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The Affective Tie That Binds: Examining the Contribution of Positive Emotions and Anxiety to Relationship Formation in Social Anxiety Disorder

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Abstract

Individuals with social anxiety disorder (SAD) have difficulty forming social relationships. The prevailing clinical perspective is that negative emotions such as anxiety inhibit one's capacity to develop satisfying social connections. However, empirical findings from social psychology and affective neuroscience suggest that *positive* emotional experiences are fundamental to establishing new social bonds. To reconcile these perspectives, we collected repeated measurements of anxiety, positive emotions (pleasantness), and connectedness over the course of a controlled relationship formation encounter in 56 participants diagnosed with SAD (64% female; M_{age} = 23.3, *SD* = 4.7). Participants experienced both increases in positive emotions and decreases in anxiety throughout the interaction. Change in positive emotions was the most robust predictor of subsequent increases in connectedness, as well as a greater desire to engage one's partner in future social activities, above and beyond reductions in anxiety (medium to large sized effects). Those findings suggest that anxiety-based models alone may not fully explain difficulties in relationship formation in SAD, and underscore the potential value of considering positive emotional experiences in conceptual and treatment models of SAD.

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Social relationship impairment is one of the more pernicious effects of social anxiety disorder (SAD). Individuals with SAD tend to have difficulty establishing and maintaining fulfilling relationships with others (e.g., Ledley, Erwin, & Heimberg, 2008; Rodebaugh, 2009; Schneier et al., 1994; see Alden & Taylor, 2004, 2010 for reviews). Given that anxiety represents a core, defining feature of SAD (American Psychiatric Association, 2013), the prevailing view of relational impairments in SAD is that heightened anxiety activated by fears of negative evaluation and rejection fuels avoidance behaviors that inhibit the development of satisfying connections with others. Accordingly, empirically supported treatment approaches for SAD (e.g., exposure-based and cognitive behavioral therapies) target anxiety-related affective processes in the service of reducing social avoidance (Clark et al., 2006; Gordon, Wong, & Heimberg, 2014; Hofmann & Otto, 2008). However, studies of relationship development outside of the clinical psychological science literature suggest that *positive* emotional experiences are fundamental to establishing social bonds, above and beyond negative affective experiences (e.g., Strong & Aron, 2006; see Ramsey & Gentzler, 2015 for a review). Given that positive emotions do not play a central role in current conceptual and treatment models for SAD, an important yet unresolved issue is whether anxiety, positive emotions, or both account for relationship impairments in SAD.

SAD is characterized by inflated appraisals of the likelihood and cost of negative social outcomes (Foa, Franklin, Perry, & Herbert, 1996; Wilson & Rapee, 2005), which activate heightened anxiety and avoidance behaviors intended to curtail predicted negative social outcomes (Clark, 2001; Clark & Wells, 1995; Heimberg, Brozovich, & Rapee, 2014; Hofmann, 2007). Anxiety and avoidance conceivably limit opportunities for establishing relationships with others as well as inhibit one's capacity to connect with others during social encounters due to elevated perceptions of threat. Even positive social encounters activate anxiety, self-protective social goals, and negative predictions about future social events in individuals with SAD (Alden, Mellings, & Laposa, 2004; Alden, Taylor, Laposa, & Mellings, 2008; Wallace & Alden, 1997) – outcomes that would be expected to short-circuit the process of friendship development. By this account, reductions in anxiety should facilitate relationship formation in individuals with SAD. To our knowledge, this hypothesis has yet to be empirically tested.

Although SAD has historically been classified, conceptualized, and treated from an anxiety-focused perspective, studies on relationship development in non-clinical samples suggest that *positive* emotions are critical to promoting and strengthening social bonds (Ramsey & Gentzler, 2015). Positive emotions promote openness to new experiences and increased exploratory behavior (Fredrickson, 2013), which may enhance one's capacity to capitalize on new relationship opportunities. Moreover, neural circuits that regulate responses to reward-relevant stimuli (e.g., striatum, orbitofrontal cortex) are also involved in processing *social* rewards (e.g., receiving positive social feedback; Izuma, Saito, & Sadato, 2008), and thus may operate to reinforce our connections with others (Fareri, Niznikiewicz, Lee, &

Delgado, 2012; for reviews see, Bhanji & Delgado, 2014; Eisenberger & Cole, 2012; Fareri & Delgado, 2014; Vrticka, 2012). Experimental evidence demonstrates that increases in positive emotions heightened one's desire to engage in social activity (Whelan & Zelenski, 2012) and predicted subsequent increases in feelings of connectedness with others (Fredrickson et al., 2008; Kok et al., 2013). Further, positive emotions experienced towards the beginning of relationships between new roommates correlated with a sense of connectedness between those roommates, whereas negative emotions did not account for connectedness when considered in conjunction with positive emotions (Waugh & Fredrickson, 2006; see also Strong & Aron, 2006). Thus, extant findings suggest that positive emotional experiences are fundamental in supporting the development of new relationships, even above negative emotions.

