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Inhibitory Control as a Moderator of Threat-related Interference Biases in Social Anxiety

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Abstract

Prior findings are mixed regarding the presence and direction of threat-related interference biases in social anxiety. The current study examined general inhibitory control (IC), measured by the classic color-word Stroop, as a moderator of the relationship between both threat interference biases (indexed by the emotional Stroop) and several social anxiety indicators. High socially anxious undergraduate students ($N=159$) completed the emotional and color-word Stroop tasks, followed by an anxiety-inducing speech task. Participants completed measures of trait social anxiety, state anxiety before and during the speech, negative task-interfering cognitions during the speech, and overall self-evaluation of speech performance. Speech duration was used to measure behavioral avoidance. In line with hypotheses, IC moderated the relationship between emotional Stroop bias and every anxiety indicator (with the exception of behavioral avoidance), such that *greater* social-threat interference was associated with higher anxiety among those with *weak* IC, whereas *lesser* social-threat interference was associated with higher anxiety among those with *strong* IC. Implications for the theory and treatment of threat interference biases in socially anxious individuals are discussed.

Keywords

social anxiety; inhibitory control; attentional bias

Numerous empirical studies have shown that social anxiety is characterized by threat-related processing biases (e.g., Bar-Haim et al., 2007; Hope, Rapee, Heimberg, & Dombeck, 1990), consistent with cognitive models of social anxiety (e.g., Clark & Wells, 1995). One of the most widely used measures of threat-related bias in socially anxious samples is the emotional Stroop (e-Stroop), a modified version of the classic color-word Stroop paradigm (Stroop, 1935), which assesses individuals' relative response latencies when naming the colors of words or pictures that have a threatening versus non-threatening meaning. A number of studies examining the e-Stroop have found that high socially anxious (versus non-anxious) individuals show slower color-naming latencies for socially threatening relative to non-threatening stimuli, referred to as a social-threat *interference* effect (see Bar-haim et al.). Moreover, several studies have shown significant reductions in social-threat interference following treatment for social anxiety, but only among treatment responders—

suggesting that these biases are malleable and may prove to be important targets for intervention.

A major challenge to understanding and applying this body of research clinically, however, is that findings are perplexingly mixed with respect to both the presence and direction of threat interference biases in social anxiety (see Steinman, Gorlin, & Teachman, in press), and the mechanism(s) underlying these biases remain controversial. Traditionally, social-threat interference has been interpreted to reflect a selective attentional bias toward social-threat cues (e.g., Hope et al., 1990), because attentional capture by the threat meaning is thought to interfere with the task of color-naming. However, this interpretation has come under serious criticism, with researchers noting that social-threat interference need not reflect early attentional capture by threat cues, *per se*; rather, it may be related to later, more strategic processing biases, such as difficulty disengaging from (Amir et al., 2003) or effortful avoidance of (Ruiter and Brosschot, 1994) threatening stimuli. Moreover, while a majority of studies have reported a social-threat interference effect in socially anxious samples, this finding is inconsistent (e.g., Putman et al., 2004), and is suppressed or even reversed under certain task conditions (e.g., elevated state anxiety; Amir et al., 1996). In light of these mixed findings, it is important to identify potential moderators that might help clarify when and how threat interference is expressed in social anxiety.

Inhibitory control as a potential moderator

In the current study, general inhibitory control (IC) is examined as a moderator of the relationship between e-Stroop interference and anxiety. IC, sometimes alternatively referred to as *executive attention* (e.g., Posner & Petersen, 1990), is typically conceptualized as one component of the broader construct of *attention control*, or the general ability to maintain goal-directed attention in the face of distracting, task-irrelevant stimuli (Posner & Petersen). Individual differences in general attention control have previously been posited to moderate threat-related processing biases in anxious individuals (e.g., Derryberry & Reed, 2002). This idea is consistent with attentional control theory (Eysenck, Derakshan, Santos, & Calvo, 2007), which posits that threat-driven processing impairs the efficiency of task-relevant processing (such as speeded color-naming on an e-Stroop task) by diverting limited executive resources away from the current task. In this light, it is plausible that preexisting individual differences in the ability to strategically override stimulus-driven, task-irrelevant processes, thus preserving one's executive resources for the current task, could moderate the expression of threat-related biases in the current study. Indeed, Derryberry and Reed (2002) showed that a self-reported measure of attention control moderated the relationship between threat-related attentional bias (indexed by a Dot probe task) and trait anxiety, such that only high trait anxious individuals with poor attention control showed an attentional hypervigilance bias toward threat, whereas those with good attention control did not differ from low trait anxious individuals. Similarly, a global performance measure of attention control—the Attentional Network Task—moderated the relationship between trait anxiety and e-Stroop interference for emotional faces (though not for emotional words), such that only high trait anxious individuals with poor attention control showed an interference effect for emotional (versus neutral) faces (Reinhold-Dunne, Mogg, & Bradley, 2009). Both

