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Post-Event Processing and Memory Bias for Performance Feedback in Social Anxiety

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Abstract

Despite predictions following from cognitive theories of anxiety, evidence for memory biases in social anxiety has been mixed. This study extends previous research by using stimuli relevant to participants' concerns and allowing time for post-event processing. Participants high ($n = 42$) or low ($n = 39$) in social anxiety symptoms gave speeches and received standardized feedback on their and a confederate's performance. Participants then took recognition and recall tests for the feedback immediately after it was given and after a two-day delay. Results showed no recall biases. However, the hypothesized recognition biases were found: the high social anxiety group remembered the confederate's feedback more positively than their own, remembered their negative feedback as worse than the low group, and diminished positive feedback over time. Moreover, post-event processing mediated the relationship between social anxiety and memory for negative feedback. Results suggest that biased recognition of social feedback is linked to social anxiety.

Keywords

social anxiety; memory bias; post-event processing; recognition

1. Introduction

Cognitive theories of social anxiety suggest that anxiety is maintained through information processing biases that lead affected individuals to view social situations through a negatively distorted lens (Clark & McManus, 2002). Biases in attention, interpretation, and memory have been proposed as possible mechanisms to explain why people with social anxiety tend to make negative evaluations of themselves in social situations, despite sometimes strong evidence to the contrary (Clark & Wells, 1995; Musa & Lépine, 2000). However, evidence for memory biases has been very inconsistent (see Coles & Heimberg, 2002). The current study investigates whether socially anxious individuals are characterized by a memory bias that may perpetuate their negative self-evaluations. Participants high and low in social anxiety were given false feedback about their and a confederate's speech performance, and memory for the feedback was tested both immediately and after a two-day delay. This design allowed for an investigation of the effects of post-event processing, a type of rumination characteristic of social anxiety, on memory for self- and other-relevant social feedback.

1.1. Memory Bias in Social Anxiety

According to Beck, Emery, and Greenberg (1985), pathological anxiety results from maladaptive cognitive schemas that, when activated, direct the intake, organization, and recall of information about a particular situation. People with anxiety disorders are thought to over-rely on schemas that preferentially process dangerous information. When a threat schema is activated, threat-relevant biases are theoretically supposed to pervade all stages of information processing (Musa & Lépine, 2000). Furthermore, in theory, these biases are interwoven such that preferential allocation of attention leads to deeper encoding of threat-relevant stimuli, which should then lead to heightened accessibility of threat memories (Heinrichs & Hofmann, 2001). However, evidence for a memory bias in social anxiety has been elusive, even though other information processing biases have been clearly linked to social worries (e.g., attention bias: Rinck & Becker, 2005; interpretation bias: Stopa & Clark, 2000).

Several studies have not found conclusive evidence of memory bias in social anxiety (see review by Coles & Heimberg, 2002). For instance, Rapee, McCallum, Melville, Ravenscroft, and Rodney (1994) found no evidence of memory bias for negative social stimuli across four studies, examining both recall and recognition, implicit and explicit memory, autobiographical memory, and recall of hypothetical performance scenarios. Further, Lundh and Öst (1997) did not find an explicit (cued recall) or implicit (word stem completion) memory bias in socially phobic participants, relative to non-anxious controls. In addition, Becker, Roth, Andrich, and Margraf (1999) did not find any disorder-relevant memory bias in participants with social phobia despite finding a strong explicit memory bias for panic-relevant words in participants with panic disorder using an identical paradigm. Moreover, Wenzel and Holt (2002) actually found a memory bias *against* threatening prose passages in participants with social phobia. These findings suggest that information processing theories of social anxiety may need to be revised regarding the role of memory biases.

Alternatively, methodological characteristics of these studies may partly explain the null findings. For example, the majority of prior studies have used stimuli comprised of generic, artificial cues, such as words on a computer screen that are not necessarily relevant to each participant's idiographic concerns (e.g., Becker et al., 1999; Lundh & Öst, 1997; though see Rapee et al., 1994, Study 4, which assessed autobiographical memory). Low external validity of stimuli combined with heterogeneity of social concerns within samples may obscure memory biases. Indeed, studies that have used more externally valid stimuli (such as facial expressions) and more homogenous samples seem to be somewhat more likely to obtain results indicating a bias (e.g., Coles & Heimberg, 2005; Lundh & Öst, 1996). In addition, studies that have been successful at finding a memory bias in socially anxious individuals have often used actual or anticipated social exposures (e.g., Mansell & Clark, 1999; O'Banion & Arkowitz, 1977). The current study builds on these earlier findings by using externally valid stimuli with a real social stressor in a sample with a specific social anxiety focus (fear of public speaking).

1.2. Post-Event Processing

Biased processing *after* the social event may also play an important role in facilitating the selective recall of negative information about one's social performance, so that past studies of memory bias may have missed effects by measuring memory only immediately after stimuli were presented. Following real-life social encounters, people with severe social anxiety ruminate for hours or even days over their perceived social failures, a process known in the cognitive model of social phobia as post-event processing (Clark & Wells, 1995). Post-event processing is unproductive and theoretically maintains anxiety, possibly through

the rehearsal and elaboration of negative social memories (Rachman, Grüter-Andrew, & Shafran, 2000; Kocovski, Endler, Rector, & Flett, 2005).

The effect that post-event processing has on biased memory in social anxiety has been investigated in three studies. Field and Morgan (2004) tested Clark and Wells' (1995) prediction that post-event processing involves the retrieval of prior instances of perceived social failure. When participants high and low in social anxiety were instructed to engage in post-event processing after recalling a social experience, those who were high in social anxiety generated more negative and shameful autobiographical memories than those who were low in social anxiety. Similarly, Mellings and Alden (2000) found that, one day after a social interaction, the extent of self-reported post-event processing predicted negative self-relevant recall, even though there was only a non-significant trend for group differences according to social anxiety classification (favoring more negative recall among the high social anxiety group). Consistent with earlier research (e.g., Hope, Heimberg, & Klein, 1990), Mellings and Alden also found that socially anxious participants had worse memory for neutral information the next day.