Although a classical feature of SAD is heightened negative affect (i.e., anxiety) in social situations, SAD is also reliably associated with low levels of positive affect, even when statistically accounting for shared variance with depression and low sociability (Brown, Chorpita, & Barlow, 1998; Kashdan, 2007; Kashdan, Weeks, & Savostyanova, 2011; Naragon-Gainey, Watson, & Markon, 2009; Watson & Naragon-Gainey, 2010). Moreover, individuals with SAD experience fewer positive emotions during everyday social interactions compared to their non-anxious counterparts (Kashdan et al., 2013). In contrast with cognitive behavioral conceptualizations of SAD, the relational literature suggests that low positive emotions that accompany SAD may interfere with developing a sense of connection with others, and may decrease the individual's incentive to seek out opportunities to connect with others following a positive exchange. Given that positive and negative emotions arise from at least partially distinct biobehavioral systems (Davidson, Jackson, & Kalin, 2000; Gable & Berkman, 2008), they may operate independently to influence the development of social connections in SAD. Moreover, cognitive and behavioral models emphasizing anxiety-related processes and relational theories emphasizing positive emotional experiences are not mutually exclusive, leaving open the possibility that *both* affective processes may be important in understanding relationship formation in SAD.

Initial evidence supports the contribution of positive emotions to relationship formation outcomes in socially anxious samples. Kashdan and Roberts (2004) investigated the association between positive and negative affect and interpersonal outcomes during a controlled relationship formation encounter in individuals with high vs. low levels of social anxiety. Across all participants (high and low social anxiety groups), trait positive affect was significantly and positively associated with interpersonal attraction towards one's conversation partner (i.e., partner liking), even after controlling for shared variance with trait negative affect, which itself was not significantly associated with partner liking. Social anxiety group status did not moderate those relationships. Similarly, across the entire sample, participants who experienced greater state positive affect (averaged across the mid- and end-point of the interaction) reported greater attraction and closeness to their partner (medium to large effects), whereas state negative affect was significantly negatively correlated with closeness (small-to-medium effect), but not with interpersonal attraction.

The goal of the current study was to build upon prior research by examining whether changes in positive emotions and anxiety unfolding throughout the course of a relationship

formation opportunity in an SAD sample accounted for factors that are important for establishing a new relationship, namely perceived connectedness and future approach motivation (i.e., the drive to seek out and engage in further contact with a target individual). Individuals meeting diagnostic criteria for SAD took part in a controlled laboratory-based relationship-building task previously shown to facilitate interpersonal closeness (Aron, Melinat, Aron, Vallone, & Bator, 1997; Kashdan & Roberts, 2004; Taylor & Amir, 2012). Closeness-generating paradigms represent one type of anxiety-provoking social context that is difficult for individuals with heightened social anxiety (e.g., Meleshko & Alden, 1993). In light of the temporal nature of relationship development, we assessed participants' subjective positive emotions (i.e., pleasantness), anxiety, and connectedness at repeated intervals throughout the task. This approach allowed us to examine the evolution of positive and negative emotional experiences as the relationship formation encounter progressed over time, as well as their relationship to subsequent changes in perceived social connectedness and future approach motivation. Based on prior literature regarding the functions of positive emotions and anxiety, we hypothesized that increases in positive emotions as well as decreases in anxiety would predict subsequent increases in participant-rated connectedness and post-interaction desire to engage their conversation partner in future social activities. We explored the unique contributions of changes in each affective experience to strengthening connectedness and future approach motivation in order to identify emotional processes that may be fundamental in supporting relationship formation in SAD.

Method

Participants

The sample comprised 56 treatment-seeking individuals who met criteria for a principal diagnosis of Social Anxiety Disorder (SAD) as assessed using the SAD module of the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM– IV-TR; American Psychiatric Association, 2000) Axis 1 Disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 2002)[1]. Participants were recruited through clinical referrals as well as posted announcements in community and online settings (e.g., ResearchMatch.org). The Mini International Neuropsychiatric Interview (MINI Version 7.0.0; Sheehan et al., 1998)[2] was administered to assess comorbid diagnoses (e.g., other anxiety disorders, major depressive disorder) and exclusionary diagnoses (e.g., psychosis). The MINI was used because of its relative brevity and good inter-rater reliability (Sheehan et al., 1998). Diagnostic assessments were conducted by a PhD-level clinician, a PhD student in clinical psychology, and two post-baccalaureate clinical research coordinators, all of whom received extensive training in the interview protocols. Diagnostic consensus was reached by reviewing completed interviews during team meetings with the first author, with consultation provided by the third author, both of whom possess considerable experience assessing and treating SAD. Exclusionary criteria were: (1) active suicidal ideation with intent or plan; (2) moderate to severe alcohol or marijuana use disorder (past year); (3) all other mild substance use disorders (past year); (4) bipolar I or psychotic disorders; (5)

