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Expectancy bias mediates the link between social anxiety and memory bias for social evaluation

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Abstract

Social anxiety (SA) involves a multitude of cognitive symptoms related to fear of evaluation, including expectancy and memory biases. We examined whether memory biases are influenced by expectancy biases for social feedback in SA. We hypothesized that, faced with a socially evaluative event, people with higher SA would show a negative expectancy bias for future feedback. Furthermore, we predicted that memory bias for feedback in SA would be mediated by expectancy bias. Ninety-four undergraduate students (55 women, mean age = 19.76 years) underwent a two-visit task that measured expectations about (Visit 1) and memory of (Visit 2) feedback from unknown peers. Results showed that higher levels of SA were associated with negative expectancy bias. An indirect relationship was found between SA and memory bias that was mediated by expectancy bias. The results suggest that expectancy biases are in the causal path from SA to negative memory biases for social evaluation.

Keywords

social anxiety; cognitive bias; outcome prediction; peer rejection; self-perception

Social anxiety (SA) is defined as a fear of being in social or performance situations that involve potential evaluation or scrutiny by others, and at clinical levels of SA this fear can be persistent and impairing (American Psychiatric Association, 2000). Severe SA is associated with a negative expectancy bias - a belief that one will appear to others as anxious, shy, or boring when anticipating an uncertain social outcome (Heimberg, Brozovich, & Rapee, 2010). According to the cognitive-behavioral model of SA, negative self-perceptions contribute to the generation and maintenance of SA (Heimberg et al., 2010). Indeed, empirical research in support of this model suggests these persistent negative expectations reflect maladaptive responses upon making prediction errors, whereby anxious individuals fail to adjust expectancies when predicted negative events do not occur (Grupe & Nitschke, 2013). The cognitive-behavioral model of SA also proposes that negative expectations about anticipated social interactions often transfer across social situations

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through related cognitive processes such as biased recall for negative evaluation. However, the interrelations between cognitive processes associated with SA have been a subject of considerably less empirical investigation. An examination of biases that occur both before (expectation) and after (memory) an evaluative event is crucial for understanding cognitive mechanisms linked with SA, and may be useful for determining why SA symptoms persist over time.

A critical cognitive component associated with SA is how memories about social events are formed. In SA, negative events tend to be recalled more frequently than do positive events (Hirsch, Clark, & Mathews, 2006). Yet evidence of negative memory bias in SA is mixed, prompting a need for clearer identification of the conditions in which it does and does not occur. Several studies have found SA-related memory bias of negative social events that signaled imminent social threat (e.g., Bielak & Moscovitch, 2012; Cody & Teachman, 2010). These studies suggest that memory biases for negative evaluations are especially strong in individuals with SA due to the self-relevant nature of the recalled information. Consistent with this view, Cody & Teachman (2010) identified self-focused rumination as a mediator between SA and overly negative recall of social evaluation from others. To this extent, the mixed evidence of memory bias motivated us to examine conditional and mediated links between SA and memory bias that involve self-focused cognitions.

One factor that may elicit memory biases is the presence of expectancy biases prior to an evaluative event. SA is associated with negative expectancy biases, whereby anxious individuals are more likely to have negatively distorted expectations of future social events than non-anxious individuals (e.g., Miles, MacLeod, & Pote, 2004). As such, a negative expectancy bias reflects a tendency for anxious individuals to expect a greater likelihood of negative versus positive events (Cabeleira et al., 2014; MacLeod & Byrne, 1996). Indeed, an individual who sees oneself as someone who is likely to be negatively evaluated may attend to, encode, and remember social experiences in ways consistent with this expectation. Current paradigms used to study for SA have not illuminated the extent to which negative expectancy biases preceding a social event influence later memory for valenced social feedback. Evidence from prediction error research suggests that failure to adjust negative expectancies in response to positive feedback perpetuates negative expectancy bias from one event to the next (Grupe & Nitschke, 2013). This carryover of expectancy bias across events raises the possibility that negative expectations impact how an event is later recalled. Thus, the main goal of this study was to determine if expectancy bias has an indirect influence on the relationship between SA and memory bias.