Edwards, Rapee, and Franklin (2003) further assessed the relationship between post-event processing and negative memory biases. They asked participants high and low in social anxiety to give an impromptu speech and then provided a mix of positive and negative feedback on their performance. Memory for the feedback was tested in both immediate and delayed free recall tasks. Edwards et al. found that a measure of trait social anxiety was associated with negative rumination and that the high social anxiety group showed negatively biased recall at both time points (a trend at time 1 and a significant group difference at time 2). However, there was not a significant relationship between negative rumination and recall bias. Thus, using a real social exposure and allowing time for post-event processing led both Mellings and Alden (2000) and Edwards et al. (2003) to find evidence for a memory bias favoring the recall of negative self-relevant information in high socially anxious participants. However, Mellings and Alden found that post-event processing was correlated with negative recall, while Edwards et al. did not. Results across studies were thus somewhat mixed, but suggest that post-event processing, when examined under the right conditions, may be an important predictor of memory biases. The current study extends this research by using multiple memory tasks, externally valid stimuli, and a two-day delay (intermediate between the delay times used in previous studies) to further explore the link between post-event processing and biased memory in social anxiety. In addition, we examine memory for positive, negative, and neutral information, because a memory bias may be manifested in poor memory for positive information, as well as preferential recall of negative.

1.3. Memory for Others' Social Feedback

We are also interested in how memory for information about the self compares to memory for information about other people, especially since this has not yet been examined in relation to post-event processing. Because one of the key features of social anxiety is a sense of inferiority, social comparison processes may be particularly relevant to understanding this type of anxiety (Antony, Rowa, Liss, Swallow, & Swinson, 2005). In fact, recent research has shown that socially phobic individuals make more upward social comparisons (in which the self is judged inferior to others) and experience more negative affect after making those comparisons, relative to control participants (Antony et al., 2005). Furthermore, socially phobic individuals have exhibited a negative bias when appraising their own social performance but a positive bias when judging the performances of others (Alden & Wallace, 1995). In the current study, memory bias is expected to be more negative for self-relevant information and more positive for other-relevant information, as socially anxious individuals

negatively compare their performance feedback to that of others during post-event processing.

1.4. Overview of Current Research

In the current study, participants high or low in social anxiety completed a public speaking task and received standardized feedback on their performance, comprised of ratings for positive and negative performance indicators. They also watched a video of a confederate giving a similar speech and read the speech feedback supposedly given to the confederate. After reading the feedback, participants were given free recall and recognition tests and a quiz about neutral information that they had read during the speeches. Memory for feedback for themselves and for the confederate was examined both immediately after the feedback was given and again after a two-day delay. Examination of memory differences between the high and low social anxiety groups at the first visit was exploratory given the prior mixed findings and because participants would have not yet had the opportunity to ruminate on the feedback. However, we hypothesized that at the second visit, participants in the high social anxiety group would show a memory bias such that they would have better memory for negative feedback about themselves and positive feedback about the confederate (as evident by enhanced recall and a tendency to recognize feedback as more negative/positive in overall valence than it actually was). Conversely, they were expected to have worse memory for positive feedback about themselves and negative feedback about the confederate. This overall pattern of results would provide strong evidence for negatively biased memory in social anxiety and help to clarify the role that post-event processing plays in eliciting that bias.

2. Method

2.1. Participants

Participants were recruited from psychology classes and were offered course credit or payment for completing the study. All participants completed a set of pre-selection measures, including the Social Interaction Anxiety Scale and the public speaking item from the Social Phobia Scale, which reads, "I get tense when I speak in front of other people" (SIAS and SPS; Mattick & Clarke, 1998). Those who scored less than or equal to three quarters of a standard deviation below a community sample mean (Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992) on the SIAS (9 or under) and who rated the public speaking item as 0 (*not at all*), 1 (*slightly*), or 2 (*moderately*) were eligible for the low social anxiety (Low SA) group. Those who scored greater than or equal to three quarters of a standard deviation above the community sample mean on the SIAS (30 or over) and who rated the public speaking item as 3 (*very*) or 4 (*extremely*) were eligible for the high social anxiety (High SA) group. The mean SIAS score for the High SA group was 45.4 (note, a cut-off score of 34 has been shown to have good sensitivity and specificity in identifying clinically significant social phobia; Brown et al., 1997). Participants were told that they were selected for the study based on their responses to pre-selection measures administered earlier in the semester, but they were not informed that they were selected because they were high or low in social anxiety symptoms, so as not to influence their performance on the public speaking task.

A total of 39 Low SA participants (28 female) and 42 High SA participants (31 female) completed the study. The mean age of participants was 18.79 years ($SD = 1.07$, range = 17 to 24), and the number of individuals reporting membership in each racial or ethnic group was as follows: 58 Caucasian, 5 African American, 5 Hispanic, 8 Asian, 1 Middle Eastern, 2 multiple ethnicities, and 2 "other." There were no significant social anxiety group differences in age, $t(79) = 1.64$, $p = .10$, $d = 0.38$; gender, $\chi^2(1, N = 81) = 0.04$, $p = .84$; or

race (comparing Caucasian to all other categories), $\chi^2(1, N = 81) = 0.28, p = .60$. Five High SA participants completed Visit 1 but did not return for Visit 2. Their data are retained for Visit 1 analyses. All Low SA participants completed both visits.

2.2. Materials

2.2.1. Speech and video tasks—Participants were told that the study would examine the best way to give feedback to people who are working to improve their communication skills. They were told that they would give a speech and that their performance would be evaluated according to a checklist. Participants were also told that they would be watching another participant's speech and reading their feedback. The order of performing the speech or watching the video was counterbalanced, as was whether the participant was asked to speak on Topic A, "The Honor Code," or Topic B, "Fraternities and Sororities." When participants gave their speeches, they were recorded on a small video camera mounted on a tripod.

Videos of the confederates' speeches were recorded earlier. When the confederates (undergraduate research assistants) gave their speeches, they were given the same instructions and same preparation time as the actual participants so that they would appear comparably impromptu. Four videos were recorded: a female confederate speaking on Topics A and B, and a male confederate speaking on Topics A and B. The video that the participants watched showed a confederate of their same gender speaking on the alternate topic.

2.2.2. Feedback—Participants were given false feedback for both their and the confederate's speech. The feedback consisted of a list of 20 indicators of speech performance, 10 positive and 10 negative, rated on a 5-point Likert scale (where 0 is *not at all* and 4 is *very much*). Feedback was standardized so that all participants were given the same ratings for their speech. Ratings for the confederates' speeches were different from those given for the participant's speech, but also standardized. For both the participant and the confederate, four of the positive items were rated either a 3 (*much*) or 4 (*very much*), as were four of the negative items (see Appendix for a sample feedback form).

