**Social Threat Induced Anticipatory Processing in Social Anxiety: Investigation Using
Attentional Control Theory**

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Abstract

Background and Objectives: Cognitive models of social anxiety disorder (SAD) emphasize anticipatory processing as a prominent maintaining factor occurring before social-evaluative events. While anticipatory processing is a maladaptive process, the cognitive mechanisms that underlie ineffective control of attention are still unclear. The present study tested predictions derived from attentional control theory in a sample of undergraduate students high and low on social anxiety symptoms.

Methods: Participants were randomly assigned to either engage in anticipatory processing prior to a threat of a speech task or a control condition with no social evaluative threat. After completing a series of questionnaires, participants performed pro-saccades and antisaccades in response to peripherally presented facial expressions presented in either single-task or mixed-task blocks. **Results:** Correct antisaccade latencies were longer than correct pro-saccade latencies in-line with attentional control theory. High socially anxious individuals who anticipated did not exhibit impairment on the inhibition and shifting functions compared to high socially anxious individuals who did not anticipate or low socially anxious individuals in either the anticipatory or control condition. Low socially anxious individuals who anticipated exhibited shorter antisaccade latencies and a *switch benefit* compared to low socially anxious individuals in the control condition.

Limitations: The study used an analogue sample; however findings from analogue samples are generally consistent with clinical samples.

Conclusions: The findings suggest that social threat induced anticipatory processing facilitates executive functioning for low socially anxious individuals when anticipating a social-evaluative situation.

Keywords: Social Anxiety Disorder, Social Phobia, Anticipatory Processing, Inhibition, Shifting, Attentional Control Theory, Antisaccade.

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1. Introduction

Anticipatory processing occurs when a socially anxious individual anticipates a social/performance event and engages in repetitive negative thinking that is dominated by past failures, negative images of oneself, predictions of poor performance, and rejection (Clark & Wells, 1995; Rapee & Heimberg, 1997). Several studies have demonstrated an association between self-reported engagement in anticipatory processing and social anxiety. For example, Vassilopoulos (2004) found that high socially anxious (HSA) individuals reported anticipatory thoughts prior to a social-evaluative event to be intrusive, persistent, and interfering. Research has shown that compared to low socially anxious (LSA) people, HSA individuals recall more past perceived failures and fewer past positive events, have more catastrophic thoughts and thoughts about escape or avoidance of the stressful situation, experience more negative bodily sensations, and have fewer thoughts concerning improvement of in-situation performance behaviours (Hinrichsen & Clark, 2003; Vassilopoulos, 2008).

Experimental studies investigating anticipatory processing in social anxiety have highlighted the maladaptive consequences of this mode of self-focused thinking (for a review see Sluis, Boschen, Neumann, & Murphy, in press). Typically, experimental studies induce HSA and LSA individuals to engage in either anticipatory processing or distraction prior to social-evaluative threat (e.g., threat of a speech task or social interaction; Hinrichsen & Clark, 2003; Vassilopoulos, 2005; Wong & Moulds, 2011). Research shows that HSA individuals who engage in anticipatory processing versus distraction, prior to the threat of a speech task, report stronger feelings of anxiety (Hinrichsen & Clark, 2003; Vassilopoulos, 2005; Wong & Moulds, 2011), a more negative overall appearance of themselves in the upcoming speech

(Vassilopoulos, 2005), and show increased relative skin conductance (Wong & Moulds, 2011). In contrast, distraction tends to significantly decrease self-reported anxiety prior to the threat of a speech task (Hinrichsen & Clark, 2003; Vassilopoulos, 2005). Attentional control theory offers a potential explanation for these dysfunctional outcomes which proposes that performance on cognitive tasks, especially those with a high cognitive load, are adversely affected by high levels of anxiety due to poor top down attentional control (see Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck, Derakshan, Santos, & Calvo, 2007 for a review). As such, enhanced ability to inhibit a prepotent response or shift attention may benefit socially anxious individuals by allowing them to reduce their engagement in dysfunctional modes of thought, such as anticipatory processing, which subsequently increases their anxiety and maintains maladaptive cognitive processes.