For the current study, an adapted version of the “Chatroom task” from previous work on SA (e.g., Guyer et al., 2008; Lau et al., 2011) was used in a community sample to simulate social evaluation from unknown peers. The Chatroom task provides a useful method for probing expectancy bias through expected evaluation (e.g., predictions about how positively or negatively one will be evaluated in the future) and memory bias (e.g., recollections about whether one was positively or negatively evaluated in the past) through post-event processing of received positive and negative social evaluations. By leading participants to believe they would receive real-life social evaluation from peers and then engage in a social interaction with one of them, the task simulated imminent social threat. The two-visit time

course of the task allowed us to address our main goal of examining the influence of expectations (Visit 1) on later memory for evaluation (Visit 2). Because we were primarily interested in the thought structures motivating participants' memory judgments of being rejected or accepted, we used a measure of memory bias – response bias – that indexes a person's tendency to remember being rejected or accepted regardless of accuracy.

Our study had two primary aims. For Aim 1 we tested whether SA was associated with expectancy bias for social evaluation. Consistent with prior findings showing negative expectancy biases in individuals with higher levels of SA (e.g., Cabeleira et al., 2014; MacLeod & Byrne, 1996), we hypothesized that SA and expected evaluation would be negatively associated, whereby higher SA would predict more negative expectations about evaluation. For Aim 2 we examined whether expectations about social evaluation mediated the link between SA and response bias. We hypothesized that a negative response bias in higher SA would be conditional upon expected evaluation. Specifically, we anticipated that a person's expectations about future evaluation would serve as a mediating variable in the causal path from SA to response bias, and that in SA this path would be characterized by negative expectancy bias resulting in negative response bias. Furthermore, we speculated that if response biases reflect the thought structures participants had coming into the evaluative event, then response bias would occur independently of memory accuracy for feedback.

Method

Participants

Ninety-four undergraduate students (55 women, mean age = 19.76 years, range = 18–22 years) were recruited from a participant pool for a two-visit experiment. The race/ethnicity breakdown of the sample was 33 Asian, 28 white/Caucasian, 15 of other race, 11 multiracial, 4 Native Hawaiian or other Pacific Islander, and 1 American Indian/Alaska Native. Based on the self-report Liebowitz Social Anxiety Scale (ADD REF) administered during the experiment, 12 participants met criteria for moderate social phobia, nine for marked social phobia, and two for severe/very severe social phobia. These proportions are consistent with those in the general population of 18–29-year-olds (Kessler et al., 2005).

Materials

We used 60 peer stimuli (30 women) in the Chatroom paradigm. These stimuli were headshots of individuals depicting smiling, friendly expressions while positioned in front of a white background. Although participants were led to believe that the headshots represented other study participants, the pictures were actually headshots selected by the experimenters from four existing sets of face stimuli used in past work (Ebner, Riediger, & Lindenberger, 2010; Minear & Park, 2004; Nelson, 2004; Tottenham et al., 2009). Stimuli selection was determined in a validation study in which similarly-aged volunteers judged the ages of the actors in a set of photos; we selected the 60 photos rated as being in participants' age range.

The Chatroom task was programmed and administered using E-Prime software (Sharpsburg, PA) on a laptop in a standard testing room. A digital camera was used to take headshots of

all participants in front of a white background in the testing room. Online profiles were collected through a web domain portal whereby participants gave short answers to basic questions (e.g., favorite hobbies). Participants also completed online questionnaires (SurveyMonkey Inc., Palo Alto, CA).

Procedure

All procedures were approved by the Institutional Review Board. All participants provided informed consent and received course credit for their participation.

The Chatroom task (e.g., Guyer, Caouette, Lee, & Ruiz, 2014) is a two-visit experimental paradigm designed to simulate social evaluation. Both visits occurred in the same testing room, with Visit 2 occurring 1–7 days after Visit 1 and the majority of participants' completing the visits two days apart. During Visit 1, participants were led to believe that this was a nationwide study of how first impressions affect online interactions, and that during Visit 2, they would chat online with a match that was identified for them from among unknown, similarly aged peers at the other study sites. To increase task validity, during Visit 1 participants created an online profile and had their picture taken. Participants were told the peers would view their profile and picture and select whether they wanted to chat with the participant, and that they would follow the same procedure for peers.

At Visit 1, during the selection task, participants were told that they would view information about the study peers and indicate with whom they were interested and not interested in chatting online. While accessing the profiles and pictures, a staged computer error indicated failure to access the online text information and participants were asked to select peers based only on the pictures of the peers; this served to minimize the number of peer features (e.g., hobbies, interests) and extraneous variables that could affect participants' selections. Participants were assured the peers could still see their profiles, and would rate them based on their profiles and photos. Participants rated their interest in chatting with each of 60 peers by placing 30 photographs into an “interested” and 30 into a “not interested” onscreen bin.