To construct this feedback, we used the Perception of Speech Performance measure developed by Rapee and Lim (1992), which consists of 17 items designed to evaluate characteristics relevant to good public speaking. We then brainstormed additional items that were similar in length and form, for a total of 26 items (13 positive and 13 negative). In this pilot version of the feedback, four positive items and four negative items were endorsed (rated a 3 or 4). Ratings for the remaining positive items alternated between 1 and 2, since we were concerned that a 0 rating for a positive item would be equivalent to an endorsement for a negative item. Ratings for the remaining negative items alternated between a 0 and a 1, since we were concerned that a 2 rating for a negative item would be too easily mistaken as an endorsement. A random order of these items was generated for pilot testing. Twelve undergraduate students were tested on their recognition memory for these items and rated their valence on a 5-point Likert scale with anchors of 0 (*very negative*), 2 (*neutral*), and 4 (*very positive*).

To select the final feedback, items were evaluated based on valence and recognition accuracy from the pilot data and normed word frequency. Negative items were excluded from the final feedback if their valence ratings were greater than 1.25, and positive items were excluded if their valence ratings were less than 2.75. The mean valence of the 10 negative items chosen for the final feedback was 0.83 ($SD = 0.31$), and the mean valence of the 10 positive items was 3.62 ($SD = 0.12$). Frequency was assessed using the Kučera-Francis (1967) norms in the MRC Psycholinguistic Database

(http://www.psy.uwa.edu.au/MRCDatabase/uwa_mrc.htm; Wilson, 1988), using the score for the key word within each item. The average Kučera-Francis frequency score for the selected positive items ($M = 36.4$, $SD = 35.17$) was not significantly different from that for the selected negative items ($M = 35.0$, $SD = 59.03$), $t(18) = 0.06$, $p > .05$. Finally, a paired samples t -test indicated that the recognition scores collected in the pilot testing for the selected positive and negative items were not significantly different, $t(11) = 0.32$, $p > .05$. Based on the pilot testing results, four positive and four negative items were chosen to be endorsed (rated a 3 or 4) for the participant and the confederate. Positive and negative endorsed items for the participant and the confederate were matched on Kučera-Francis word frequency and recognition accuracy scores (from piloting). Three random orders of the items were created.

2.2.3. Memory task—Participants were tested on their memory for the speech performance feedback and for neutral speech topic information both five minutes after receiving the feedback and after a two-day delay. Memory for feedback was tested using both recall and recognition paradigms. For the self-relevant recall task (and separately for the other-relevant recall task), participants were asked to write down every item they remembered from their feedback that was checked 3 (*much*) or 4 (*very much*). Next, for the self-relevant recognition task (and separately for the other-relevant recognition task), participants were given a copy of the feedback without circled ratings and instructed to reproduce the item ratings as accurately as possible. Memory for neutral speech topic information was tested through a multiple choice quiz on the paragraphs that were read prior to giving the speech or watching the confederate's speech.

2.3. Measures

2.3.1. Social anxiety measures—Participants were selected for the study using the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998), a 20-item questionnaire that assesses anxiety in a variety of social interaction situations. The SIAS has strong psychometric properties and good screening utility for both clinical and research purposes (Rodebaugh, Woods, Heimberg, Liebowitz, & Schneier, 2006). Participants were also selected using the public speaking item from the Social Phobia Scale (SPS; Mattick & Clarke, 1998). Later in the study, the SPS was administered in its entirety to validate the classification into high and low social anxiety groups. The SPS is a 20-item companion scale to the SIAS and assesses anxiety in a variety of social performance situations. Cronbach's alpha in the current study was .93. Additionally, participants completed the Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983), a standard measure of cognitive symptoms of social anxiety. The BFNE has good internal consistency and convergent and discriminant validity across a range of samples (Weeks et al., 2005). In our sample, Cronbach's alpha was .92.

2.3.2. Agreement rating—To evaluate credibility of the feedback, an agreement rating was obtained by asking participants "To what extent do you agree with your/the other participant's feedback?" following the speech and video tasks. Means ranged from 6.09 to 7.42 on a 0-10 scale, where higher numbers indicate greater agreement.

2.3.3. Suspicion of deception—During a funnel debriefing at the end of the study, participants were first asked whether they noticed anything strange or suspicious about the study. Next, they were asked whether they suspected that the feedback was false and or that the person in the video was not a real participant. Based on their debriefing answers, participants were placed into the following groups: no suspicion, indicated suspicion of feedback or confederate at initial query, or indicated suspicion of feedback or confederate only when prompted.

2.3.4. Mood and general anxiety measures—Participants rated their anxiety on a 0-100 verbal analogue Subjective Units of Distress Scale (where 0 is *completely calm* and 100 is *extremely anxious*; SUDS; Wolpe, 1990) throughout the experiment in order to report their anticipatory, post-event, and peak anxiety. In addition, participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), a 20-item scale assessing positive and negative affect, at the beginning of each visit to check for group differences in mood prior to the manipulation and the memory tasks. The PANAS has good reliability and construct validity in a non-clinical sample (Crawford & Henry, 2004). Cronbach's alpha for each subscale at both visits ranged from .82 to .89.

Participants also completed the trait form of the Spielberger State-Trait Anxiety Inventory (STAI-Trait; Spielberger, 1983) to assess general trait anxiety. The STAI-Trait consists of 20 items that ask individuals how they generally feel. It has high test-retest reliability and convergent validity with other anxiety questionnaires (Spielberger, 1983). Cronbach's alpha for the current study was .94. Finally, participants completed the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996), to assess depressive symptoms. The BDI-II is a widely used 21-item inventory with good psychometric properties (Storch, Roberti, & Roth, 2004). Cronbach's alpha in our sample was .91.

2.3.5. Rumination measures—To assess participants' general tendency to ruminate, we administered the 22-item Ruminative Responses scale (RRS) of the Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991), which asks about behaviors characteristic of respondents when they feel sad. The RRS has high internal consistency and correlations with other rumination measures (Nolen-Hoeksema & Morrow, 1991). Cronbach's alpha in the current study was .93. In addition, participants completed the Post-Event Processing Questionnaire (PEPQ; Rachman, Grüter-Andrew, & Shafran, 2000) to examine post-event rumination specific to the speech that they gave. The PEPQ is a 13-item scale measuring post-event processing following a specific social situation. In the current study, the scale was modified to instruct participants to think back to the speech that they gave. For example, one item read, "Did your memories and thoughts about the speech keep coming into your head even when you did not wish to think about it again?" Participants were shown a visual analogue scale of 0 (*never/none/not at all*) to 100 (*always/extremely*) and were asked to write their numeric rating in the blank beside each question. Cronbach's alpha for this scale was .88.

2.3.6. General memory measure—To check that there were not general memory ability differences across the groups, participants were administered the Digit Span subtest from the Wechsler Adult Intelligence Scale-III (WAIS-III; Wechsler, 1997).