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[1]Enrollment began prior to the release of the SCID for DSM-5. Interview questions were subsequently scored to reflect DSM-5 criteria for SAD.
[2]We thank David Sheehan for giving us permission to use a preliminary version of the MINI for DSM-5 in this study.

moderate to severe traumatic brain injury with evidence of neurological deficits, neurological disorders, or severe or unstable medical conditions that might be compromised by participation in the study; (6) inability to speak or understand English; (7) concurrent psychotherapy (unless 12-week stability criteria had been met for non-empirically supported therapies only); (8) concurrent psychotropic medication (e.g., SSRIs, benzodiazepines); and (9) characteristics that would compromise safety to complete an MRI scan (e.g., metal fragments in body)[3].

The sample demographic composition was as follows: age (M = 23.3, SD = 4.7), gender (19 men, 36 women, 1 who did not identify with either gender), race (38% White, 34% Asian, 7% Black, 2% Native American/Alaskan Native, 7% more than one race, and 4% identified as 'other'), ethnicity (25% Hispanic); and years of education (M = 15.3; SD = 1.6). Thirty-eight percent of participants reported their annual household income as $50,000 or above; 30.6% reported $20,001 to $50,000; 13.0% reported $5,001 to $20,000, and 18.5% reported $5,000 or less. The majority of participants (84%) identified their marital status as single.

Measures

Symptom measures—Social anxiety symptoms were measured using the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998), a well-established and psychometrically sound 20-item self-report inventory that assesses social interaction anxiety (Brown et al., 1997; Heimberg et al., 1992). We removed the three reverse-scored items following studies demonstrating improved psychometric properties of the 17-item straightforward SIAS (SIAS-SF; Rodebaugh et al., 2011; Rodebaugh, Woods, & Heimberg, 2007; current sample Cronbach's α = .68). Our clinician-rated social anxiety symptom measure was the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), a 24-item scale that poses a variety of social situations that involve interacting with or performing in front of others. Individuals are asked to rate both their level of fear and avoidance for each situation on a 4-point scale ranging from "none/never" to "severe/usually." Items are summed to create a total score reflecting social anxiety severity (current sample Cronbach's α = .88). The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) was used to assess depression symptom severity during the past two weeks. The BDI–II has high internal consistency among college samples and psychiatric outpatients (Cronbach's α = .93 and .92, respectively; current sample Cronbach's α = .90), and sound psychometric properties (Beck et al., 1996; Dozois, Dobson, & Ahnberg, 1998).

State affect—Participants reported their current levels of anxiety and pleasantness (reflecting positive emotion) throughout the relationship formation task. The task was structured such that the participant and their conversation partner (i.e., the confederate) took turns answering a series of six questions about themselves. The participant completed affect ratings after both the participant and their conversation partner had answered each one of the questions. Participants were asked to indicate how they were feeling "right now" using 0-to-100 scales with anchors of *not at all* and *extremely* (i.e., "How anxious do you feel?";

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[3]Participants completed a functional magnetic resonance imaging (fMRI) scan to address a separate research question. Hence, several of the exclusion criteria were implemented to ensure MRI safety and minimize confounding of the imaging findings.

"How pleasant do you feel?"). Thus, a total of six affect ratings were collected, one after each question had been answered by both parties. Single-item scales provide an efficient means to index an individual's current mood state and are commonly used to measure changes in mood in response to laboratory tasks (Arch & Craske, 2006; Tsao & Craske, 2000; Wolpe, 1958). In support of construct validity, the same single item (0–100) ratings of current anxiety and pleasantness rated earlier in the experimental testing session (prior to being informed about the social interaction task) were significantly correlated with well-established, psychometrically sound measures of the same constructs (i.e., the correlation between pleasantness and the positive affect subscale of the Positive and Negative Affect Schedule [PANAS-PA; Watson, Clark, & Tellegen, 1988] was $r = .62$, p < .001, and the correlation between anxiety and the Spielberger State-Trait Anxiety Inventory-State subscale [STAI-State; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983] was $r = .60$, p < .001).

State social connectedness—Following each relationship-building question, participants rated "how connected to your partner do you feel?" on a 0-to-100 scale with anchors of *not at all* and *extremely*.

Approach motivation—The Desire for Future Interaction Scale (DFI; Coyne, 1976) was administered as a measure of motivation to engage in further contact with one's conversation partner. The DFI is a well-established measure used in interpersonal studies of psychopathology (Segrin, 2001). The DFI consists of eight items rated on a 7-point scale with anchors of *not at all* and *very much* that assess the extent to which the rater would be willing to engage in a variety of social activities with their interaction partner in the future (*Sample items:* 'Would you like to spend time with this person in the future?' Would you like to have this person as a friend?'). The individual items of the DFI have been shown to reliably load on a single factor (e.g., Segrin, 1993). Higher scores reflected greater motivation to engage in further contact with one's conversation partner. Prior studies support the reliability and validity of the DFI (Powers & Zuroff, 1988; Voncken & Dijk, 2013; current sample Cronbach's α = .91).

