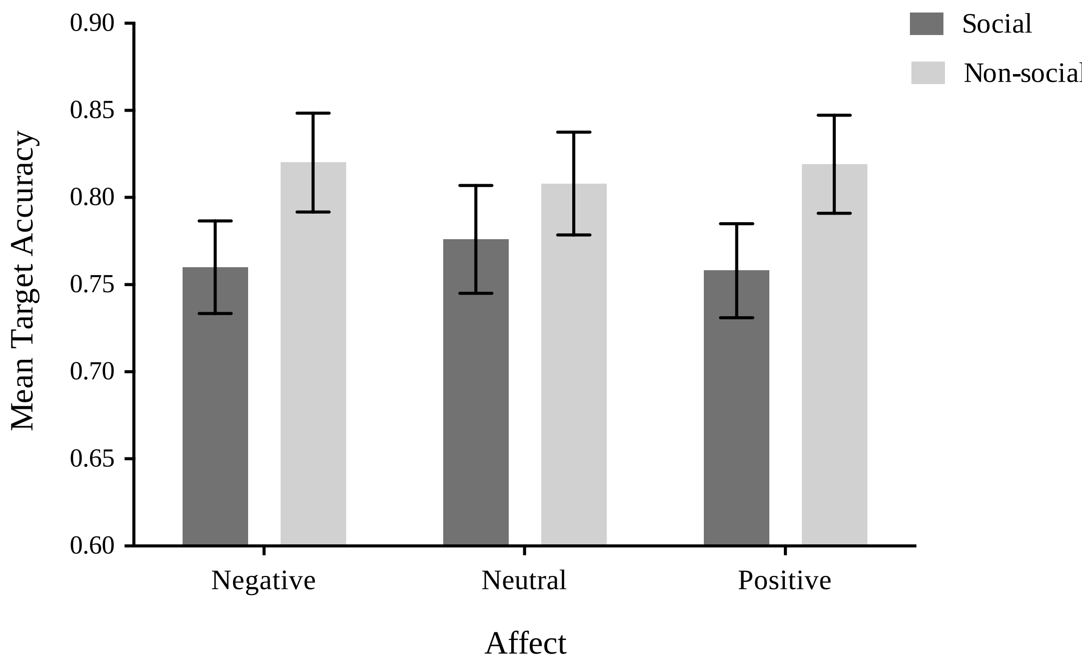

Figure 3. Mean target accuracy for social by affect categories. Accuracy was lower following social distractors for each affective category. Error bars represent standard errors.

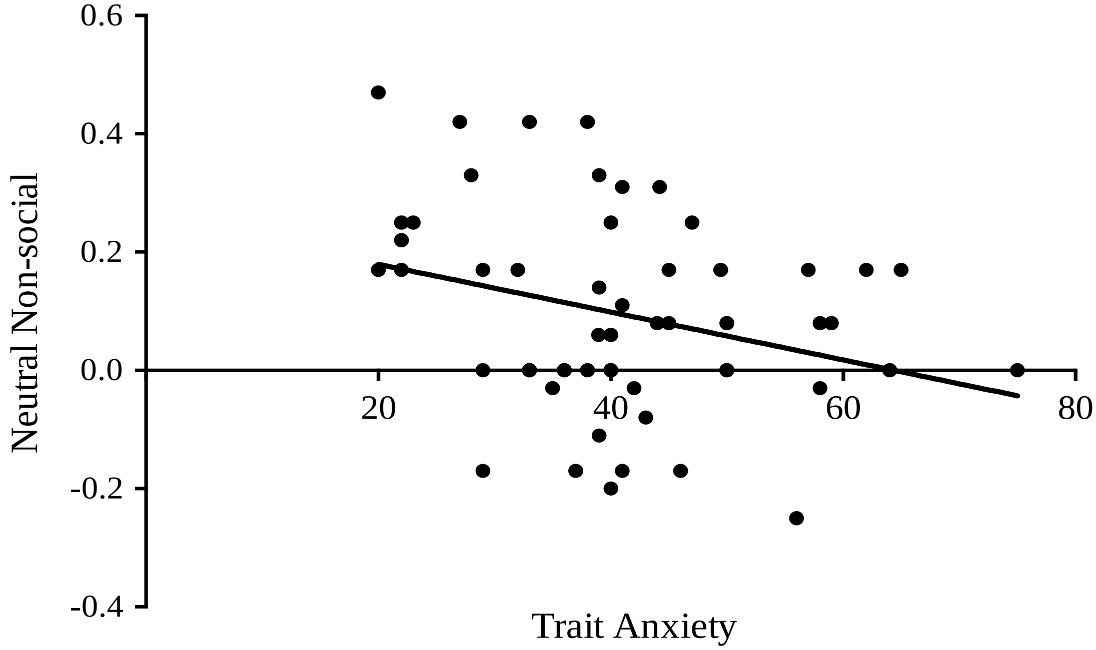

Figure 4. Trait anxiety was only associated with slower disengagement from neutral non-social distractors.