2.4. Procedure

Participants were told the study would examine reactions to feedback from a public speaking task. After informed consent was signed, the experimenter asked participants to rate their current anxiety (using SUDS) and to complete the PANAS. The speech and video tasks were then completed in counterbalanced order. When participants gave the speech, they were given either Topic A or B and told to speak about the pros and cons of the topic. Participants were given a brief paragraph of facts about the topic and told to read the paragraph out loud at the beginning of their speech. They were then given one minute to prepare their speech. At the end of the planning period, the experimenter showed participants the rating form that would be used to evaluate the speech. The experimenter then asked participants to stand and give their speech in front of the experimenter and a video camera. Participants were asked to speak for three minutes.

During the task, the experimenter pretended to rate the participant's speech. In reality, the experimenter was completing the rating form with the standardized ratings, using a template that the participant could not see. The experimenter then gave the form to participants and instructed them to read the feedback carefully and to answer a question about the extent to which they agreed with the feedback. This question was intended to provide information on the credibility of the feedback and to ensure that participants had read and thought about the feedback. They were given one minute to study the feedback.

When participants watched the video of the confederate, they were told that the speaker was another participant who had been instructed to complete the same task. Participants were asked to read the paragraph that the confederate would be speaking on and then to watch the video. After watching the video, participants were given the feedback the confederate had supposedly received. They were told that the purpose of watching the video and reading the feedback was to see another example of feedback for comparison. They were asked to study the confederate's feedback for one minute and to rate the credibility of the feedback. Participants completed diaphragmatic breathing exercises in between the speech and video tasks in order to reduce the effects of residual anxiety from the task that was completed first.

Following the speech and video tasks, participants had a 5-minute break before completing the memory tests. Memory Task 1 consisted of the quizzes about the neutral speech topic paragraphs and the free recall and recognition tasks for the feedback. The order of the feedback tasks and quizzes was counterbalanced, so that some participants completed the recall and recognition tasks first and the topic quizzes second, and others completed the topic quizzes first and the recall and recognition tasks second (free recall always preceded the recognition test). Participants completed the self-relevant feedback tasks and quiz first if they had given the speech first, but they completed the other-relevant feedback tasks and quiz first if they had watched the video first. After Memory Task 1, participants were asked to return two days later and were told that they would either give a second speech or complete an interview. Participants were told that the reason for giving the second speech two days later was to see if their performance had improved after they had some time to think about the feedback. They were told that they could still complete the interview if they chose not to give the speech (to reduce the risk that participants would not return because of anxiety about public speaking).

Participants returned for Visit 2 after 40 to 56 hours. This delay was chosen in order to maximize the effects of post-event processing while minimizing attrition and ensuring that participants would still remember specific details about their speech. After first rating their baseline anxiety (using SUDS) and completing the PANAS, participants completed questionnaires on rumination (RSQ-RRS) and post-event processing (PEPQ). They then completed Memory Task 2, which was identical to Memory Task 1. Next, participants were administered the WAIS Digit Span subtest, followed by the STAI-Trait, BDI-II, SPS, and BFNE, in random order. These descriptive measures were conducted at Visit 2 due to time constraints at Visit 1. Using a funnel debriefing protocol, suspicion about the feedback or confederate deception was then evaluated, before participants were fully debriefed. Participants were then fully informed about the deception and were told that the reason for the deception was to show all participants the same feedback but to have them believe that it was relevant to their performance. After debriefing, participants had the option to withdraw their data from the study because of the use of deception (although no participants chose to withdraw their data).

3. Results

3.1. Descriptive Statistics

As determined by pre-selection, the High SA group had a higher mean SIAS score than the Low SA group; $t(79) = 21.91, p < .001, d = 4.93$. Further, the High (versus Low) SA group had more social performance anxiety on the SPS, $t(74) = 6.67, p < .001, d = 1.55$, and greater fear of negative evaluation on the BFNE, $t(74) = 7.44, p < .001, d = 1.73$. Not surprisingly, there were baseline group differences in affect, such that the High SA group showed lower positive affect, $t(79) = 3.44, p < .001, d = 0.77$, and higher negative affect, $t(79) = 6.04, p < .001, d = 1.36$, on the PANAS at Visit 1. These differences in affect were similar at Visit 2, prior to the second memory task. Relative to the Low SA group, the High SA group also reported higher SUDS at baseline, $t(79) = 4.47, p < .001, d = 1.01$, and higher peak SUDS when performing the speech, $t(79) = 5.05, p < .001, d = 1.14$, and when watching the video, $t(79) = 2.94, p = .004, d = 0.66$. The High SA group also reported more trait anxiety, STAI-Trait: $t(74) = 6.50, p < .001, d = 1.51$, and more depressive symptoms, BDI-II: $t(74) = 3.07, p = .003, d = 0.71$. In addition, the general tendency to ruminate, as measured by the RSQ-RRS, differed between groups such that the High SA group showed more negative rumination, $t(74) = 5.60, p < .001, d = 1.30$. Importantly, however, the High and Low SA groups did not differ on general memory ability, Digit Span: $t(74) = 0.20, p = .84, d = 0.05$. See Table 1 for a summary of descriptive statistics.

3.2. Memory for Speech Feedback

3.2.1. Agreement with feedback—Agreement ratings were examined to check for differences in feedback credibility. There was a significant group difference in agreement with the self-relevant speech feedback, such that High (relative to Low) SA participants reported greater agreement with their feedback ratings, $t(79) = 2.23, p = .03, d = 0.50$. There were no group differences in agreement with the other-relevant speech feedback ratings, $t(79) = 1.02, p = .31, d = 0.23$. To account for the difference in agreement with self-relevant feedback, that agreement rating is used as a covariate in the relevant analyses.¹

3.2.2. Recognition Valence—To investigate recognition memory effects, individual item difference scores were computed from the ratings participants circled based on the degree to which they were remembered as more positive or negative than the original feedback. For example, if a positive item was given a rating of 2 in the standardized feedback, but a participant's memory of the item was 4, this would correspond to a weight of +2. Negative items were weighted similarly but reverse scored, so that negative weights (e.g., -2) always indicated a bias in the direction of worse speaking performance. These scores were then summed separately to create total positive and total negative item recognition valence scores. Total scores above zero (indicating that participants remembered feedback as better than it actually was), represent positively biased recognition valence; total scores below zero (indicating that participants remembered feedback as worse than it actually was) represent negatively biased recognition valence. Note that in these results, "bias" indicates strength and direction of the overall recognition valence.