studies offer preliminary support for the hypothesis that individuals with good attention control may be able to override the influence of their relatively uncontrolled threat biases.

One limitation of these prior studies, however, is that they examined attention control as a single unitary construct, whereas it has more typically been conceptualized as a composite of three distinct attentional mechanisms: *alerting*, *orienting*, and *IC* (e.g., Posner & Petersen, 1990; White et al., 2011). According to this conceptualization, the *alerting* and *orienting* systems are primarily involved in the selection and maintenance of goal-relevant attentional targets, while the *IC* system is primarily involved in the resolution of conflicts arising from automatic activation of goal-irrelevant cues. *IC* is typically measured by tasks that require inhibiting a relatively automatic response tendency in favor of a less habitual, more goal-congruent response (e.g., color-naming versus word-reading on the color-word Stroop paradigm). The few studies that have specifically focused on *IC* in the context of anxiety suggest that it may play a distinct role in moderating anxious processing, which may be obscured by global measures of the general attention control construct. For instance, White et al. found that greater *IC* ability in children actually increased risk for later anxiety, whereas greater attention shifting—an aspect of attention control more closely tied to *orienting*—had the opposite effect. As this example highlights, the correlates of greater *IC* are not always beneficial. In fact, greater *IC*, indexed by the color-word Stroop, was actually associated with greater trait anxiety and worry in a sample of older adults with generalized anxiety disorder, but not in the age-matched healthy control group (Price & Mohlman, 2007). The authors attributed this to the potentially maladaptive function of *IC* in facilitating anxious individuals' efforts to avoid engaging with threat-related material, which in turn may prevent corrective learning and habituation from occurring, thus maintaining anxiety symptoms in the long-term.

In light of these findings, it is important to further examine the role of *IC* in moderating the relationship between threat interference biases and social anxiety, because it is currently unclear when this aspect of the broader *attention control* construct will diminish or exacerbate the bias-anxiety relationship. Thus, the present study tested whether *IC*, as indexed by performance on the color-word Stroop, would moderate the relationship between e-Stroop interference and a range of affective, cognitive, and behavioral social anxiety markers, including more dispositional or trait-like social anxiety, state anxiety before and during a social stressor, task-interfering negative cognitions and avoidance behavior in response to the stressor, and negative self-evaluations of one's social performance. We hypothesized that social-threat interference would show stronger positive associations with social anxiety among participants with weaker *IC*, given their relatively greater difficulty overriding the influence of a task-interfering threat bias.

In sum, the current study is the first to our knowledge to examine *IC* as a moderator of the relationship between threat interference bias and a range of anxiety markers in high socially anxious individuals, permitting a unique, multimodal assessment of factors influencing the variable bias-anxiety link.

Method

Participants

Participants ($N=159$, 71.7% female) were undergraduate students who participated in exchange for course credit or payment. Participants were recruited based on their scores on the Brief Fear of Negative Evaluation scale (BFNE; Leary, 1983) and the public speaking item of the *Social Phobia Scale* (SPS; Mattick & Clarke, 1998), both administered as part of a department-wide preselection survey. Students who scored at least one standard deviation above a published college student mean on the BFNE (37 or higher; Rodebaugh et al., 2004) and reported at least a “moderate” level of public speaking anxiety (3 or higher) on the public speaking item were invited to participate. The average age of participants was 18.70 ($SD=1.19$), and race and ethnicity were reported as 70.3% Caucasian, 18.7% Asian, 4.5% African-American, and 7.6% Hispanic. Data from nine participants were excluded because they did not endorse English as their native language on a demographic survey administered during the study. One participant declined to be videotaped during the speech task (though allowed their non-recorded speech data to be used). Three other participants declined to give a speech; thus, their data are missing from the speech-related anxiety indicator measures.