At Visit 2, participants were reminded that they would chat with their best match based on the selection tasks. Then they completed the expected evaluation task, during which they viewed the peers again but this time rated how interested the peers would be in chatting with them. During each of the 60 trials, a headshot appeared on the screen with the rating bar superimposed below. Participants were told to move the rating to reflect their prediction (i.e., towards the left = *0-Not at all*; towards the right = *100-Very much*).

Participants then completed the feedback task in which the 60 headshots appeared one at a time, and below each picture, a reminder appeared (2000 msec) regarding whether participants had said they were “interested” or “not interested” in chatting with the peer. The reminder was then replaced with feedback (2000 msec) indicating whether the *peer* had said they were “interested” or “not interested” in chatting with the participant. Feedback was pseudo-randomized, with participants receiving equal numbers of acceptances and rejections by peers from each selection bin and by gender.

Approximately 10 minutes after the feedback task, participants completed a surprise recall test. Participants were told that they would again view the peers they had seen and answer the question, “Was this person interested in you?” After the headshot appeared on the screen, participants left-clicked on a mouse to indicate, “No, not interested,” if they believed that the peer had rejected them, or right-clicked to indicate, “Yes, interested,” if they believed that the person had accepted them. This self-paced task cycled through all 60 photos.

At the end of Visit 2, immediately before debriefing each participant, a funnel debriefing method (Chartrand, van Baaren, & Bargh, 2006) was used to probe for general suspicion and to determine whether participants believed they would be chatting with another person. The experimenter then debriefed participants on the deceptive nature of the task, telling them that they would not actually be chatting with anyone. Participants were grouped into “deceived” (n=71) and “non-deceived” (n=23) categories based on the funnel debriefing and participants' comments following debriefing (e.g., doubted the task's authenticity); this was comparable to adolescent samples who completed Chatroom (Guyer, Benson, et al., 2014; Guyer, Caouette, et al., 2014). As no differences across parameters of task performance or results were observed between deceived and non-deceived participants, all analyses used the full sample.

Measures

Social anxiety (SA)—Trait social anxiety was measured at Visit 1 with the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), which contains 24 self-reported items, 13 concerning performance anxiety and 11 concerning social situations. Each item is rated on degree of fear in different situations from 0 = *none* to 3 = *severe*. Each item is rated again in terms of avoidance frequency for those situations from 0 = *never* to 3 = *usually*. The LSAS provides an overall social anxiety severity score and four subscale scores: 1) performance fear, 2) performance avoidance, 3) social interaction fear, and 4) social interaction avoidance. The LSAS and its subscales are normally distributed and demonstrate excellent internal consistency (Heimberg et al., 1999). Convergent validity of the LSAS has been demonstrated via significant correlations with other commonly used measures of social anxiety and avoidance (Heimberg et al., 1999). We used the LSAS overall severity score in our main analyses (range = 0–144).

Expectancy bias—Expected evaluations were assessed with participants' ratings of how much they expected the peer to reject or accept them, and expectancy bias was determined from these ratings. For each peer, ratings were made on an interval scale from 0–100 with 0 = “Not at all” indicating that participants believed the peer would not be interested in them at all and 100 = “Very much” indicating that participants believed the peer would be very interested in them; 50 was the midpoint and indicated neutrality. Responses across the 60 trials were averaged to obtain a mean expectancy bias score per participant. For clarity of interpretation, mean scores were subtracted from 50 to make 0 the neutral midpoint. Mean ratings above 0 represented a positive expectancy bias while mean ratings below 0 represented a negative expectancy bias.

Response bias—Based on participants' yes/no response to the memory probe ("Was this person interested in you?"), an interval scale for response bias was derived from two proportion scores: recalling accepting feedback when feedback was indeed accepting (hit rate), and recalling accepting feedback when feedback was actually rejecting (false alarm rate). A standard mathematical procedure used in signal detection for yes/no paradigms was used to derive a value for each participant's tendency to favor remembering accepting or rejecting judgments (Stanislaw & Todorov, 1999). This value (*c*) is the distance between the participant's criterion, or the mean likelihood of responding "accepted" or "rejected" across all trials, and the neutral point, or the point at which neither judgment is favored. To derive *c*, we averaged the *z*-scores for the hit rate and false alarm rate:

$$c = \frac{\Phi^{-1}(Hits) + \Phi^{-1}(False\ alarms)}{2}$$

A *c* value of 0 would indicate that a person is equally likely to recall being accepted or rejected, signifying no response bias. Positive values of *c* represent a positivity bias, or a tendency toward recalling being accepted, and negative values of *c* represent a negativity bias, or a tendency toward recalling being rejected. Responses across all feedback trials were used to generate a single, continuous *c* score of response bias per participant.