To test for differences in overall recognition valence, a 2 (time: Visit 1, Visit 2) x 2 (target: self, other) x 2 (item valence: positive, negative) x 2 (social anxiety group: High SA, Low SA) repeated measures ANCOVA was conducted, with recognition valence as the dependent variable and self-relevant feedback agreement as the covariate. Interestingly,

¹When level of agreement with self-relevant feedback was not considered as a covariate, the social anxiety group difference results were similar and the effects were greater. We speculate that the Low SA group reported less agreement with their ratings because they are likely to discount negative feedback (which comprised half of the feedback they received).

results indicated that the intercept was significantly different from 0, indicating that feedback of all types was remembered more positively than it actually was, $F(1, 68) = 4.81$, $p = .03$, $\eta_p^2 = .07$, suggesting a surprising positive recognition bias for the whole sample, on average. There was also a main effect for time, such that feedback was remembered more positively at Visit 2, compared to Visit 1, $F(1, 68) = 9.47$, $p = .003$, $\eta_p^2 = .12$, as well as a significant target x group interaction, $F(1, 68) = 4.88$, $p = .03$, $\eta_p^2 = .07$. Paired-samples t -tests conducted to explore the target x group interaction revealed that, as hypothesized, participants in the High SA group remembered the confederate's feedback ratings as significantly more positive than their own, $t(40) = 3.44$, $p = .001$, $d = 0.54$. Participants in the Low SA group did not show this difference, $t(37) = 0.39$, $p = .70$, $d = 0.06$. This finding suggests that individuals high in social anxiety have more positive memory for others than for themselves (see Figure 1).

Importantly, results of this ANCOVA also revealed the predicted significant 4-way interaction (time x target x item valence x group), $F(1, 68) = 5.51$, $p = .02$, $\eta_p^2 = .08$. To understand the 4-way interaction, 2 (time) x 2 (item valence) x 2 (group) repeated measures tests were conducted separately for self-relevant and for other-relevant feedback. We focus on those findings specific to the hypotheses about social anxiety group differences. Results from the 3-way ANCOVA for self-relevant feedback revealed a marginally significant time x item valence x group interaction for self-relevant feedback, $F(1, 71) = 3.96$, $p = .05$, $\eta_p^2 = .05$. Follow-up paired-samples t -tests revealed that, as expected, the High SA group remembered their positive feedback items as significantly more negative at Visit 2 than at Visit 1, $t(36) = 2.22$, $p = .03$, $d = 0.36$. The Low SA group did not show this difference in ratings of positive self-relevant feedback items between visits, $t(37) = 1.02$, $p = .32$, $d = 0.16$, and in fact, the means are in the opposite direction (see Figure 2a). This indicates that people high in social anxiety diminish their positive feedback over time, while those low in social anxiety do not. Furthermore, the follow-up independent-samples t -tests indicated that High SA participants remembered their negative feedback items at Visit 1 more negatively than Low SA participants did, $t(76) = 2.51$, $p = .01$, $d = 0.57$, and ratings of negative items did not change significantly over time for either social anxiety group. See Figures 2b and 3. Additionally, paired-samples t -tests revealed that the Low SA group showed more positively biased recognition for their negative items than for their positive ones at Visit 1, $t(37) = 2.66$, $p = .01$, $d = 0.43$, suggesting that they distorted their negative feedback immediately after receiving it. The High SA group did not show this self-enhancement bias ($p > .10$), and again, the means are in the opposite directions. No other main effects or interactions for social anxiety group from the follow-up 3-way ANCOVAs were significant (all $p > .10$). Specifically, there were no social anxiety group differences in recognition of the confederate's feedback over time, with both groups remembering the confederate's feedback as more positive than it really was.

See Table 2 for a list of means and standard deviations for the recognition valence variables. Note, also, that the pattern of results for recognition valence remained the same when covarying either baseline PANAS scores or BDI scores, except for a few instances where marginally significant trends became significant findings and vice versa.

A chi-square analysis to check for differences in suspicion status between the Low and High SA groups revealed no group differences, $\chi^2(6, N = 76) = 4.35$, $p = .23$. A total of six participants (three in each group) reported that they suspected that the feedback was false before being prompted. To check for the effects of suspicion, the 4-way repeated measures ANCOVA for overall feedback recognition valence was re-run without the six participants who reported suspecting false feedback. Results were similar to those from the original ANCOVA.

Overall, results for recognition valence suggest that all participants remembered feedback as more positive than it actually was. Interestingly, though, High SA participants remembered the confederate's feedback more positively than their own, remembered their negative feedback as worse (compared to the Low SA group), and diminished positive feedback over time. In contrast, Low SA participants showed a consistent positive bias for all types of feedback.

3.2.3. Recognition Accuracy—Although the above analyses showed differences in feedback recognition valence, we did not know whether recognition ratings were more accurate for the High SA group in addition to being less positively biased. For example, if a High SA participant had rated half of the items as more negative than they actually were and half as more positive, these ratings would cancel each other out so that the recognition would be *inaccurate* (by having a large absolute difference from the original ratings) but *unbiased* (by summing to a weighted recognition valence score of 0). We expected High SA participants to be less positively biased but not necessarily to be any more or less accurate than Low SA participants, because the negative self-schemas thought to be characteristic of high social anxiety should predominantly affect the valence of one's overall impression of oneself. To investigate absolute recognition accuracy, we computed the absolute values of the recognition valence difference scores. Scores for positive and negative items were summed separately to create total positive item and total negative item accuracy scores for both targets (self and other). To test for differences in accuracy, a 2 (time) x 2 (target) x 2 (item valence) x 2 (group) repeated measures ANCOVA was conducted, with recognition accuracy scores as the dependent variable and self-relevant feedback agreement as the covariate. Results indicated a main effect for item valence, such that positive items were remembered more accurately than negative items, $F(1, 68) = 4.32, p = .04, \eta_p^2 = .06$. No significant group differences or interactions were found (all $p > .10$), suggesting that neither social anxiety group had more accurate recognition memory, despite the expected differences in recognition valence biases. Covarying baseline PANAS or BDI scores did not substantively change these results.