Materials¹

Anxiety-related Measures

Trait social anxiety: The Social Interaction Anxiety Scale (SIAS; Mattick & Clark, 1998) is a 20-item self-report measure of social anxiety symptoms (e.g., “I have difficulty talking with other people”). Participants rated each item on a 0–4 Likert scale (ranging from 0=“not at all characteristic or true of me” to 4=“extremely characteristic or true of me”). Cronbach’s alpha was .91. The mean SIAS score (40.76) was less than one standard deviation below the published mean for a diagnosed socially phobic sample ($M=49.0$, $SD=15.6$; Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992), suggesting that our recruitment strategy provided an adequate analogue sample. Note: we refer to this measure as an index of “trait social anxiety” insofar as it reflects social anxiety symptoms that were present prior to the experiment.

State anxiety: The Subjective Units of Distress Scale (SUDS; Wolpe, 1969) is a verbally administered rating scale used to index self-reported state anxiety, on a scale ranging from 0 (no anxiety) to 100 (extreme anxiety). Participants were asked to rate their state anxiety at baseline, their anticipatory anxiety prior to starting their speech, and their peak anxiety during the speech task (peak anxiety was assessed immediately following the speech).

Negative task-interfering cognitions: The Self-Statements during Public Speaking scale (SSPS; Hofmann & DiBartolo, 2000) is a 10-item self-report measure assessing a range of negative, task-interfering thoughts that one might experience during a public speaking task (e.g., “What I say will probably sound stupid”). Following completion of the speech,

¹ The materials reported here are part of a larger study that examined the effectiveness of a new emotion regulation strategy, termed implementation intentions, in high socially anxious individuals. The strategy manipulation did not show condition effects on the measures included in this paper, so we collapsed across conditions for these analyses. Note, we also re-ran the main analyses when controlling for condition, and the pattern of results did not change. A full list of measures is available from the first author.

participants rated each item on a 0–5 Likert scale (ranging from 0=“do not agree at all” to 5=“agree extremely with the statement”). Cronbach’s alpha was .87.

Negative self-evaluation of speech performance: The modified Speech Performance Questionnaire (SPQ; Rapee & Lim, 1992) is a 12-item scale consisting of public speaking performance indicators (e.g., “Had long pauses”). Participants rated their own performance following completion of the speech using a 0–4 Likert scale (from 0=“Not at all” to 4=“Very much”). Cronbach’s alpha was .89.

Behavioral avoidance: Participants were instructed to give a persuasive speech about their impressions of the university so far, and to speak for up to four minutes or until they became too uncomfortable to continue. Participants were given one minute to prepare their speech, and were told that their speech performance would later be evaluated by trained researchers. They then gave their speech in front of the video camera and an experimenter who maintained a neutral facial expression. Speech duration was used to index behavioral avoidance.

Threat Bias and IC Measures—Spoken responses and latencies for all reaction time measures were recorded using Inquisit software (Inquisit, Version 3.0.6.0; Millisecond Software, 2011) running on a desktop PC.

Stroop tasks²

Emotional Stroop (e-Stroop) stimuli: The word stimuli for the e-Stroop consisted of 6 social threat and 6 neutral words (from Teachman, Smith-Janik, & Saporito, 2007), which were matched for average length and frequency. In total, the e-Stroop contained two critical blocks: one block of social threat words and one block of neutral words. Each block consisted of 24 trials (presented in random order), such that each word was presented once in each of four ink colors—red, green, yellow, and blue. In addition, eight musical instrument words (also from Teachman et al.) were used as practice stimuli.

Color-word Stroop stimuli: The color-word Stroop stimuli consisted of four color words—“red,” “green,” “yellow,” and “blue”—presented in either a congruent or incongruent ink color. The color-word Stroop block consisted of 24 color-word stimuli presented in a quasi-randomized order, such that congruent color words were presented twice as frequently as incongruent color words (based on Kane & Engle, 2003). Eight additional color word trials were first completed as practice.