Personnel

Experimenters were undergraduate, post-baccalaureate, or graduate students who were thoroughly trained on the study protocol to deliver scripted instructions to participants. Undergraduate and post-baccalaureate students (age 19–25) served as confederates during the relationship formation task (14 women and 3 men). Confederates were trained to converse in a warm and pleasant manner using a scripted set of verbal and nonverbal behaviors, and to deliver their role in a natural rather than staged way (see Taylor & Amir, 2012). Given several concurrently running studies involving the relationship formation task with a range of clinical and non-clinical participants, confederates were blind to participants' diagnostic status. Experimenters and confederates were blind to the study hypotheses.

Confederate Consistency Check

To evaluate consistency of confederate performance, observers rated confederate behavior while viewing videotapes of the social interaction using five items written to reflect displays of warmth and friendliness (friendly, talkative, disinterested, distant, self-disclosive). Two

participants did not consent to videorecording of their social interactions, thus n=54 for confederate behavior ratings. Items were rated on a 7-point scale with anchors of *not at all* and *very much*, and were summed to create an overall index of confederate warmth and friendliness (scale range = 5–35; current sample Cronbach's α = .77). Examination of the observer ratings of confederate warmth and openness suggested that confederates adhered to the expected behavior (M = 29.00, SD = 2.64).

Procedure

The study procedures were approved by the University of California, San Diego Human Research Protections Program. After receiving information about the study, participants provided informed written consent and completed the diagnostic eligibility assessment, including clinician-administered LSAS and self-report symptom measures (i.e., SIAS, BDI-II). During a separate visit, eligible participants completed the relationship formation task with a trained confederate. The majority of participants (86%) interacted with a female confederate (64% of interactions comprised same-sex dyads). Participants and confederates were not explicitly matched on any demographic characteristics[4].

Immediately prior to the relationship formation task, a given participant was informed that he or she would be getting to know an assistant who worked in the lab, i.e., a confederate. We did not inform participants that the confederate was another subject taking part in the study in order to avoid eliciting negative participant reactions through deception, particularly given that participants were enrolled as part of a larger treatment study. Next, the confederate was introduced to the participant and both received verbal instructions about the task. They were informed that they would get to know one another by taking turns answering questions about themselves, and that the conversation would be videotaped. The conversation task, an abbreviated version of a previously validated relationship-building task (Aron et al., 1997), asked the participant and confederate to take turns responding to a series of six questions, including an initial open-ended ice-breaker question ("Tell your partner a bit about yourself"). The questions were designed to gradually increase in emotional content and the level of self-disclosure they elicited (Taylor & Amir, 2012; Kashdan & Roberts, 2004; 2006 Study 1 for a similar shortened version of this paradigm). Participants were randomly assigned to complete one of two sets of questions (version A, *n*=28; version B, *n*=28)[5]. See Appendix A for the list of questions. Participants completed state affect and social connectedness ratings each time both they and the confederate had finished answering a question, for a total of six ratings. Ratings were completed on separate forms following each question and out of view from the confederate. The conversation ended after all six questions were answered by both the participant and confederate. Immediately following the conversation, the confederate left the room, and participants completed the DFI.

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[4]Given that the match (or mismatch) between participant and confederate demographic characteristics (e.g., gender) could ostensibly influence relationship formation processes, we conducted several sensitivity analyses in which participant age and the correspondence between participant and confederate gender (i.e., same vs. opposite sex dyads) were entered as covariates in the statistical models. Results revealed that accounting for participant age, or whether dyads were same vs. opposite sex did not alter the patterns of significance reported in the main text.
[5]Two question sets were used because participants completed the relationship formation task on a second occasion (i.e., post-treatment) as part of a clinical trial. Sensitivity analyses were conducted in which question set (A vs. B) was entered as a covariate in the statistical models. All statistically significant findings reported for the main analyses were robust in those sensitivity analyses.

Overview of Statistical Analyses

Our first research question examined the process of change in state affect, i.e., positive emotion (pleasantness) and anxiety, and the development of interpersonal connectedness throughout the course of a relationship formation encounter. We asked the question: Do increases in positive emotions, decreases in anxiety, or both account for subsequent increases in connectedness in individuals with SAD? The within-task relationship formation data formed a multilevel structure such that repeated measures collected over time (i.e., after each of six intimacy-building questions throughout the task) were nested within participants. The lower level (Level 1) data comprised repeated measures of anxiety, pleasantness, and connectedness that were collected following each question. Level 1 data were nested within upper level units (Level 2), i.e., participants. This data structure is appropriate for hierarchical linear modeling approaches. All analyses were conducted using SPSS version 18.