3.2.4. Correct Recall—To test for differences in the number of endorsed feedback items correctly recalled, a 2 (time) x 2 (target) x 2 (item valence) x 2 (social anxiety group) repeated measures ANCOVA was conducted, with self-relevant feedback agreement as the covariate. Not surprisingly, results indicated a trend for time, $F(1, 73) = 3.24, p = .08, \eta_p^2 = .04$, such that more feedback items were recalled at Visit 1 than at Visit 2. Again, we focus here on interactions relevant to our hypotheses about social anxiety group differences. Specifically, results indicated a significant time x group interaction, $F(1, 73) = 12.48, p = .001, \eta_p^2 = .15$. This interaction remained significant when baseline PANAS and BDI scores were covaried. Follow-up paired-samples *t*-tests revealed a significant decrease in the number of feedback items (not specific to valence) recalled at Visit 2, compared to Visit 1, for the High SA group, $t(36) = 3.82, p = .001, d = 0.63$, but not for the Low group, $t(38) = 0.76, p = .45, d = 0.12$. Contrary to our predictions, no other main or interactive effects for SA group were significant (all $p > .10$). To account for the effects of suspicion, the 4-way repeated measures ANCOVA for correct recall was re-run without the six participants who reported suspecting false feedback. Results were similar to those from the original ANCOVA, except that the trend for time became non-significant, $F(1, 67) = 2.37, p = .13, \eta_p^2 = .03$. The time x group interaction remained significant, $F(1, 67) = 14.73, p < .001, \eta_p^2 = .18$. Overall, contrary to expectations, recall results suggest no significant group differences other than the surprising finding that the High SA group forgot more feedback over time than the Low SA group.

3.2.5. Memory for Neutral Information—To test for differences in memory for neutral situational information, a 2 (time) x 2 (target) x 2 (social anxiety group) repeated measures ANOVA was conducted, with quiz scores as the dependent variable. Not surprisingly, results indicated a main effect for time, $F(1, 74) = 6.21, p = .02, \eta_p^2 = .08$, with more neutral information being remembered at Visit 1 than at Visit 2. There was also a main effect for target, $F(1, 74) = 41.08, p < .001, \eta_p^2 = .36$, such that participants remembered more information from their own speech than from the confederate's. These same main effects were found when BDI score was used as a covariate. However, the main effect for time disappeared when baseline PANAS scores were covaried. No significant group differences or interactions were found (all $p > .10$), suggesting that the observed high social anxiety memory biases are specific to recognition for speech feedback.

3.3. Relationships between Post-Event Processing, Social Anxiety, and Memory

The mean item rating on the PEPQ was compared between the social anxiety groups to examine differences in post-event processing. As expected, the High SA group reported significantly more rumination about their speech performance on the PEPQ than the Low SA group, $t(74) = 3.51, p = .001, d = 0.82$. Correlations between PEPQ scores and memory variables were computed to further investigate the relationship between memory and post-event processing. See Table 3 for correlations between recall, recognition, and social anxiety symptoms and post-event processing. As hypothesized, participants' PEPQ scores were significantly correlated with the number of negative items they recalled from their own feedback at Visit 2 and were also correlated with recognition valence for negative self-relevant feedback items at Visit 2. Correlations between PEPQ scores, recall and recognition of positive items, and memory for the confederate's feedback were not significant (all $p > .10$). Interestingly, general rumination (as measured by the RSQ-RRS) was not significantly correlated with any memory variables (all $p > .10$), suggesting that only negative rumination specific to the social event (i.e., post-event processing) affects memory for one's social performance. The pattern of correlations was similar for both SA groups. Furthermore, as expected, social anxiety scores on the SIAS were also related to recall and recognition bias for negative feedback items (see Table 3).

We then conducted a mediation analysis to see if post-event processing could explain the relationship between social anxiety and negative item recognition bias at Visit 2. Although post-event processing has been linked to both social anxiety and memory bias, the relationship between these three variables has not yet been explored. If post-event processing is a mediator, it may help explain why some socially anxious individuals show a memory bias only after having time to ruminate on their perceived failures. As Figure 4 illustrates, the relationship between social anxiety symptoms and negative item recognition decreased substantially and became non-significant when controlling for post-event processing (reducing from $\beta = -.29, p < .05$, to $\beta = -.16, p > .10$). The other conditions for mediation were also met: social anxiety symptoms were a significant predictor of negative item recognition ($\beta = -.29, p = .01$) and of post-event processing ($\beta = .42, p < .01$), and post-event processing was a significant predictor of negative item recognition when controlling social anxiety ($\beta = -.31, p = .01$). Sobel's statistic was 2.17, $p = .03$, indicating that post-event processing is indeed a mediator of the relationship between social anxiety and negative item recognition.

4. Discussion

The current study adds to the memory and social anxiety literature by measuring recognition as well as recall to investigate differences in memory for the self versus another person for positive, negative, and neutral information. In addition, this study extends the research done

on the role of post-event processing in predicting a memory bias in social anxiety. It was expected that after receiving performance feedback and having time for post-event processing, participants high in social anxiety (versus low) would show a memory bias such that they would remember their own feedback as more negative than it actually was but would remember a confederate's feedback as more positive than it actually was. Using recall tests produced null results, consistent with many previous investigations. However, recognition tests demonstrated memory biases in the high social anxiety participants, such that they showed more positively biased recognition for the confederate's feedback compared to their own. They also demonstrated negatively biased recognition (relative to the low social anxiety group) for negative items immediately after receiving them and for positive items over time. In addition, post-event processing was associated with more negatively biased memory of negative feedback items after a delay and mediated the relationship between social anxiety symptoms and negatively biased recognition.

4.1. Memory Biases in Recognition but not Recall

Findings for recognition memory showed that, overall, both social anxiety groups remembered performance feedback as more positive than it actually was and remembered it even more positively over time. These results are consistent with the self-enhancement bias literature in the social cognition field, which proposes that people are motivated to maintain or increase a positive self-concept, even in the face of contradictory information (see review by Leary, 2007). Despite the overall positivity bias shown in recognition ratings, participants high in social anxiety did show a memory bias relative to those low in anxiety in some areas. First, they were unbiased when recognizing their own feedback valence, but they remembered the confederate's feedback as much more positive than it actually was, a finding that may be described as an "other-enhancement" bias (see also Alden & Wallace, 1995, and Antony et al., 2005). It will be interesting in future work to examine socially anxious individuals' memory for social comparisons directly, rather than assessing memory for self and other individually.

Furthermore, participants high in social anxiety showed differences in how they recognized negative and positive feedback items, relative to those low in social anxiety. For example, they remembered negative feedback items more negatively than the low social anxiety group did immediately after receiving the feedback. Interestingly, this finding suggests the presence of some degree of negative memory bias for socially anxious individuals even before post-event processing has occurred. In contrast, participants low in social anxiety not only remembered their negative feedback items more positively than those high in social anxiety, they also had a greater positive bias for negative versus positive items. This finding suggests that people low in social anxiety tend to distort negative feedback to be more positive initially, while those high in social anxiety do not.