Prior to starting the Stroop tasks, participants were told that they would see a variety of words presented on the screen, and that their goal was to name the color of the ink that each word was printed in, while ignoring the word itself. Participants wore a headset microphone that recorded their spoken responses, and were asked to respond as quickly and accurately as possible. Participants first completed a block of color-word and a block of neutral word

²Note that a masked (subliminal) version of the emotional and color-word Stroop were also administered in the present study, but are not reported here given this paper’s theoretical focus on inhibitory control as a moderator of conscious threat bias. Results from the masked Stroop are available from the first author.

practice trials. The critical blocks of emotional and color-word Stroop stimuli were then administered in random order. Each word remained on the screen until the participant made a response.

Procedure

After signing informed consent, participants provided a baseline SUDS rating and completed a battery of self-report questionnaires, including the SIAS and a demographic survey, followed by the emotional and color-word Stroop tasks. Participants then completed the speech task. Prior to the speech, participants provided an anticipatory SUDS rating. Once they stopped speaking, they provided their peak SUDS during the speech and completed the SPQ and SSPS measures in random order, before being debriefed.

Results

Data Preparation and Descriptive Statistics

The left side of Table 1 displays the means and standard deviations for all Stroop interference and anxiety indicators. All Stroop interference, self-report, and behavioral measures were normally distributed. Extreme outliers, defined as values deviating by more than three times the interquartile range from the lower or upper quartile of a variable's distribution, were removed from all self-report questionnaire data. No more than one outlier had to be removed for any single measure.

To score the emotional and color-word Stroop interference indices, latencies from trials with errors (there were <2% errors across blocks) and outlier latencies (>4000 or <100 ms, or >3 SDs away from a participant's mean latency within a given condition; following Mogg, Bradley, Williams, & Mathews, 1993) were excluded from analyses. The e-Stroop threat interference index was computed by subtracting the mean latency for neutral words from the mean latency for social threat words, such that relatively higher scores reflect greater interference from social threat words. The color-word Stroop interference index was computed by subtracting the mean latency for congruent color-word trials from the mean latency for incongruent color-word trials, such that higher scores reflect greater color-word Stroop interference, indicating weaker IC.³

Anxiety in Response to the Speech Task

To examine whether the speech task was effective at inducing state anxiety, a one-way analysis of variance (ANOVA) was conducted with Time of SUDS (Baseline, Anticipatory, Peak) as a within-subject factor. There was a significant effect of Time ($F(2,154)=213.82$, $p<.001$, $\eta_p^2=.74$), with follow-up pairwise comparisons indicating significant increases from Baseline to Anticipatory SUDS and from Anticipatory to Peak SUDS (all $p<.001$), confirming that the speech task was an effective social stressor.

³Note, a small group of participants (18.1% of the full sample) exhibited below-zero color-word interference scores, suggesting *faster* responses for incongruent relative to congruent words. Notably, only three of these participants showed a speeding of more than 100 ms (i.e., 1/10th of a second) between their mean incongruent and congruent trial latencies; thus, most of the below-zero scores are quite small and can perhaps most plausibly be interpreted in terms of random noise around the mean. By contrast, 49 participants (36.3% of the sample) showed a *slowing* of more than 100 ms for incongruent vs. congruent trials, consistent with past research that uses the color-word Stroop task as an IC measure (see MacLeod, 2005).

Direct Associations between Threat Bias Indices, IC, and Anxiety

Correlational analyses were conducted to test the zero-order relationships between the e-Stroop threat interference index, the color-word Stroop interference index, and each anxiety indicator. As shown in Table 1, threat interference was not significantly associated with any anxiety indicators.

IC as a Moderator of Social Threat Bias

To test whether IC, as measured by color-word Stroop interference, moderated the effect of threat interference (as measured by the e-Stroop interference index) on anxiety, separate linear regression analyses were conducted for each anxiety indicator. These analyses were conducted using the “stats” and “lme4” packages in R (R Core Team, 2013; Bates, Maechler, Bolker, & Walker, 2013), which provide several advantages over more traditional ANOVA approaches in SPSS—such as improved flexibility in modeling interactive time effects and more inclusive, unbiased handling of missing data (e.g., Nich & Carroll, 1997; Wilksch & Wade, 2014). All continuous predictor variables were centered prior to these analyses. For trait social anxiety, negative task-interfering cognitions, self-evaluation of speech performance, and behavioral avoidance, generalized linear regression models were run with e-Stroop, color-word Stroop, and the e-Stroop x color-word Stroop interaction term entered as predictors. For state anxiety, a mixed (between- and within-subject) linear regression analysis was conducted so that the linear and curvilinear effects of Time (estimated via orthogonal polynomial contrast coding of the ordered categorical Time factor, which has 3 levels—Baseline, Anticipatory, Peak) could be included in the model. Specifically, the fixed effects of e-Stroop, color-word Stroop, the Time factor, and all 2-way and 3-way interaction terms were entered as predictors. A random effect of “subject” was also entered, to control for random variation due to individual differences in the repeated SUDS measure.