1.1 Anxiety and the Inhibition Function

To assess individual differences in attentional control, the antisaccade paradigm may be used (Ainsworth & Garner, 2013). The antisaccade task requires participants to make an eye movement to the opposite side of the screen after being presented with a visual cue appearing to the left or right of fixation. As this requires participants to inhibit an automatic eye-movement to the target location, the antisaccade task utilises top-down attentional control (inhibition). The pro-saccade task, which involves fixating on the cue location, is typically used as a control measure in this paradigm. Two performance measures of the antisaccade task are processing efficiency (i.e., latency to make a correct saccade) and performance effectiveness (i.e., errors). According to attentional control theory, adverse effects of anxiety pose greater impairment on processing efficiency than on performance effectiveness (Eysenck & Derakshan, 2011). Thus, anxiety should affect the antisaccade task, but not the pro-saccade task.

Individuals with high levels of trait anxiety display slower antisaccades than low anxious controls (Ansari & Derakshan, 2010; Ansari & Derakshan, 2011; Ansari, Derakshan, & Richards, 2008; Derakshan, Ansari, Hansard, Shoker, & Eysenck, 2009). Furthermore, trait anxious individuals find it difficult to efficiently inhibit responses on the antisaccade task when using facial expressions as emotional cues (Derakshan et al., 2009; Garner, Ainsworth, Gould, Gardner, & Baldwin, 2009; Reinholdt-Dunne et al., 2012; Wieser, Pauli, & Mühlberger, 2009). Wieser et al. (2009) used happy, angry, fearful, sad, and neutral facial expressions as emotional cues with HSA and LSA individuals to examine the predictions of attentional control theory with socially anxious individuals. Although socially anxious individuals displayed diminished effectiveness (more errors), there were no differences between HSA and LSA individuals in pro-saccade and antisaccade latencies (processing efficiency). The authors suggest this finding may be due to the salience of human faces attracting attention for socially anxious individuals and thereby reducing their latencies but increasing errors. This finding is surprising given that attentional control theory assumes that anxiety impairs processing efficiency more than performance effectiveness. However, Wieser et al. (2009) employed this paradigm with socially anxious individuals in the absence of any social-evaluative threat. Given that socially anxious individuals often only experience anxiety when faced with social-evaluative threat (e.g., speech task, social interaction), attentional control deficits may be more readily observed in the context of their feared stimulus (Mills, Grant, Judah, & White, 2014).

1.2 Anxiety and the Shifting Function

The task-switching paradigm is commonly used to assess the executive function of switching (Diamond, 2013; Miyake et al. 2000; Rogers & Monsell, 1995; Monsell, 2003). A typical task-switching paradigm involves two tasks or decisions (A and B). In the no-switch task participants only perform one task within a block of trials. In the switch trials a mixture

of task A and B trials are completed within a single block. Typically performance is slower or less accurate for the mixed than single task blocks of trials, thus demonstrating a switch-cost (Rogers & Monsell, 1995; Monsell, 2003). However, a protocol that mixed antisaccade and pro-saccade trials showed an improvement in antisaccade performance relative to the single task block of trials (Ansari, Derakshan, & Richards, 2008).

Ansari et al. (2008) compared the performance of high and low trait anxious individuals for the single-task block and the mixed-task block of antisaccade and pro-saccade tasks using emotionally neutral cues. They found a reduced switch-cost for correct antisaccade latencies for the low-anxious participants, but not for high-anxious participants and no group difference in switch-costs for the pro-saccade task. There were no group differences on saccade accuracy which supports the prediction that anxiety affects performance efficiency more than performance effectiveness. The authors interpreted these results as showing that high anxious individuals exhibit diminished “top-down” control of attention when shifting. The findings of Ansari et al. (2008) with neutral task cues are encouraging as the adverse effects of anxiety on task performance would be greater in the presence of threat-related material, an issue that was examined in the current study.

2. Aims, Overview and Hypotheses

The present study examined attentional control in high and low socially anxious individuals that engaged in anticipatory processing prior to the threat of a speech task or a control condition. An undergraduate sample of non-clinical participants was sampled on the basis that social anxiety is continuously distributed in the general population and results obtained with an analogue sample are largely similar to results found using a clinical sample (Stopa & Clark, 2001). The mixed saccade paradigm was employed as a valid and reliable measure of attentional control that is not reliant on manual reaction times (Ainsworth & Garner, 2013). Emotional faces (cues) were used for the stimuli as this is more meaningful

for socially anxious individuals and should significantly impact on saccadic responses. In order to assess attentional control during anticipatory processing; some participants were tested under conditions of social-evaluative threat (e.g., speech task). Finally, measures of depression, trait anxiety, and self-reported attentional control were taken in order to control for any potential confounding effects.