Participants high in social anxiety also showed a recognition memory bias in their diminishment of positive feedback over time, as evidenced by their increasing negativity bias in recognition of positive feedback items. Initial recognition ratings for positive feedback items were similar between social anxiety groups but became significantly more negative for the high social anxiety participants after the delay. The divergence between social anxiety groups in recognition memory for positive feedback items over time suggests that some process occurring in the intervening days contributed to the formation of the high social anxiety group's increasingly negative bias for positive items. Although previous research in this area has focused on memory for negative information (e.g., Becker et al., 1999; Mellings & Alden, 2000), this study highlights the importance of investigating memory for positive information as well. Because this information is likely to be inconsistent with socially anxious participants' negative self-schemas, it may be particularly susceptible to distortion over time.

Unlike recognition, recall findings did not demonstrate memory biases specific to social anxiety, replicating the null findings of some earlier studies that used recall only (e.g., Becker et al., 1999; Lundh & Öst, 1997; Wenzel & Holt, 2002). Perhaps people with social anxiety do not spontaneously generate especially biased negative memories, but when given external cues that match the prior social interaction, they demonstrate a memory bias. The need for these cues fits the idea of a latent social rejection schema that requires activation in order to lead to negative self-evaluations (Baldwin, Granzberg, Pippus, & Pritchard, 2003). Recognition may be a more sensitive test of memory bias in social anxiety, because it allows for the use of these cues, though many open questions remain about what types of cues will be necessary to prime biased recognition versus recall. Also, it should be noted that several previous investigators did not find social anxiety group differences using recognition tasks (e.g., Cloitre, Cancienne, Heimberg, Holt, & Liebowitz, 1995; Rapee et al., 1994). However, these studies generally did not use realistic social exposures to elicit social anxiety, and studies that did activate social anxiety using a social stressor (e.g., Mellings & Alden, 2000; Edwards et al., 2003) typically used recall tasks and not recognition. The current study suggests that a number of factors need to be present for memory biases to be observed, including opportunity for recognition of socially relevant cues and use of ecologically valid stimuli from real social interactions.

With regard to neutral topic information, social anxiety status did not make a difference in how much speech topic information was remembered. While these results contradict the findings of some previous studies (e.g., Mellings & Alden, 2000; Hope, Heimberg, & Klein, 1990), they also increase our confidence that the observed memory biases are specific to social feedback and not to recall or recognition memory more generally. In addition, performance on the Digit Span test, which was administered to test general memory ability, was similar between groups. The specificity of the observed memory bias suggests that the results are not due to superior or inferior memory overall in the high social anxiety group.

4.2. Post-Event Processing

As expected, post-event processing did predict memory biases for negative feedback items. Participants who reported more post-event processing showed more negative recognition for these items after the delay. This bias was predicted given the hypothesized negative content of the recurrent, intrusive memories of social failure that characterize post-event processing (Rachman, Grüter-Andrew, & Shafran, 2000). Presumably, activating negative memories through this type of rumination reinforces the evaluations of poor performance. Notably, post-event processing did not predict memory for positive feedback items, perhaps because anxious participants do not ruminate on this information. However, given that the high social anxiety group's recognition ratings for positive feedback items became more negative over time, more research is needed to clarify whether and how post-event processing may have contributed to this effect. Furthermore, post-event processing was a significant mediator of the relationship between social anxiety symptoms and negative recognition. While social anxiety symptoms predicted negatively biased recognition of negative items at the second visit, this relationship diminished when post-event processing was included as a mediator. Although the design of this study does not allow for the detection of a causal relationship, post-event processing may be one mechanism that can help explain *how* an individual with social anxiety develops biased memory for negative self-relevant social information.

4.3. Lack of Positive Bias in Social Anxiety

The surprising finding that individuals high in social anxiety are unbiased in recognition of their feedback, while those low in social anxiety recognized their feedback as much better than it really was, suggests that memory bias in social anxiety may be better conceptualized

as the lack of a normative positive bias than as the presence of a negative bias. As in depressive realism (Alloy & Abramson, 1979), individuals with social anxiety have less biased memory for the valence of their performance feedback, perhaps analogous to a “socially anxious realism.” Those low in social anxiety may be exhibiting a positive bias that has protective effects against the development of problems like depression and social anxiety. It is important to note, however, that on an individual item level, participants high in social anxiety were no more *accurate* than those low in social anxiety, only less positively *biased* with respect to overall recognition valence. Our findings regarding high socially anxious participants’ lack of self-enhancement are provocative, but their practical import is still somewhat unclear.

4.4. Limitations and Conclusions

A limitation in the design of this study is that it is not possible to determine whether participants were actually remembering their feedback as different from what it really was, or if participants could not remember feedback and so made ratings according to their own impressions of their speech. Controlling for participants’ rating of the credibility of the feedback helps to address this issue, but it will be helpful in future research to also take perceived and/or actual performance differences between groups into account. Also, we used an analogue sample and do not know if the same effects would be found in a sample diagnosed with social phobia. However, because the high social anxiety group’s mean score on the Social Interaction Anxiety Scale was higher than the recommended clinical cut-off score for social phobia (Brown et al., 1997), the sample likely included many individuals with clinically significant distress. An additional limitation is the inability to identify the specific thoughts that characterized rumination during post-event processing. For example, participants may have been thinking about their own interpretations of their performance, rather than the feedback that we provided. Use of a thought-sampling technique may be a useful way of addressing this limitation in future research and may also help to identify when post-event processing is most active, since post-event processing may not have peaked during the two-day delay used in our study. Finally, the social anxiety groups also differed on depressive and other symptoms (as expected), and these differences may have contributed to a memory bias, although it should be noted that controlling for baseline affect and depression symptoms did not change the main social anxiety group results.

Despite these limitations, the current results raise a number of interesting issues about when memory biases will be observed in social anxiety. These findings suggest that having another person for comparison, providing recognition cues, and assessing positive as well as negative feedback may help demonstrate social anxiety group differences in memory. Finally, in some cases it is individuals low in social anxiety who show the (positive) bias, suggesting that high social anxiety may be characterized by a lack of normative self-enhancement.

Taken together, these findings indicate that memory is another information processing bias that characterizes social anxiety, providing support for cognitive models and suggesting an explanation for the persistence of negative self-evaluations in individuals high in social anxiety. Because these individuals are remembering other people’s performance as better than their own, they may be setting unrealistic expectations that they feel unable to meet. Such a thought process could lead to an increase in social anxiety for future social situations, which in turn may lead to even more negatively biased memory for themselves compared to others. This idea suggests the possibility of memory training as an intervention for social phobia and supports efforts to target post-event processing in treatment. If clients can be trained to remember more positive aspects of their social performance or if the cycle of post-event processing can be halted, their anxiety, distress, and avoidance may be greatly reduced. Social anxiety is a common and potentially devastating condition, and

understanding how memory biases and post-event processing may contribute to its maintenance will facilitate development of more efficacious forms of therapy.