Our primary model tested whether changes in affect (positive emotion or anxiety) accounted for subsequent changes in connectedness over the course of the relationship formation task. See Figure 1. We first examined the slope in connectedness over time (Figure 1, path c) to determine whether participants felt more connected with their conversation partner as the task progressed. Next, we examined the slopes in pleasantness and anxiety over time (Figure 1a and 1b, respectively, path a) to establish whether and how participants' subjective affect changed over the course of the interaction. We then conducted mediation analyses to examine whether changes in positive emotion and/or anxiety accounted for predicted increases in connectedness over the course of the task. Note that we are referring to mediation in a statistical, not causal sense, such that indirect effects of measured (not manipulated) variables are examined. A lower level mediation approach was used because of the longitudinal nature of the data; that is, the predictor variable (time) and mediators (affect) were Level 1 variables measured repeatedly throughout the task (Bauer, Preacher, & Gil, 2006; Kenny, Korchmaros, & Bolger, 2003). Each mediator (pleasantness and anxiety) was first entered in separate models to establish the presence of indirect effects independent of the effects of changes in the other affective variable. Significant indirect effects were followed by a sensitivity analysis in which both positive emotion and anxiety variables were entered together in a model to establish unique variance accounted for by each affective variable in predicting connectedness. To conduct a more rigorous test of mediation in which the mediator temporally precedes the outcome (Kazdin, 2007), we time lagged the mediator and outcome variable (Aderka et al., 2011; Donegan & Dugas, 2012; Bomyea et al., 2015). That is, we examined whether changes in the mediator at *time t* accounted for changes in the outcome at *time t* + 1. Note that all models described above were time-lagged. That is, we examined the slope of the hypothesized intervening variables (pleasantness and anxiety) at *time t*, whereas the slope of the outcome (connectedness) was examined at *time t*+1.

To test for significant mediation (i.e., the indirect effect of time on connectedness through change in affect), we followed the procedure described by MacKinnon and colleagues (MacKinnon, Fairchild, & Fritz, 2007; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). This procedure tests the product of the coefficients for the effects of the *a* and *b* paths through the construction of asymmetric confidence intervals, given that the *ab* path tends to

be asymmetric. If the 95% confidence interval does not include zero, the mediated effect is considered significant (MacKinnon, Lockwood, & Williams, 2004). We used the program PRODCLIN (MacKinnon et al., 2007) to calculate the asymmetric confidence limits for our analyses. Based on the power simulations conducted by Fritz and MacKinnon (2007), the current sample size was sufficient to detect a significant indirect effect with .80 power and α = .05 for, at minimum, a medium effect in either path a or path b and a large effect in the other path (e.g., a large effect of time on affect [path a] and a medium effect of affect on connectedness controlling for time [path b]).

Our second research question examined whether changes in affect experienced over the course of the relationship formation task predicted participant-rated desire to seek out and engage their conversation partner in future social activities (DFI). To address this question, we first obtained slope and intercept parameter estimates for each participant using a regression-based approach (see Pfister, Schwarz, Carson, & Jancyzk, 2013). The slope estimate represents the rate of change over the course of the interaction in pleasantness or anxiety. Positive slope estimates reflect increases in affect over the interaction whereas negative estimates reflect decreases in affect. To obtain the y-intercept parameter, time was shifted so that intercept estimates represented affect scores (pleasantness or anxiety) at the end of the conversation, i.e., after both the participant and confederate answered the final question. Thus, higher scores reflect greater post-interaction positive emotion or anxiety. Zero-order correlations (Pearson's r) were first examined between participant DFI and slope and intercept estimates for pleasantness and anxiety. Next, separate linear regression models were tested for slope and intercept parameters predicting participant DFI from pleasantness and anxiety together. This analysis allowed us to examine unique variance accounted for in predicting participant future approach motivation from a given affective variable (e.g., pleasantness) while controlling for shared variance with the other affective variable (e.g., anxiety). The current sample size was sufficient to detect, at minimum, $r > .36$ with .80 power and α = .05 (two-tailed; estimated using the R statistical package *pwr* [Champely, 2016]).

Results

Clinical characteristics

Participants exhibited elevated symptoms of social anxiety (LSAS, M = 80.48, SD = 15.71; SIAS-SF, M = 45.86, SD = 6.90) comparable to treatment-seeking samples reported in prior research (e.g., Clark et al., 2006; Rodebaugh et al., 2011). The sample also endorsed mild-to-moderate levels of depression (BDI-II, M = 19.23, SD = 10.63), and met DSM criteria for a range of comorbid conditions: major depressive disorder (current; 26.8%), generalized anxiety disorder (30.4%), panic disorder (1.8%), agoraphobia (5.4%), obsessive compulsive disorder (1.8%), posttraumatic stress disorder (1.8%), mild alcohol use disorder (5.4%), and mild marijuana use disorder (3.6%). Half (50%) of participants reportedly received prior psychological treatment, and 54% previously received psychotropic medication.