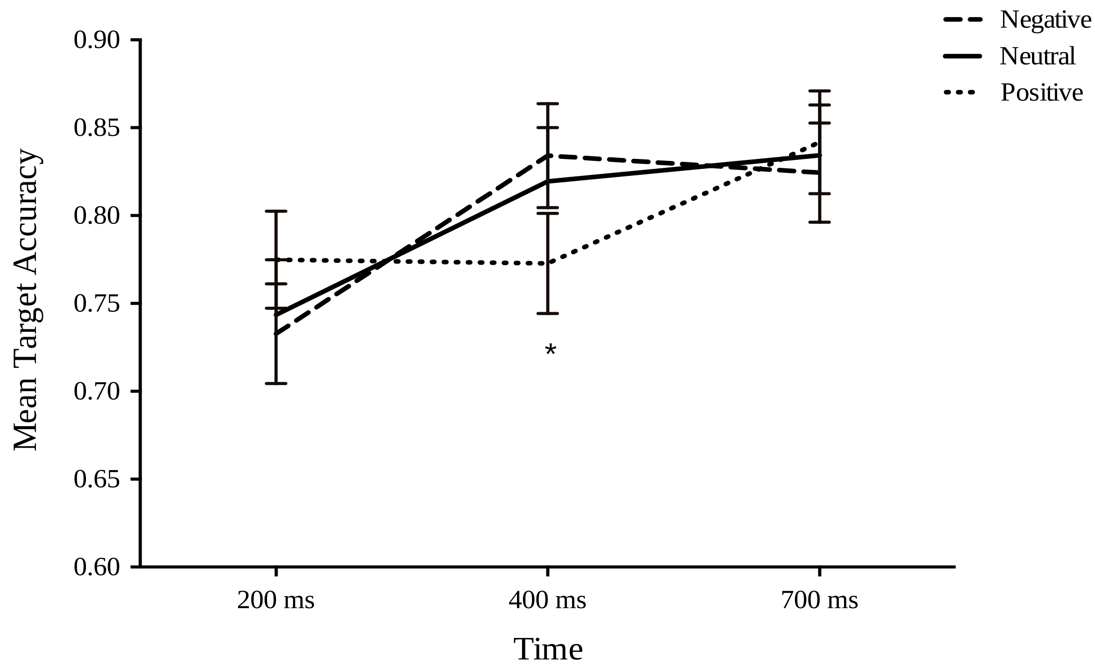

Figure 5. Mean target accuracy for affect categories by lag time in milliseconds. Accuracy was lower following positive compared to negative and neutral distractors at 400 ms. Error bars represent standard errors.

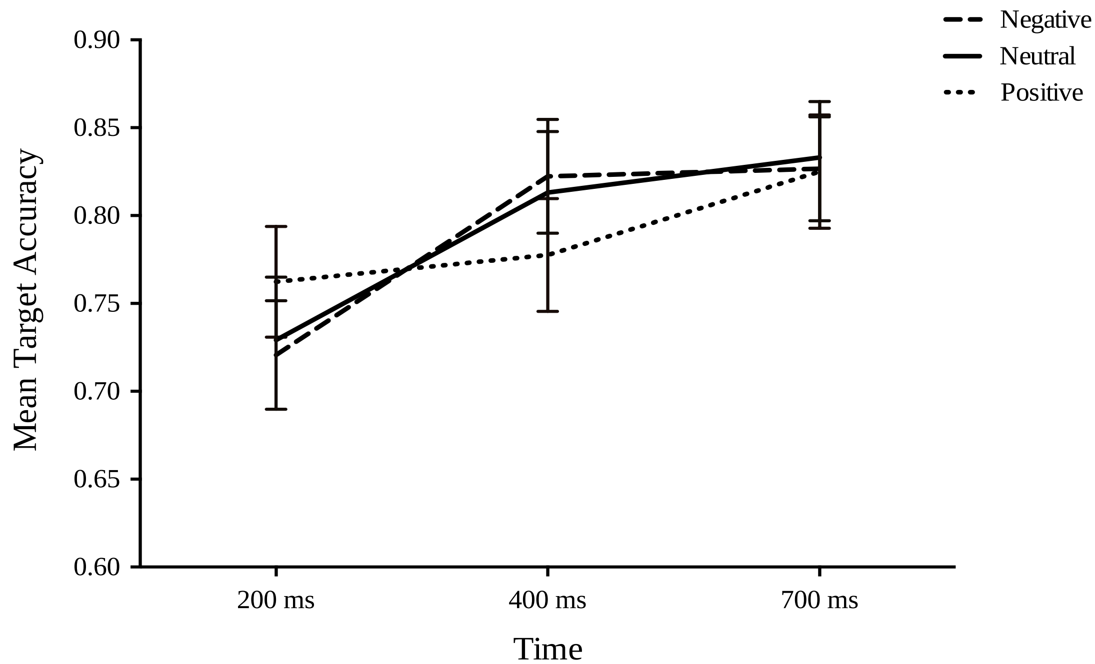

Figure 6. Mean target accuracy for affect categories by lag time in milliseconds when trait anxiety was entered as a covariate; covariate appearing in the model evaluated at, STAI-T *M* = 40.94. Error bars represent standard errors.