Based on attentional control theory and previous literature, the following hypotheses were examined. It was expected that correct antisaccade latencies would be longer than correct pro-saccade latencies, along with more errors in the antisaccade than in the pro-saccade task, regardless of group or condition. Additionally, it was predicted that HSA individuals would exhibit greater impairment on executive functioning than LSA individuals, regardless of condition, and that HSA individuals in the anticipate condition would exhibit more impairment on executive functioning than HSA individuals in the control condition, or LSA individuals in either condition. Furthermore, it was expected that these effects would be greater on performance efficiency (i.e., response latency) than performance effectiveness (i.e., response accuracy).

3. Method

3.1 Participants

A total of 326 undergraduate volunteers completed an online screening measure of the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) and one public speaking item from the Social Phobia Scale (SPS; Mattick & Clarke, 1998) in exchange for partial course credit. The SIAS has strong psychometric properties and good screening utility for both clinical and research purposes (Rodebaugh, Woods, Heimberg, Liebowitz, & Schneier, 2006). The anxiety groups were selected by choosing those who scored one standard deviation above the mean (HSA group) and less than the mean (LSA group) on the SIAS ($M = 19.5$, $SD = 10.9$; Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992; Judah, Grant,

Lechner, & Mills, 2013; Mills, Grant, Judah, & Lechner, 2013). Thus, participants were classified into the LSA group if they scored (≤ 19) on the SIAS and rated the public speaking item as 0 (*not at all*), 1 (*slightly*), or 2 (*moderately*). Participants who scored (≥ 30) on the SIAS and rated the public speaking item as 3 (*very*), or 4 (*extremely*) were classified into the HSA group (Cody & Teachman, 2011). The final sample consisted of 81 participants. The participants' ages ranged from 17 to 48 years ($M = 24.09$, $SD = 8.21$), and 56 (69.1%) of them were female. All participants indicated they had normal or corrected-to-normal vision. Participants did not differ on each measure as a function of condition ensuring the validity of random assignment (all $ps > .51$). However, as expected the high and low social anxiety groups differed on each questionnaire measure (see Table 1).

Table 1. Means and standard deviations for each measure for both high and low social anxiety groups

Variable	Low Social Anxiety		High Social Anxiety		$F(1,74)$	p
	M	SD	M	SD		
SIAS	9.15	5.13	48.03	11.04	426.73	<.001
SPS	9.51	8.47	38.03	14.17	119.48	<.001
BFNE	13.44	8.61	31.75	8.74	92.17	<.001
STAI-T	11.49	7.41	29.88	10.20	87.02	<.001
ACS	41.39	7.81	54.50	6.27	67.70	<.001
BDI	12.37	6.29	26.28	12.52	39.79	<.001

Note: SIAS, Social Interaction and Anxiety Scale; SPS, Social Phobia Scale; BFNE, Brief Fear of Negative Evaluation Scale; STAI-T, State-Trait Anxiety Inventory-Trait; ACS, Attentional Control Scale; BDI, Beck Depression Inventory.

3.2 Questionnaire Measures

All questionnaire measures use a Likert-type scale with participants asked to indicate the extent to which each statement is characteristic or true of them.

3.2.1 Brief Fear of Negative Evaluation Scale. (BFNE; Leary, 1983) is a 12-item measure assessing fear of negative evaluation from others. The BFNE has shown good four-

week test-retest reliability ($r = .75$; Leary, 1983), along with excellent internal consistency in the current study ($\alpha = .95$).

3.2.2 The Social Interaction Anxiety Scale and Social Phobia Scale. (SIAS; SPS; Mattick & Clarke, 1998) The SIAS and SPS are companion scales that measure fear of social interaction in dyads or groups, and the fear of being observed, respectively. Each questionnaire is a 20-item measure. Excellent internal consistency was shown for both the SIAS and SPS in the current study ($\alpha = .95$, $\alpha = .96$, respectively).