Memory accuracy—Three memory accuracy scores were calculated for each participant: proportion of all peers correctly recalled, proportion of rejecting peers correctly recalled as rejecting, and proportion of accepting peers correctly recalled as accepting.

Social evaluation type—During the feedback task in Visit 2, participants received an equal number of randomized acceptances (i.e., the peer is interested) and rejections (i.e., the peer is not interested) from the same peers whom they had rated during Visit 1 and predicted evaluation from in Visit 2.

Participant age, sex, race/ethnicity, IQ, and deception status were included in all analyses as control variables. All statistical analyses were conducted using R software.

Results

SA and expectancy bias

We used general linear regression to examine the association between SA and expectancy bias, with SA as a predictor plus all control variables. Expectancy bias rating was the criterion variable. As predicted, a negative linear relationship between SA and expected evaluation was found, $B = -.19$, $SE = .04$, $t(87) = -4.70$, $p < .001$. Participants with higher levels of SA had more negative expectations about evaluation, consistent with negative expectancy bias in high SA (Figure 1). All control variables were nonsignificant.

Expectancy bias as a mediator of the SA-response bias link

In order to assess whether expectancy bias is in the causal path between SA and response bias, we conducted a mediation analysis using bootstrapping (5,000 resamples; Preacher &

Hayes, 2008). Response bias was the outcome variable, expectancy bias served as the mediator, and SA and control variables were entered as predictors. All control variables were non-significant predictors in the mediation model. To establish mediation, we confirmed three links among the entered predictors (see Figure 2 for standardized regression coefficients of the paths). First, the model tested for a direct link (the total effect) between SA and response bias. The direct link from SA to response bias, a common, but not required condition for mediation (MacKinnon, Fairchild, and Fritz, 2007), was nonsignificant, $B = .000$, $SE = .003$, $t(87) = .000$, $p = 1.00$. We speculated that expectancy bias might be a suppressor variable which increases the predictive validity of another variable when included in a regression equation (MacKinnon, Fairchild, & Fritz, 2007). A suppression effect is present when the coefficient values for the direct and indirect effects of an independent variable on a dependent variable have opposite signs (Zhao, Lynch, & Chen, 2010). We tested this possibility by completing the remaining steps of the mediation model.

The second link we established for mediation was between SA and expectancy bias. This result is reported above, and it was also reconfirmed in the mediation model using bootstrapping, $B = -.19$, $SE = .04$, $t(87) = 4.70$, $p < .001$. The third link we confirmed was between expectancy bias and response bias, $B = .02$, $SE = .01$, $t(87) = 2.63$, $p = .01$. As the last step for testing mediation we entered SA and expectancy bias simultaneously. In this model, expectancy bias remained a significant predictor of response bias ($B = .02$, $SE = .01$, $t(86) = 2.95$, $p < .01$). A significant indirect effect of SA through expectancy bias was confirmed ($B = -.004$, $SE = .002$) at a 95% bias-corrected CI (−.0076 to −.0012), establishing that expectancy bias is in the causal path between SA and response bias.

Taken together, our results suggest that expectancy bias is a suppressor variable that mediates the link from SA to response bias. First, the significance of the indirect effect established expectancy bias as a mediator. Second, the direct effect of SA with the mediator present increased relative to the total effect of SA in the absence of the mediator ($B = .004$, SE −.00, $t(86) = 1.33$, $p = .19$). This is consistent with criteria for a suppression effect (MacKinnon et al., 2007). Third, the direct effect ($B = .004$) and indirect effect ($B = -.004$) coefficients are opposite in sign, which further indicates expectancy bias as a suppressor variable (Zhao et al., 2010).