Change in affect as a mediator of increases in connectedness during relationship formation

Descriptive information on measures of positive emotion, anxiety, and connectedness are presented in Table 1. Results of the hypothesized mediation models are presented in Figure 1. Table 2 displays outcomes of the statistical analyses for each of these models. Results revealed that time significantly predicted connectedness ratings, such that participants reported feeling increasing levels of connectedness with their conversation partner as the interaction progressed ($B = 3.71$, $p < .001$, path c). Participant-rated affect also changed significantly throughout the interaction such that pleasantness increased ($B = 2.81$, $p < .001$, path a, Figure 1a), and anxiety decreased ($B = -3.33$, $p < .001$, path a, Figure 1b). Thus, over the course of the relationship formation task, participants felt an increasingly greater degree of connection with their partner, as well as increased subjective feelings of pleasantness and decreased anxiety. The mediation analysis sought to clarify the relationship between these outcomes, namely whether changes in affect accounted for subsequent changes in connectedness.

Increases in pleasantness predicted subsequent increases in connectedness when entered in the multilevel model together with time ($B = 0.20$, $p < .001$, path b, Figure 1a). The mediation analysis revealed that the indirect effect (ab) of time on connectedness through increases in pleasantness was significant such that the 95% confidence interval did not overlap with zero ($ab = .5620$; 95% CI [.2588, .9245]). The direct effect of time on increases in connectedness remained significant when controlling for change in pleasantness, which suggested partial mediation ($B = 3.15$, $p < .001$, path c', Figure 1a).

Decreases in anxiety marginally predicted increases in connectedness when entered in the multilevel model together with time ($B = -.084$, $p = .063$, path b, Figure 1b). However, the mediation analysis revealed that the indirect effect (ab) of time on connectedness through decreases in anxiety was not significant, i.e., the 95% confidence interval overlapped with zero ($ab = .2797$; 95% CI [−.0105, .6034]). The direct effect of time on increases in connectedness remained significant when controlling for change in anxiety ($B = 3.43$, $p < .001$, path c', Figure 1b).

Positive emotion and anxiety concurrently predicting connectedness—

Correlations revealed that pleasantness and anxiety were significantly, albeit modestly negatively associated at baseline, $r = -.28$, $p = .036$. To determine the unique variance accounted for by each affective variable in predicting connectedness, we examined the indirect effect of time on connectedness through concurrent changes in both pleasantness and anxiety. Results of this analysis revealed that even when accounting for concurrent changes in the other affective variable, pleasantness significantly increased, $B = 2.00$ ($SE = .46$), $t(68.59) = 4.38$, $p < .001$ (path a), and anxiety significantly decreased over the course of the interaction, $B = -2.46$ ($SE = .51$), $t(67.44) = -4.86$, $p < .001$ (path a). Increases in pleasantness significantly predicted increases in connectedness when simultaneously accounting for time and changes in anxiety, $B = .18$ ($SE = .053$), $t(271.28) = 3.44$, $p = .001$ (path b). The indirect effect (ab) of time on connectedness through increases in pleasantness remained significant when accounting for change in anxiety ($ab = .4338$; 95% CI [.1699, .

7537]. However, change in anxiety was not a significant predictor of changes in connectedness over the course of the interaction when accounting for concurrent changes in pleasantness and time, $B = -.045$ ($SE = .047$), $t(262.80) = -.95$, $p = .34$ (path b). The direct effect of time on connectedness remained significant when controlling for change in pleasantness and anxiety, $B = 3.05$ ($SE = .43$), $t(72.461) = 7.05$, $p < .001$ (path c'), again suggesting partial mediation.

We conducted a sensitivity analysis in which an interaction term for anxiety × pleasantness was entered into the statistical model predicting change in connectedness[6]. Variables were centered at the sample mean prior to computing the interaction term. Results revealed that the interaction of anxiety × pleasantness significantly predicted changes in connectedness, $B = -.0037$ ($SE = .0015$), $t(251.97) = -2.45$, $p = .015$. An examination of the pattern of estimated means from the multilevel model revealed that the association between pleasantness and increases in connectedness was attenuated at higher levels of anxiety. See Figure 2. Consistent with the primary analyses reported in the main text, the main effect of pleasantness on changes in connectedness was also significant, $B = .24$ ($SE = .056$), $t(273.46) = 4.24$, $p < .001$, whereas the effect of anxiety on connectedness was not, $B = -.047$ ($SE = .047$), $t(265.43) = -1.01$, $p = .31$.