3.2.3 State-Trait Anxiety Inventory. (STAI; Spielberger, 1983) Comprising two 20-item measures of general anxiety, the STAI State assesses how participants currently feel, and the STAI Trait assesses how they generally feel. Internal consistency in the current study was excellent for both the STAI-S ($\alpha = .94$), and the STAI-T ($\alpha = .96$).

3.2.4 Attentional Control Scale. (ACS; Derryberry & Reed, 2002) is a 20-item measure of general capacity to control attention including an assessment of attention focusing, flexible control of thoughts, and breadth of attention. The ACS demonstrated good internal consistency in the current study ($\alpha = .88$).

3.2.5 Beck Depression Inventory II. (BDI II; Beck, Steer, & Brown, 1996) is a revised 21-item measure used to assess the severity of depression during the past two weeks. Excellent internal consistency was demonstrated in the current study ($\alpha = .93$).

3.3 Mixed emotional saccade task

A modified version of the mixed emotional saccade task (Ansari et al., 2008; Wieser et al., 2009) was used. Facial stimuli were taken from the NimStim Faces Set (Tottenham et al., 2009) and included male and female facial expressions of anger, fear, sadness, happiness, and neutral. Participants were required to perform antisaccade and pro-saccade tasks in response to the faces which were presented in two blocks: single task (i.e., participants completed trials of the same task consecutively in different blocks, either antisaccade or pro-

saccade) and mixed task (i.e., antisaccade and pro-saccade trials were presented randomly where participants were required to switch between tasks). The order of the trials and blocks was counterbalanced (see Wieser et al., 2009 for stimuli visual angle specifications).

The OpenSesame software package (Dalmaijer, Mathôt, & Van der Stigchel, 2013) was used to present the mixed emotional saccade task on a Tobii TX300 eye-tracker 23-in wide screen TFT monitor with a resolution of $1,920 \times 1,080$ pixels (see Figure 1). After 24 practice trials, the ten facial images were presented 16 times each on the right side and 16 times on the left of the screen, resulting in 320 experimental trials in total. Participants completed 4 blocks of 40 trials for the two single tasks (80 trials each) and 4 blocks of 40 trials for the mixed task.

Eye-movements were measured at a sampling rate of 300 Hz using the Tobii TX300 eye-tracker and Tobii studio software 3.2 (Tobii Technology AB, 2011). The eye-tracker was calibrated using nine fixation points equally spaced. Participants were seated with their eyes at a distance of 60 cm from the centre of the screen.

Figure 1. Antisaccade and pro-saccade experimental tasks (mixed task block requires randomly switching between tasks). Inter-trial interval varied randomly between 750-1250 ms.

3.4 Procedure

HSA and LSA participants were pseudo-randomly assigned to either an anticipatory processing condition or a control condition and tested individually (20 HSA anticipate condition, 20 HSA control condition, 20 LSA anticipate condition, and 21 LSA control condition).

After obtaining written consent, demographics and baseline levels of state anxiety were measured using the STAI-S, along with measures of social anxiety (SPS, BFNE), depression (BDI II), trait anxiety (STAI-T), and attentional control (ACS). Those in the anticipatory processing conditions were informed that they would be required to deliver an impromptu three-minute speech about one of two designated topics that would be video recorded and rated for its quality. To induce anticipatory anxiety, these participants were given a social threat induction as adapted from Vassilopoulos (2005). Participants in the anticipatory processing conditions were then shown a short video of another student giving a speech in order to ensure further anticipatory anxiety. Following the video, participants were instructed to sit for five minutes and think about the speech task they were about to make. Anxiety levels were re-assessed following five-minutes of anticipatory processing using the STAI-S. Participants in the control condition were not given the social-evaluative threat induction and all participants were then instructed to complete the questionnaires and the mixed emotional saccade task, which took approximately 20 minutes. In order to ensure time equivalency for those in the control and AP conditions, those in the control condition were instructed to sit quietly once they had completed the questionnaire measures while the experimenter organised some papers and equipment for the next part of the experiment (Mansell & Clark, 1999).

After the mixed emotional saccade task, those in the anticipatory processing conditions were advised that they would not perform their impromptu speech and all

participants were debriefed about the purpose of the study. Participants were also advised to keep details of the study confidential to minimise diffusion effects.