A consistent pattern of findings emerged for four out of five anxiety indicators (trait social anxiety, task-interfering cognitions, negative self-evaluation, and state anxiety): there were no significant main effects of e-Stroop or color-word Stroop for any indicator, nor any significant interactions with Time for the state anxiety indicator (all $p > .10$); however, the 2-way e-Stroop x color-word Stroop interaction term was predictive (see Tables 2 and 3 for multiple regression and mixed-effects model results, respectively). Follow-up tests consistently revealed that *higher* threat interference was associated with greater anxiety among those with *higher* color-word Stroop interference (i.e., weaker IC), whereas *lower* threat interference was associated with greater anxiety among those with *lower* color-word Stroop interference (i.e., stronger IC), as illustrated in Figures 1A–1D.⁴ The only exception was behavioral avoidance, for which there were no significant main effects or interactions (all $p > .10$).

⁴For maximum clarity and consistency, the e-Stroop bias index is described in terms of greater and lesser degrees of “threat interference,” rather than “threat facilitation,” throughout this manuscript. However, as seen in Figures 1A–1D, some participants actually exhibited faster response latencies for social-threat relative to neutral words (as indicated by a below-zero e-Stroop bias score), suggesting a threat *facilitation* rather than a threat interference effect.

Discussion

The goal of the present study was to help clarify the relationship between threat interference bias and social anxiety, by examining inhibitory control (IC) as a moderator of the bias-anxiety association. We predicted that the positive relationship between threat interference and social anxiety would be stronger among those with weak (versus strong) IC. Findings supported this prediction, even indicating that the direction of the bias-anxiety relationship is reversed in those with strong IC—such that *lesser* (rather than greater) threat interference appears to be associated with greater anxiety in strong-IC individuals. This finding was quite robust, as it was seen across multiple anxiety indicators (including trait and state anxiety, negative cognitions during the speech, and negative self-evaluations of speech performance), though it was not obtained for behavioral avoidance.

Moderation by IC

By showing that the direction of the bias-anxiety relationship is moderated by individual differences in IC, the current findings may help shed light on prior studies that have failed to show a direct association between social threat biases and social anxiety (e.g., Putman et al., 2004). The positive relationship between threat interference and anxiety, observed among weak-IC individuals within the present study, is consistent with the majority of past findings (e.g., Amir et al., 2003; Hope et al., 1990), and with cognitive models positing that threat hypervigilance and difficulty disengaging from threat are hallmarks of social anxiety (Clark & Wells, 1995). On the other hand, the novel finding that lesser, rather than greater, threat interference is associated with greater anxiety among strong-IC individuals, suggests that these individuals may be *better* able to override the (normally involuntary) processing of task-irrelevant threat information to the extent that they are more anxious. Notably, given that activation and override of threat processing are not distinguishable in the present study, the findings could also suggest that strong-IC anxious individuals do not experience the expected pattern of involuntary threat processing in the first place, though this seems unlikely.

Several explanations could account for this less interference-greater anxiety pattern among strong-IC individuals. The self-evaluative nature of the social-threat words might prime a higher motivation to exert IC, among those who are capable of doing so. This explanation is in line with Amir et al.'s (1996) finding that trait anxious individuals exhibit threat facilitation rather than interference when under conditions of elevated state anxiety (presumably due to the heightened motivation to exert strategic control). Relatedly, strong-IC individuals with high social anxiety may have more practice and skill in the avoidance of social-threat stimuli. This would be consistent with Price and Mohlman's (2007) proposal that strong IC can serve a maladaptive function in anxiety, insofar as it aids in emotional suppression and avoidance of feared stimuli. Along these lines, consistent with prior findings of speeded threat detection in social anxiety (e.g., Musa & Lepine, 2000), it could be that both high- and low-IC individuals are initially faster at detecting a word's threat meaning to the extent that they are socially anxious; however, whereas high-IC ability promotes faster disengagement and thus overall faster color-naming responses among high-IC individuals, low-IC ability results in difficulty disengaging from threat and thus overall

slower color-naming responses among low-IC individuals. Of course, these explanations are not mutually exclusive. Future research is needed to determine the mechanisms of this IC moderation effect, and to clarify whether it is truly unique to IC, or whether other components of attention control, including orienting and attention shifting, show similar effects. Overall, this finding highlights the importance of considering individual differences in executive or attentional function when examining domain-specific attentional biases in anxiety.