Change and endpoint affect as predictors of participant future approach motivation

Both change in pleasantness and end of conversation pleasantness significantly predicted participant future approach motivation, $r(56) = .39$ and $.50$, $p = .003$ and $< .001$, respectively. That is, SAD participants who experienced the greatest increase in positive emotions over the course of the interaction, as well as those with the highest degree of positive emotion at the end of the interaction displayed the greatest desire to engage their conversation partner in future social activities. In contrast, slope estimates for anxiety were marginally inversely related to participant DFI, $r(56) = -.26$, $p = .054$, and post-interaction anxiety (intercept estimates) were not significantly related to participant DFI, $r(56) = -.21$, $p = .12$.

Regression analyses were conducted to predict participant DFI from both pleasantness and anxiety estimates simultaneously. See Table 3. We also tested a sensitivity model that included an interaction term for anxiety × pleasantness[6]; however, the interaction term did not significantly predict DFI in the slope model, $B = .014$ ($SE = .093$), $t(54) = .10$, $p = .92$, nor in the intercept (post-interaction) model, $B = -.076$ ($SE = .002$), $t(54) = -.63$, $p = .53$. Accordingly, only results of the main effect regression models are presented here.

Results of the regression analysis for slope estimates revealed that greater increases in pleasantness significantly predicted participant DFI when controlling for shared variance with change in anxiety, $B = 1.10$ ($SE = .45$), $t(54) = 2.42$, $p = .019$. Slope estimates for anxiety, however, did not significantly predict participant DFI, $B = -.22$ ($SE = .41$), $t(54) = -.54$, $p = .60$. Regression analyses of the intercepts, reflecting affect at the end of the conversation, yielded similar findings: Greater post-interaction pleasantness significantly

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[6]These analyses were conducted following the suggestion of an anonymous reviewer in response to an earlier draft of this article. Given that the interaction of anxiety × pleasantness was not proposed a priori, these analyses should be considered exploratory and used to inform future hypothesis generation.

predicted participant DFI when controlling for post-interaction anxiety, $B = .20$ ($SE = .053$), $t(54) = 3.82$, $p < .001$; however, post-interaction anxiety was not significantly related to participant DFI, $B = -.029$ ($SE = .053$), $t(54) = -.55$, $p = .59$.

Discussion

Individuals with social anxiety disorder (SAD) have difficulty forming relationships with others. The current study sought to reconcile whether changes in anxiety, positive emotions, or both accounted for processes that are important during the initial stages of relationship development. The relationship formation task was sensitive to facilitating interpersonal connectedness, which is notable given the severity of social anxiety symptoms reported by the current sample. Participants experienced reductions in anxiety and increases in positive emotion as the conversation progressed. Critically, increases in positive emotions were the most robust predictor of increasing feelings of connectedness over the course of the interaction, as well as a greater motivation to engage one's partner in future social activities, above and beyond reductions in anxiety. Those findings extend the extant literature and contemporary models of SAD (Clark, 2001; Clark & Wells, 1995; Heimberg et al., 2014; Hofmann, 2007) by underscoring the potential importance of positive emotions in promoting relationship formation in individuals with SAD, a psychiatric condition traditionally classified and conceptualized according to anxiety-related affect. To the extent that difficulty establishing positive connections with others is a core problem for many individuals with SAD (Alden & Taylor, 2004; Rodebaugh, 2009), it may be beneficial to explicitly assess and target positive affective processes in treatment.

The role of positive emotions in facilitating social connections is well-documented (Fredrickson, 2013; Fredrickson et al., 2008; Gable & Berkman, 2008; Kok et al., 2013; Ramsey & Gentzler, 2015; Strong & Aron, 2006). New social encounters set the occasion for incentive cues that signal the potential for establishing a connection with others. Neural systems that regulate responses to the anticipation and receipt of social reward cues (e.g., signs of acceptance) govern subsequent affective, motivational, and behavioral processes that promote friendship development and maintenance (Bhanji & Delgado, 2014; Eisenberger & Cole, 2012; Fareri & Delgado, 2014; Vrticka, 2012). Specifically, increases in positive emotions (Vittengl & Holt, 2000) motivate people to seek out future opportunities to connect with others (Whelan & Zelenski, 2012), thereby creating a self-perpetuating cycle supporting the initiation and strengthening of social bonds (Ramsey & Gentzler, 2015). The current findings build upon earlier research (Kashdan & Roberts, 2004), which together suggest that similar positive affective-relationship formation processes operate for individuals with SAD. Thus, existing theories of SAD may benefit from incorporating knowledge about relationship formation drawn from social psychology and affective neuroscience (e.g., Alden & Taylor, 2010).