3.5 Data Preparation and Preliminary Analyses

Data from the mixed emotional saccade task was prepared according to previous research (see Ansari et al., 2008). Given that the groups differed in their scores on depression, trait anxiety, and self-reported attentional control, ANCOVA analyses were conducted using these measures as covariates.

4. Results

To examine the effectiveness of the anxiety manipulation for those in the anticipate conditions, a 2×2 Group (HSA, LSA) $\times$ Time (Pre, Post) ANOVA was conducted on STAI-S scores. The ANOVA revealed a statistically significant group $\times$ time interaction [$F(1,37)=18.91, p=.001, n_p^2 = .34$]. There was a statistically significant increase in STAI-S baseline and STAI-S post induction scores for both high (Pre STAI-S, $M = 19.32, SD = 8.23$; Post STAI-S, $M = 41.42, SD = 7.18$) [$t(18) = -8.56, p < .001$] and low (Pre STAI-S, $M = 5.10, SD = 6.10$; Post STAI-S, $M = 13.65, SD = 9.48$) [$t(19) = -4.77, p < .001$] socially anxious participants in the anticipate conditions indicating that the social threat induction increased participant's state anxiety prior to performing the mixed emotional saccade task. As expected, this increase was greater for those in the HSA anticipate condition compared to those in the LSA anticipate condition (Pre STAI-S, $t(38) = 6.25, p < .001$; Post STAI-S, $t(37) = 10.28, p < .001$).

4.1 Analyses of the Inhibition Function

4.1.1 Correct response latencies of pro-saccades and antisaccades in the mixed-task block. Figure 2 shows the mean correct saccade latencies for each of the anti- and pro-saccade tasks according to group and condition. Analyses revealed a significant main effect of task [$F(1,66)=19.43, p < .001, n_p^2 = .23$] and a significant three-way interaction

[$F(1,66)=5.43, p=.02, n_p^2=.08$]. The main effect of task showed that correct latencies were significantly shorter for pro-saccade ($M = 180.63, SD = 16.03$) than for antisaccade ($M = 243.49, SD = 26.81$) trials, regardless of condition or group. The group $\times$ task and condition $\times$ task interactions were not significant. Furthermore, the main effects of group and condition were also non-significant ($F_s < 0.79, p_s > .37$).

Figure 2. Mean correct saccade latencies (with standard errors) of task by group in the anticipate and control conditions.

To follow up the significant three-way interaction simple effects analysis for each group and each condition were conducted. In the HSA group, the simple main effect of task [$F(1,33)=10.47, p < .01, n_p^2=.24$] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials, but this did not differ as a function of condition [task $\times$ condition interaction and main effect of condition were non-significant; $F(1,33)=1.50, p=.23, n_p^2=.04$; $F(1,33)=0.31, p=.58, n_p^2=.01$]. In the LSA group, the simple main effect of task [$F(1,30)=9.04, p < .01, n_p^2=.23$] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials, however the interaction between condition

$\times$ task was non-significant [$F(1,30)=2.16, p=.15, n_p^2 = .07$] as was the main effect of condition [$F(1,30)=0.15, p = .71, n_p^2 = .01$].

In the anticipate conditions, the simple main effect of task [$F(1,31)=7.82, p<.01, n_p^2 = .20$] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade trials. The group $\times$ task interaction [$F(1,31)=2.15, p=.15, n_p^2 = .07$] and main effect of group [$F(1,31)=0.22, p = .65, n_p^2 = .01$] were not significant. In the control condition, the simple main effect of task [$F(1,32)=11.53, p < .01, n_p^2 = .27$] revealed that correct latencies were significantly shorter for pro-saccade than for antisaccade latencies, but this did not differ as a function of group [task $\times$ group interaction and main effect of group were non-significant; $F(1,32)=0.002, p = .97, n_p^2 = .00$; $F(1,32)=0.87, p = .36, n_p^2 = .03$].

4.1.2 Errors for pro- and antisaccades in the mixed-task block. Figure 3 shows the mean percentage of saccade errors for each of the anti- and pro-saccade tasks according to group and condition. Analyses revealed a significant main effect of task [$F(1,66)=4.71, p = .03, n_p^2 = .07$] reflecting that errors were significantly higher for antisaccade ($M = 4.30, SD = 2.23$) than for pro-saccade ($M = .90, SD = .55$) trials. However, neither the two-way interaction of group $\times$ task, the two-way interaction of condition $\times$ task, nor the three-way interaction of group $\times$ condition $\times$ task were significant. Furthermore, the main effects of group and condition were also non-significant ($F_s < 1.24, p_s > .26$).