Memory accuracy

We used general linear regression to examine whether SA influenced memory accuracy of peer feedback independent of response bias. The first model included mean memory accuracy across all acceptance and rejection trials as the criterion, the second included rejection trials only, and the third included acceptance trials only. SA was added as a predictor in each model, along with all control variables. SA was a nonsignificant predictor of memory accuracy across all trials ($B = .001$, $SE = .001$, $t(87) = 1.08$, $p = .28$), all rejection trials ($B = .001$, $SE = .001$, $t(87) = .91$, $p = .37$), and all acceptance trials ($B = .001$, $SE = .001$, $t(87) = .89$, $p = .38$). All control variables were nonsignificant predictors of memory accuracy in the three models.

Discussion

In the current study, we examined the impact of social anxiety on expectancy bias and response bias for social evaluation. In Aim 1 we assessed whether individuals with higher levels of SA had more negative expectations about evaluation in a peer evaluative context. Consistent with prior studies of SA (Cabeleira et al., 2014; Miles et al., 2004) and with our hypothesis, more negative expected evaluations were related to higher levels of SA. As the intercept for expectancy bias was at the neutral point, we interpret our findings as evidence of an increasing negativity bias, distinct from a decreasing positivity bias (Hirsch & Clark, 2004). Our results suggest that anticipating a real-life social evaluation is a condition that evokes negative expectancy biases for those who experience high levels of SA. This interpretation is consistent with the viewpoint that fear and avoidance in SA is related to exaggerated cognitive estimates of the likelihood for negative evaluation (Heimberg et al., 2010).

In Aim 2, we examined whether response bias for socially evaluative outcomes in SA reflects perceptions of how others would judge one's self (i.e., expectancy bias). We found evidence of a significant indirect effect of SA on response bias at Visit 2 through expectancy bias at Visit 1 in a model that met criteria for full mediation (Preacher & Hayes, 2008). Notably, the addition of expectancy bias to our model actually increased the direct effect of SA, indicating that expectancy bias was a suppressor variable that fully accounted for an existing relationship between SA and response bias. The present results support our hypothesis that a person's expectations about future evaluation would mediate the causal path from SA to response bias. Specifically, increasing SA levels predicted increasingly negative expectancy bias, which in turn predicted more negative response bias. These results support a role for expectancy bias in contributing to response bias for social evaluation. The influence of negative expectations on memory is consistent with prior literature indicating that negative self-imagery can bias recall of self-relevant information (Hirsch et al., 2006). Negative expectations leading into an evaluative event may represent one dimension of self-imagery that is later activated during retrieval of memories about that event, resulting in negatively distorted recall. Notably, response bias was linked to SA in the absence of any SA-based differences in memory accuracy, suggesting that memory judgments may have been intrinsically tied to participants' pre-existing thought structures rather than to episodic recollections of the feedback.

The current study is not without limitations. Because we assessed trait SA in a community sample, further research is needed to determine the function of expectancy and response biases for social evaluation in a clinical sample. Nevertheless, the robustness of our findings in a nonclinical sample suggests that even individuals with subclinical levels of SA may demonstrate biases in their cognitive processing of socially evaluative outcomes. Our analyses also did not address participants' motivations for chatting with certain peers after the study. Specific reasons for choosing who they did/did not want to chat with may have impacted which sets of peers were memorable to them. Future work should account for the nuances of how personal goals for social interaction affect an anxious person's expectations going into the event and subsequent memory for specific types of peers. Finally, we focused

on response bias for recollecting feedback across all peers. Future work would benefit from examining instances of recollecting feedback for each individual peer.

Our results provide compelling evidence that in SA, negativity bias in memory for self-relevant social evaluation is influenced by earlier negative expectations preceding an evaluative event. To our knowledge, this is the first study to link SA with response bias through expectancy bias. Our study also adds further support to the cognitive-behavioral model of SA (Heimberg et al., 2010), which proposes that a multitude of cognitive symptoms interact to sustain the experience of SA across situations. Further study can test this proposition by examining whether expectancy and recall biases are mutually reinforcing – that is, whether socially anxious people form negative expectations about future evaluation based on negative interpretations of past evaluation. Finally, our results suggest that reducing negative expectations about social events may be a useful treatment strategy that helps reduce other cognitive symptoms of clinical SA.

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References

American Psychiatric Association. Diagnostic criteria from DSM-IV-TR. 2000; xii:370.

Bielak T, Moscovitch DA. Friend and foe? Memory and expectancy biases for faces in social anxiety. Journal of Experimental Psychopathology. 2012; 3(1):42–61. doi: http://dx.doi.org/10.5127/jep.19711.