Clinical implications

A growing number of studies have demonstrated that cognitive bias modification (CBM) paradigms aimed at training attention away from threat stimuli can be effective at reducing social anxiety symptoms (e.g., Amir et al., 2009), but the current findings suggest that such interventions may not be equally helpful or appropriate for all socially anxious individuals. For instance, training individuals to orient their attention away from social-threat stimuli may be unhelpful for someone with strong IC, who may already be too well-adept at avoiding socially relevant cues. For these individuals, the training may need to be modified to promote more approach-based emotion regulation strategies, such as sustained attentional engagement coupled with acceptance or cognitive reappraisal of threat stimuli. Little is known about how individual differences in IC and other aspects of attention control contribute to the effectiveness of different treatments, and this area is ripe for future research.

Limitations and conclusions

The current findings should be interpreted in light of several limitations. First, this study was correlational in nature; although threat-related attentional biases were conceptualized as predictors in the current study (primarily for the sake of analytic consistency and parsimony), it is not possible to make causal or temporal inferences on the basis of these findings, and we suspect the bias-anxiety relationships are bidirectional. Second, given that the emotional and color-word Stroop tasks used in the present study were quite similar in format and administration method, the shared method variance between them could be raised as a potential concern. However, it seems unlikely that the current results could be due to shared method variance, particularly given the finding that the e-Stroop is related to the anxiety indices in opposite directions, depending on whether an individual's color-word Stroop interference is high or low. This implies that the e-Stroop and color-word Stroop do not relate to anxiety outcomes in the same way, as would be expected if they largely indexed the same construct. Third, contrary to hypotheses, the behavioral avoidance measure in the present study showed no significant associations with either Stroop predictor measure (and mixed relationships with the other anxiety measures), thus precluding any strong inferences about the relationship between threat-related biases and behavioral responding. (Notably, lack of variability on the task is not likely an explanation for the null findings, given that only 25% of participants spoke for the full four minutes.) Finally, the use of an undiagnosed sample limits the study's generalizability to a clinical population, though our sample's mean social anxiety score was comparable to that of a diagnosed socially phobic sample (Heimberg et al., 1992), suggesting our sample provided a suitable analogue.

Notwithstanding these limitations, this study was the first to our knowledge to find that IC moderates the relationship between threat-related attentional biases and a range of social anxiety markers, thus helping to clarify the nuanced relationship between these biases and social anxiety.

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Figure 1. Scatterplots of anxiety indicator scores among Strong (<median) versus Weak (>median) Color-Word Stroop Interference groups.
Note: median splits are for visual purposes only; continuous variables were entered in all regression models. Both predictor variables were centered for these analyses. IC = Inhibitory Control; C-W Stroop = Color-Word Stroop; E-Stroop = Emotional Stroop. The dashed vertical line in each graph demarcates the “zero” point on the x-axis (representing the e-Stroop interference index), to allow for clearer visualization of the number of scores that fall above and below this point.

Table 1

Descriptive statistics (means and SDs) and zero-order correlations between emotional Stroop interference and each anxiety indicator.

	<i>M (SD)</i>	1	2	3	4	5	6	7	8
Social-Threat Bias (e-Stroop Interference)	12.5 (51.65)	—							
Inhibitory Control (Color-word Stroop Interference)	76.20 (89.13)	.30***	—						
2. Trait Social Anxiety (SIAS)	40.45 (15.05)	.07	-.03	—					
4. Baseline State Anxiety (SUDS)	14.14 (13.27)	-.09	-.07	.20*	—				
5. Anticipatory State Anxiety (SUDS)	40.46 (21.52)	.08	.05	.36***	.51***	—			
6. Peak State Anxiety (SUDS)	50.12 (23.00)	.05	.02	.37***	.39***	.88***	—		
7. Negative Cognitions (SSPS)	28.61 (8.32)	-.05	-.03	.66***	.20*	.41***	.49***	.76***	—
8. Self-Evaluation (SPQ)	37.80 (8.76)	-.04	-.04	.55***	.17*	.38***	.48***	—	
9. Avoidance (speech duration in sec.)	166.53 (63.86)	-.05	-.09	-.18*	-.04	-.06	-.07	-.29***	-.32***