Figure 3. Mean percentage of errors (with standard errors) of task by group in the anticipate and control conditions.

4.2 Analyses of the Shifting Function

4.2.1 Correct anti- and pro-saccade latencies in the single-task versus mixed-task block (switch-costs effects). Analyses for the shifting function were conducted for the switch-costs data (difference in saccade mean latency between the single-task and mixed-task blocks). Analyses revealed a significant three-way interaction [$F(1,72)=3.83, p = .05, n_p^2 = .05$; see Figure 4]. The two-way interactions of group $\times$ task, and condition $\times$ task were non-significant, and the main effect of task was non-significant ($F_s < 1.84, p_s > .17$). The significant main effect of group [$F(1,72)=3.89, p = .05, n_p^2 = .05$], revealed that the HSA group had a switch benefit ($M = -4.22, SE = 2.17$) compared to the LSA group ($M = 2.97, SE = 2.13$) who demonstrated a switch-cost.

Figure 4. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition.

Follow-up analysis for the three-way interaction showed that for the LSA group, the main effect of task was not significant [$F(1,35)=0.50, p=.49, n_p^2 = .01$], although the interaction between condition $\times$ task was significant [$F(1,35)=4.50, p=.04, n_p^2 = .11$]. This significant interaction indicated a switch benefit in antisaccades for LSA individuals in the anticipate condition compared to the LSA control group who showed a switch-cost [$t(38) = 2.99, p = .006$], whereas the opposite effect was seen in switch-cost for the LSA group in pro-saccades with controls performing faster than those who anticipated, however this effect was non-significant [$t(38) = 1.62, p = .11$]. In the HSA group, the condition $\times$ task interaction was non-significant [$F(1,34)=0.20, p = .66, n_p^2 = .01$] as was the main effect of task [$F(1,34)=0.48, p = .49, n_p^2 = .01$].

In the control condition, neither the two-way interaction of group $\times$ task [$F(1,35)=0.35, p = .56, n_p^2 = .01$] nor the main effect of task [$F(1,35)=0.87, p = .36, n_p^2 = .02$] were significant, however the main effect of group was significant [$F(1,35)=3.82, p=.05, n_p^2 = .10$] indicating a switch benefit for HSA individuals ($M = -3.58, SE = 2.77$) compared to

LSA individuals who were slower ($M = 5.50$, $SE = 2.77$). In the anticipate condition, the group $\times$ task interaction was non-significant [$F(1,34)=2.68$, $p = .11$, $n_p^2 = .07$] as was the main effect of task [$F(1,34)=0.17$, $p = .68$, $n_p^2 = .01$].

4.2.2 Errors for the anti- and pro-saccades in the single-task block versus the mixed-task block (switch-cost). Analyses revealed a non-significant main effect of task. Furthermore, the two-way interaction of condition $\times$ task and the three-way interaction of group $\times$ condition $\times$ task were non-significant ($F_s < 0.81$, $p_s > .36$). However, the two-way interaction of group $\times$ task was significant [$F(1,70)=3.96$, $p = .05$, $n_p^2 = .05$] which indicated a switch benefit in pro-saccades for HSA ($M = -.33$, $SD = 1.31$) compared to LSA ($M = .28$, $SD = .69$) individuals [$t(75) = -2.55$, $p = .01$].

4.2.3 Switch-cost for correct anti and pro-saccade latencies of the switch versus repeat trials in the mixed-task block. Analyses revealed a non-significant main effect of task and neither the three-way interaction, the two-way interaction of group $\times$ task nor the two-way interaction of condition $\times$ task approached significance ($F_s < 1.64$, $p_s > .20$; see Figure 5). Furthermore, there were no significant effects of error rates for switch-cost for anti and pro-saccades of the switch versus repeat trials in the mixed-task block.

Figure 5. Mean switch-cost of correct anti and pro-saccade latencies (with standard errors) of group by condition for switch versus repeat trials in the mixed-task block.