Cabeleira CM, Steinman SA, Burgess MM, Bucks RS, MacLeod C, Melo W, Teachman BA. Expectancy bias in anxious samples. Emotion. 2014; 14(3):588–601. doi: 10.1037/a0035899. [PubMed: 24798678]

Chartrand TL, van Baaren RB, Bargh JA. Linking automatic evaluation to mood and information processing style: Consequences for experienced affect, impression formation, and stereotyping. Journal of Experimental Psychology, General. 2006; 135(1):70–77. doi: 10.1037/0096-3445.135.1.70. [PubMed: 16478316]

Cody MW, Teachman BA. Post-event processing and memory bias for performance feedback in social anxiety. Journal of Anxiety Disorders. 2010; 24(5):468–479. doi: http://dx.doi.org/10.1016/j.janxdis.2010.03.003. [PubMed: 20399601]

Ebner N, Riediger M, Lindenberger U. FACES - A database of facial expressions in young, middle-aged, and older women and men: Development and validation. Behviour Research Methods. 2010; 42:351–362. doi: 10.3758/BRM.42.1.351.

Grupe DW, Nitschke JB. Uncertainty and anticipation in anxiety: An integrated neurobiological and psychological perspective. Nature Reviews Neuroscience. 2013; 14(7):488–501. doi: 10.1038/nrn3524.

Guyer AE, Benson B, Choate VR, Bar-Haim Y, Perez-Edgar K, Jarcho JM, Nelson EE. Lasting associations between early-childhood temperament and late-adolescent reward-circuitry response to peer feedback. Development and Psychopathology. 2014

Guyer AE, Caouette JC, Lee CC, Ruiz SK. Will they like me? Adolescents' emotional responses to peer evaluation. International Journal of Behavioral Development. 2014; 38(1) doi: 0.1177/0165025413515627.

Guyer AE, Lau JY, McClure-Tone EB, Parrish J, Shiffrin ND, Reynolds RC, Nelson EE. Amygdala and ventrolateral prefrontal cortex function during anticipated peer evaluation in pediatric social anxiety. Archives of General Psychiatry. 2008; 65(11):1303–1312. doi: 10.1001/archpsyc.65.11.1303. [PubMed: 18981342]

Heimberg RG, Brozovich FA, Rapee RM. A cognitive behavioral model of social anxiety disorder: Update and extension. Social Anxiety: Clinical, developmental, and Social Perspectives. 2010:395–422.

Heimberg RG, Horner KJ, Juster HR, Safren SA, Brown EJ, Schneider FR, Liebowitz MR. Psychometric properties of the Liebowitz Social Anxiety Scale. Psychological Medicine. 1999; 29:199–212. [PubMed: 10077308]

Hirsch CR, Clark DM. Information-processing bias in social phobia. Clinical Psychology Review. 2004; 24(7):799–825. doi: http://dx.doi.org/10.1016/j.cpr.2004.07.005. [PubMed: 15501557]

Hirsch CR, Clark DM, Mathews A. Imagery and interpretations in social phobia: Support for the combined cognitive biases hypothesis. Behavior Therapy. 2006; 37(3):223–236. doi: 10.1016/j.beth.2006.02.001. [PubMed: 16942974]

Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Archives of General Psychiatry. 2005; 62(6):593–602. doi: 10.1001/archpsyc.62.6.593. [PubMed: 15939837]

Lau JYF, Guyer AE, Tone EB, Jenness J, Parrish JM, Pine DS, Nelson EE. Neural responses to peer rejection in anxious adolescents: Contributions from the amygdala-hippocampal complex. International Journal of Behavioral Development. 2011; 36(1):36–44.

Liebowitz MR. Social phobia. Modern Problems of Pharmacopsychiatry. 1987; 22:141–173. [PubMed: 2885745]

MacKinnon DP, Fairchild AJ, Fritz MS. Mediation analysis. Annual Review of Psychology. 2007; 58:593–614. doi: 10.1146/annurev.psych.58.110405.085542.

MacLeod AK, Byrne A. Anxiety, depression, and the anticipation of future positive and negative experiences. Journal of Abnormal Psychology. 1996; 105(2):286–289. [PubMed: 8723011]

Miles H, MacLeod AK, Pote H. Retrospective and prospective cognitions in adolescents: anxiety, depression, and positive and negative affect. Journal of Adolescence. 2004; 27(6):691–701. doi: 10.1016/j.adolescence.2004.04.001. [PubMed: 15561311]

Minear M, Park DC. A lifespan database of adult facial stimuli. Behavior Research Methods, Instruments, & Computers. 2004; 36:630–633.