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Appendix

Sample Feedback Form

	Not at all	Slightly	Moderately	Much	Very much
Seemed confident	0	1	2	3	4
Sounded out of breath	0	1	2	3	4
Was interesting	0	1	2	3	4
Said "um" a lot	0	1	2	3	4
Spoke fluently	0	1	2	3	4
Made a good impression	0	1	2	3	4
Spoke too quickly	0	1	2	3	4
Blushed visibly	0	1	2	3	4
Kept eye contact	0	1	2	3	4
Appeared to be sweating	0	1	2	3	4
Seemed well-prepared	0	1	2	3	4
Was understandable	0	1	2	3	4
Stammered over words	0	1	2	3	4
Looked poised	0	1	2	3	4
Voice quivered	0	1	2	3	4
Voice was audible	0	1	2	3	4
Had long pauses	0	1	2	3	4
Trembled noticeably	0	1	2	3	4
Moved around excessively	0	1	2	3	4
Seemed intelligent	0	1	2	3	4

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Figure 1.

Mean recognition valence for self- and other-relevant feedback.

Note. Combined recognition valence score for all items (positive and negative) and both time points (Visit 1 and Visit 2). Scores above 0 indicate positively biased recognition. Scores below 0 indicate negatively biased recognition.

** $p < .01$

Figure 2.

a. Mean recognition valence for positive self-relevant items as a function of time and social anxiety group status.

b. Mean recognition valence for negative self-relevant items as a function of time and social anxiety group status.

Note. Scores above 0 indicate positively biased recognition. Scores below 0 indicate negatively biased recognition.

* $p < .05$

Figure 3.

Mean recognition valence for negative self-relevant feedback items at Visit 1.

Note. Scores above 0 indicate positively biased recognition. Scores below 0 indicate negatively biased recognition.

* $p < .05$

Figure 4.

Standardized regression coefficients for the relationship between social anxiety symptoms and negative item recognition at Visit 2 as mediated by post-event processing. The standardized regression coefficient between social anxiety symptoms and recognition controlling for post-event processing is in parentheses.

* $p < .05$, ** $p < .01$

Table 1
Descriptive Statistics for High and Low Social Anxiety Groups

Variable	Mean (SD)	
	High SA (n = 42)	Low SA (n = 39)
<i>Social anxiety</i>		
Social interaction anxiety (SIAS)	45.40 (10.92)	6.09 (2.62)
Social performance anxiety (SPS)	25.19 (13.52)	8.99 (6.70)
Fear of negative evaluation (BFNE)	42.73 (8.36)	29.42 (7.22)
<i>Baseline Affect</i>		
Positive affect (PANAS-Positive)	21.24 (5.35)	26.23 (7.59)
Negative affect (PANAS-Negative)	17.76 (4.79)	12.51 (2.65)
<i>Individual difference variables</i>		
Trait anxiety (STAI-Trait)	48.30 (11.01)	35.04 (7.72)
Depression (BDI-II)	13.16 (9.99)	7.40 (5.65)
Memory ability (WAIS-III Digit Span)	19.27 (3.68)	19.10 (3.51)
<i>State anxiety</i>		
Baseline anxiety (SUDS)	42.52 (27.54)	19.00 (19.44)
Peak anxiety during speech (SUDS)	67.55 (23.43)	40.38 (24.95)
Peak anxiety during video (SUDS)	28.74 (23.34)	14.97 (18.20)
<i>Rumination</i>		
Ruminative response style (RSQ-RRS)	53.62 (12.08)	39.47 (9.89)
Post-event processing (PEPQ)	34.81 (16.30)	21.88 (15.81)

Note. SIAS = Social Interaction Anxiety Scale, SPS = Social Phobia Scale, BFNE = Brief Fear of Negative Evaluation Scale, PANAS = Positive and Negative Affect Scale, STAI = State-Trait Anxiety Scale, BDI-II = Beck Depression Inventory – 2nd edition, WAIS-III = Wechsler Adult Intelligence Scale – 3rd edition, SUDS = Subjective Units of Distress Scale, RSQ-RRS = Response Styles Questionnaire – Ruminative Response Scale, PEPQ = Post-Event Processing Questionnaire.

Table 2
Means and Standard Deviations for Recognition Valence Variables by Social Anxiety Group

Recognition valence variables	<u>Social anxiety group</u>	
	High SA	Low SA
Visit 1		
<i>Self</i>		
Positive Items	0.24 (3.45)	0.29 (3.41)
Negative Items	−0.28 (5.09)	2.24 (3.60)
<i>Other</i>		
Positive Items	1.08 (3.72)	0.30 (3.67)
Negative Items	2.95 (3.68)	1.71 (4.32)
Visit 2		
<i>Self</i>		
Positive Items	−0.43 (4.25)	0.79 (3.88)
Negative Items	1.62 (5.74)	2.95 (4.01)
<i>Other</i>		
Positive Items	1.70 (4.28)	0.57 (3.91)
Negative Items	3.76 (5.20)	2.65 (4.33)

Note. Scores above 0 indicate positively biased recognition. Scores below 0 indicate negatively biased recognition.

Table 3
Correlations between Social Anxiety, Post-Event Processing, and Memory

Memory variables		Social anxiety (SIAS)	Post-event processing (PEPQ)
Visit 1	<i>Self</i>	Recall	.16
		Recognition	-.06
	Negative Items	Recall	.23*
		Recognition	-.40**
<i>Other</i>	Positive Items	Recall	.01
		Recognition	.05
	Negative Items	Recall	.04
		Recognition	.09
Visit 2	<i>Self</i>	Recall	.04
		Recognition	-.18
	Negative Items	Recall	.12
		Recognition	-.29*
<i>Other</i>	Positive Items	Recall	.14
		Recognition	-.17
	Negative Items	Recall	.36**
		Recognition	-.38**
	Positive Items	Recall	-.15
		Recognition	.01
	Negative Items	Recall	.13
		Recognition	-.12

Note. A negative correlation for a recognition variable indicates that more social anxiety or post-event processing is associated with more negatively biased recognition of those items. A positive correlation for a recall variable indicates that more social anxiety or post-event processing is associated with more total recall of those items. Thus, correlations for recall and recognition variables indicate a similar pattern.

* $p < .05$

** $p < .01$