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Note. For all anxiety indicators except Avoidance, higher scores indicate greater anxiety. For Avoidance, higher scores signify longer speaking time, indicating less avoidance of the social stressor. e-Stroop = Emotional Stroop. SIAS = Social Interaction Anxiety Scale. SUDS = Subjective Units of Distress Scale. SPQ = Speech Performance Questionnaire. SSPS = Self-Statements during Public Speaking scale.

Table 2

Multiple regression results for trait social anxiety, negative cognitions, and negative self-evaluation, as predicted by emotional Stroop interference, color-word Stroop interference, and their interaction term.

<i>Trait Social Anxiety (SIAS)</i>						
Predictor	R^2	β	SE	t	df	p
Social-Threat Bias (e-Stroop Interference)	.00	.37	1.34	.28	140	.783
Inhibitory Control (Color-Word Stroop Interference)	.00	-.27	1.33	-.20	140	.841
Social-Threat Bias x Inhibitory Control	.03*	1.81	.93	1.95	140	.044

<i>Negative Cognitions (SSPS)</i>						
Predictor	R^2	β	SE	t	df	p
Social-Threat Bias	.01	-.78	.74	-1.06	138	.289
Inhibitory Control	.00	.01	.73	.01	138	.992
Social-Threat Bias x Inhibitory Control	.03[†]	.99	.51	1.95	138	.054

<i>Negative Self-Evaluation (SPQ)</i>						
Predictor	R^2	β	SE	t	df	p
Social-Threat Bias	.01	-.80	.78	-1.04	138	.302
Inhibitory Control	.00	-.34	.77	-.45	138	.657
Social-Threat Bias x Inhibitory Control	.05*	1.37	.54	2.55	138	.012

* $p < .05$;

[†] $p < .10$

Note. All continuous predictor variables were centered prior to analyses. β values are unstandardized estimates of the effect of each predictor, expressed per one unit increase in each anxiety indicator. R^2 for each predictor represents the additional variance explained in the anxiety indicator when this predictor term is added to the model. SE = standard error of the estimate. e-Stroop = Emotional Stroop. SIAS = Social Interaction Anxiety Scale. SSPS = Self-Statements during Public Speaking scale. SPQ = Speech Performance Questionnaire.

Table 3

Mixed-effects regression results for state anxiety, as predicted by emotional Stroop interference, color-word Stroop interference, and their interaction term.

Predictor	State Anxiety (SUDS)				
	Variance	β	SE	t	df p
<u>Random Effects</u>					
Intercept	233.6				
Residual	151.1				
<u>Fixed Effects</u>					
Time		25.29	1.05	24.00	281 <.001
Time ²		-6.56	1.05	-6.22	280 <.001
Social-Threat Bias (e-Stroop Interference)		-.42	1.39	.28	142 .783
Inhibitory Control (Color-Word Stroop Interference)		.44	1.38	-.29	142 .769
Time x Social-Threat Bias		.99	1.10	.90	279 .369
Time ² x Social-Threat Bias		-.71	1.10	-.65	279 .518
Time x Inhibitory Control		.78	1.10	.71	280 .481
Time ² x Inhibitory Control		-1.05	1.10	-.95	280 .342
Social-Threat Bias x Inhibitory Control		2.05[†]	1.05	1.95	142 .053
Time x Social-Threat Bias x Inhibitory Control		.77	.76	1.00	279 .317
Time ² x Social-Threat Bias x Inhibitory Control		-.86	.77	-1.12	279 .262

* $p < .05$;

[†] $p < .10$

Note. All continuous predictor variables were centered prior to analyses. β values are unstandardized estimates of the effect of each predictor, expressed per one unit increase in state anxiety. SE = standard error of the estimate. e-Stroop = Emotional Stroop. SUDS = Subjective Units of Distress Scale. Time and Time² represent the linear and quadratic trends (respectively) estimated for the ordered Time (Baseline, Anticipatory, Peak) factor.