Nelson, EE. Section on Development and Affective Neuroscience. National Institute of Mental Health; Bethesda, MD: 2004. Adolescent and Adult Facial Expressions Stimuli Database.

Preacher, KJ.; Hayes, AF. The Sage Sourcebook of Advanced Data Analysis Methods for Communication Research. Sage Publications, Inc.; Thousand Oaks, CA: 2008. Contemporary approaches to assessing mediation in communication research; p. 13-54.

Stanislaw H, Todorov N. Calculation of signal detection theory measures. Behavior Research Methods, Instruments, & Computers: A Journal of the Psychonomic Society, Inc. 1999; 31(1):137–149.

Tottenham N, Tanaka JW, Leon AC, McCarry T, Nurse M, Hare TA, Nelson CA. The NimStim set of facial expressions: Judgments from untrained research participants. Psychiatric Research. 2009; 168(3):242–249.

Zhao X, Lynch JG, Chen Q. Reconsidering Baron and Kenny: Myths and truths about mediation analysis. Journal of Consumer Research. 2010; 37(2):197–206.

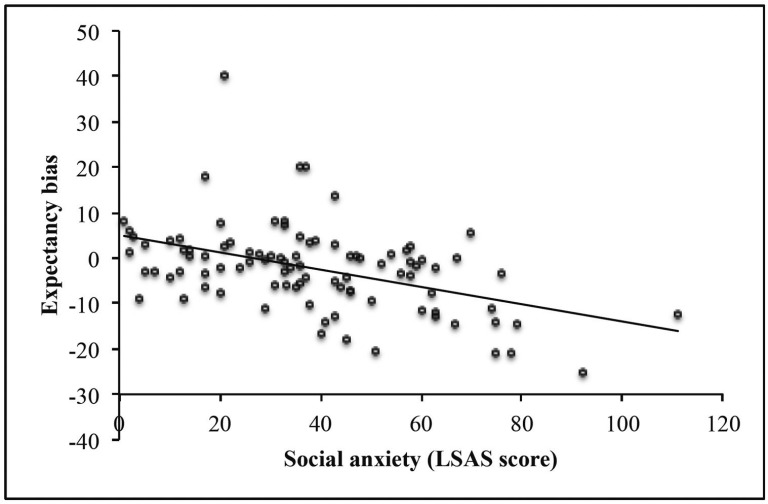

Figure 1.

General linear model of expectancy bias regressed on social anxiety (SA). A negative linear relationship between SA and expectancy bias was found, $B = -.19$, $SE = .04$, $t(87) = -4.70$, $p < .001$. Positive scores (above 0) indicate a positive expectancy bias while negative scores (below 0) indicate a negative expectancy bias. Participants with more severe SA had more negative expectations about evaluation. The model controlled for participant age, sex, ethnicity, IQ, and deception status.

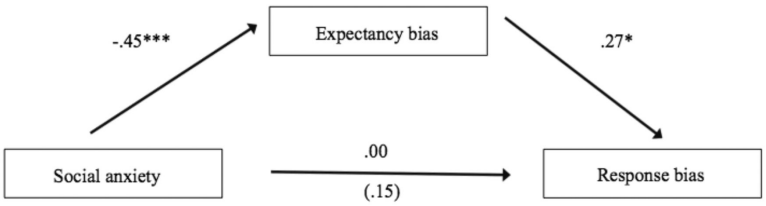

Figure 2.

Mediation model with standardized regression coefficients for the relationship between social anxiety and response bias at Visit 2 as mediated by expectancy bias at Visit 1. The standardized regression coefficient between social anxiety (SA) and response bias controlling for expectancy bias is in parentheses. SA predicted expectancy bias, which in turn predicted response bias. The total effect of SA on response bias (in the absence of expectancy bias) was nonsignificant, $p = 1.00$. The direct effect of SA on response bias (when expectancy bias was included in the model) was also nonsignificant, $p = .19$), while the indirect effect of SA on response bias through expectancy bias was significant at a 95% bias-corrected CI (−.0076 to −.0012). Expectancy bias fully mediated the relationship between SA and response bias.

* $p < .05$

*** $p < .001$