5. Discussion

The aim of the current study was to examine the underlying mechanisms thought to be responsible for anticipatory processing in social anxiety using attentional control theory (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011; Eysenck et al., 2007). The current study also aimed to extend previous work in the area by manipulating anticipatory processing and employing the mixed emotional saccade paradigm in order to assess the main tenets of attentional control theory. Thus, it was expected that HSA individuals (compared to LSA individuals) who anticipated would exhibit deficits in two basic functions of the *central executive*, including the inhibition and shifting functions.

As predicted, findings showed that correct antisaccade latencies were longer than correct pro-saccade latencies, along with higher error rates, which is consistent with previous research (Ansari et al., 2008; Wieser et al., 2009). Furthermore, this effect was also greater for performance efficiency than for performance effectiveness as evidenced by the lack of anxiety-related effects on saccade accuracy. Conversely, the hypothesised effects of group or condition were not found as expected. More specifically, the HSA group who anticipated did not exhibit impairment on the inhibition and shifting functions compared to the HSA group who did not anticipate or the LSA groups in either condition. Interestingly however, the predominant findings were for the LSA group only. For example, LSA individuals who anticipated demonstrated a *switch benefit*, compared to LSA individuals in the control condition who exhibited a switch-cost. These findings suggest that anticipatory processing facilitates the ability to shift attention for LSA individuals when anticipating a social-evaluative situation. This was an unexpected finding that warrants further explanation. The improved *executive functions* performance observed by LSA individuals when anticipating may be a consequence of increased motivation to perform the speech task. For example, given that these individuals do not experience incapacitating levels of anxiety prior to a

social-evaluative event, their alertness and arousal to perform the task as a result of threat experienced may be increased which in turn may have benefited their performance and facilitated their attentional control abilities. Indeed, the effects of impaired performance for LSA individuals in the control condition are somewhat more unexpected. Thus, it appears that engaging in anticipatory processing prior to the threat of a speech task is beneficial and adaptive compared to not engaging in this thought process for LSA individuals.

The absence of an impairment in the HSA group was also surprising, along with the lack of impairment on attentional control for anticipatory processing. While it was expected that anticipatory processing would impair executive functioning for HSA individuals, these findings are generally consistent with that of Wieser et al. (2009). For example, Wieser and colleagues found that HSA individuals made more antisaccade errors in response to all facial expressions, but no group differences between HSA and LSA individuals were observed in terms of pro-saccade and antisaccade latencies. Wieser et al. (2009) concluded that this may be due to the salience of human facial stimuli which may attract attention for socially anxious individuals, thus reducing response times. A similar conclusion may apply to the current findings and suggest that multiple factors may contribute to the lack of anxiety induced effects observed, such as the role of motivation (Kouneiher, Charron, & Koechlin, 2009), or the cognitive load of task demands (Gazzaley, 2011), which may partially contribute to the underlying mechanisms responsible for anticipatory processing in social anxiety.

Motivation appears to play a vital role in socially anxious individual's ability to perform a difficult task effectively. For example, Kouneiher et al., (2009) showed that motivation can integrate with cognitive control, such that when HSA individuals are motivated, perhaps due to perceived negative evaluations associated with poor performance, compensatory strategies are more likely to be employed in order to maintain task performance with LSA individuals. This explanation also appears likely in describing the

current findings of the lack of impaired performance in HSA individuals which was analogous to that of LSA individuals. Thus it seems that the anxiety experienced by HSA individuals when anticipating a social-evaluative situation may have adaptive benefits in terms of their executive functioning, however this may only be true for HSA individuals with high levels of motivation. The role of motivation and how this interacts with anxiety on cognitive functioning is an important area worthy of future investigations.

Conversely, findings for the switching function from the current study are inconsistent with that of previous research. For example, Ansari and colleagues (2008) found an improvement in the mixed-task block for low-anxious participants, but not for high-anxious participants, whereas the current study failed to demonstrate this effect. Given that Ansari et al. (2008) used neutral stimuli, it was expected that the emotional cues in the present study would yield greater attentional control deficits due to their threat-relevance for HSA individuals. Nevertheless, as suggested by Wieser et al. (2009), the salience of human facial stimuli may have increased an attentional avoidance response for socially anxious individuals, thus reducing response times and improving their switching performance.

While the current findings show some support for the predictions of attentional control theory, there are several limitations to note. First, the data obtained in the current study was acquired from an undergraduate sample. Nonetheless, the final sample consisted of individuals categorised into high and low social anxiety groups and results obtained using an analogue sample are largely similar to results found using a clinical sample (Stopa & Clark, 2001). Second, given that the social threat induction was not delivered to those in the control condition followed by a distraction task (as opposed to facilitated anticipatory processing), caution should be ensured when interpreting the current findings. As such, it is difficult to determine whether the outcomes observed were due to the effects of the social threat induction, anticipatory processing, or indeed a combination of both. Nonetheless,

previous research within the field of anticipatory processing has demonstrated that participants given a social threat induction followed by a distraction task still engaged in anticipatory processing, despite engaging in a distractor task (Vassilopoulos, 2005). This finding by Vassilopoulos (2005) formed the basis for exclusion of the social threat induction followed by a distractor task to control participants in the current study. Third, while the cue offset and target onset duration of 500 ms used in the current study is the most commonly applied duration to detect attentional control deficits (Sluis & Boschen, 2014), manipulating different interval durations may yield diverse anxiety effects worthy of future investigation. For example, Ansari and Derakshan (2011) manipulated the interval between offset of instructional cue and onset of target (CTI) and found that high anxious individuals showed comparable saccade latencies to that of low anxious individuals when the CTI was medium (400 ms) compared to when it was short (0 ms; which resulted in poorer performance). Given that the current study used a CTI comparable to Ansari and Derakshan's medium interval duration, the improved performance observed by HSA individuals in the current study may be reflective of their findings suggesting that medium CTI's may result in greater investment of attentional resources in preparation for the task goal, thus improving their performance. Lastly, the current study neglected to assess for other potential contributing factors that underlie anticipatory processing including the role of motivation, or manipulating the cognitive load of the task.

If the aforementioned compensatory strategies relative to the role of motivation are indeed employed by HSA individuals when performing cognitive tasks, then compromising compensatory strategies by increasing cognitive load may reveal clearer attentional control deficits. For example, attentional control theory posits that under conditions of high task demands, such as attenuating cognitive resources between two tasks, HSA individuals may be more easily overloaded than LSA individuals which may in turn detract from their ability to

strengthen cognitive efficiency on the main task. The role of cognitive load has been investigated by previous researchers who have demonstrated that high anxious participants showed longer latencies compared to low anxious peers under conditions of 'high' cognitive load (Derakshan & Eysenck, 1998; Eysenck, Payne, & Derakshan, 2005; MacLeod & Donnellan, 1993). The current study neglected to manipulate cognitive load of the task, thus future research would benefit from replicating the present findings by investigating the role of cognitive load in order to elucidate whether this does indeed reveal clearer deficits in attentional control for anticipatory processing between HSA and LSA individuals. In terms of the current findings, it is possible that there may actually be a threshold point of cognitive load whereby anticipatory processing may facilitate performance and have an adaptive component for HSA individuals when the cognitive load is low to moderate, such as that in the current study. However, anticipatory processing may be maladaptive and impair executive functioning when the cognitive load is high (e.g. concurrently performing two tasks). Nevertheless, this is only conjecture and still needs to be tested empirically in future research.

The present findings have several implications for understanding the role of anticipatory processing in social anxiety and how this interacts with attentional control. Models of SAD highlight anticipatory processing as a feature of social anxiety that contributes to dysfunctional outcomes associated with this clinical condition. According to the current findings, there appear to be multiple underlying mechanisms associated with the maladaptive effects of anticipatory processing which are complex and interacting. Furthermore, some of the premises of attentional control theory were not supported by the current findings, which provide justification for the expansion of theoretical models of attentional control to gain a greater understanding of this construct in relation to SAD and indeed other anxiety disorders.

In conclusion, the current study adds to the growing literature on social anxiety and attentional control and provides insight into the complexities of the underlying mechanisms of anticipatory processing in social anxiety. It is evident that more research is needed to determine the exact mechanisms by which anticipatory processing is dysfunctional and beneficial for HSA individuals. Future research addressing the interacting effects of motivation and cognitive/emotional load with attentional control during anticipatory processing should provide greater understanding in this area. In turn, future studies will have the potential to inform the development of interventions for those with SAD.

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