Contemporary cognitive and behavioral theories of SAD (Clark, 2001; Clark & Wells, 1995; Heimberg et al., 2014; Hofmann, 2007) emphasize the role of anxiety and fear-related processes in maintaining SAD. Reductions in anxiety throughout the social interaction were marginally associated with greater interpersonal closeness and future approach motivation; however, those relationships were modest in size, particularly when considered in

conjunction with positive emotions. A similar pattern of outcomes emerged for subjective anxiety experienced at the end of the interaction predicting SAD participants' desire to engage their partner in future social activities. Considered together, those findings suggest that positive affective processes may play a more pivotal role (cf. anxiety) in facilitating initial relationship formation. Future experimental studies are needed to test such causal hypotheses. Although initial relationship formation encounters are essential first steps towards establishing a range of social connections (e.g., acquaintances, friends, romantic partners, etc.), it is nevertheless a circumscribed social context that may have unique affective demands. Thus, the current findings may not generalize (nor would they be expected to do so) to other commonly feared social situations such as performance-based tasks. Decreases in anxiety may be a stronger predictor of avoidance behavior reduction in performance-based stress-provoking contexts (e.g., speech tasks) than in interpersonal-based contexts (see however, research demonstrating the role of positive emotions in regulating negative affective states during stress; Fredrickson & Levenson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Tugade & Fredrickson, 2004). Research is needed to examine the role of both positive and anxiety-related affective processes across different types of social contexts commonly feared by individuals with SAD (Kashdan et al., 2013).

The current findings may have important clinical implications. Anxiety reduction is a central target in many prevailing treatment approaches for SAD. Given that negative emotions (e.g., anxiety) and positive emotions are regulated by partially distinct biobehavioral systems (Davidson et al., 2000; Gable & Berkman, 2008), some patients who undergo anxiety reduction-based treatments may experience little change in positive emotions, even if their anxiety is substantially reduced (e.g., Kring et al., 2007). The current findings suggest that it would be informative to assess for changes in positive emotions and relational functioning, in addition to symptoms of anxiety, particularly given that anxiety- and avoidance-focused symptom measures are empirically distinct from measures of social approach behavior and positive social functioning (Alden & Taylor, 2011). While reductions in anxiety likely help to remove barriers to interacting with others, the present findings suggest that, increasing positive emotions may also be needed to facilitate individuals' feelings of connectedness and future approach motivation when they do engage in social interaction. Consistent with that proposal, although contemporary empirically supported treatments (e.g., cognitive behavioral therapy) for SAD reduce symptoms of anxiety, they produce less robust effects on measures of social relationship satisfaction (Eng, Coles, Heimberg, & Safren, 2005). Thus, targeting positive emotions in the service of bolstering stronger social connections may be a fruitful avenue for future clinical research. The exploratory finding demonstrating that the association between increases in pleasantness and connectedness was attenuated at higher levels of concurrent anxiety suggests that anxiety reduction is also likely to be an important target of enhancing relationship formation in SAD. Replication of this post hoc analysis is now needed.

The current data cannot speak to *why* reductions in anxiety and increases in pleasantness occurred throughout the conversation. The experimental relationship formation task was a novel interpersonal context for participants, likely to elicit concerns about what would be required of them (i.e., fears of the unknown; Carleton, 2016) and how their partner would evaluate and respond to them (i.e., fears of evaluation; Heimberg et al., 2014; Weeks &

Howell, 2014). Possible mechanisms underlying changes in affect may have been increases in situational familiarity (i.e., less uncertainty) as well as perceptions of positive outcomes and/or the absence of negative outcomes throughout the social interaction. Research is needed to identify whether changes in anxiety and positive emotions occur through common or distinct pathways during relationship formation in SAD, to identify individual difference characteristics that moderate affective responses (e.g., intolerance of uncertainty; fears of positive or negative evaluation), and to identify interventions that can potentiate desired affective changes.

Several study limitations should be considered. First, positive emotions and anxiety were not experimentally manipulated. Although a temporal statistical relationship was found between increases in pleasantness and connectedness over time, experimental manipulations intended to induce differential affective states would offer stronger evidence to support positive emotions as a causal process underlying the formation of new social connections (e.g., Whelan & Zelenski, 2012). Second, all participants met diagnostic criteria for SAD and displayed elevated symptoms of social anxiety. One could argue that inclusion of a non-clinical comparison group is necessary to establish specificity of the current findings to individuals with SAD. Although specificity is important from a transdiagnostic perspective, the potential impact of the findings in terms of informing conceptual models and treatment approaches for SAD does not hinge on demonstrating specificity per se. That is, regardless of whether the same pattern of relationships is, or is not, observed in non-clinical groups or other psychiatric conditions, the current findings suggest that positive emotions may be an important affective process underpinning relationship formation in SAD, a topic that is under-addressed in contemporary theories and treatments. Nevertheless, it may be valuable for future research to extend the current findings to other psychiatric conditions characterized by relational impairments (e.g., major depression), or to include individuals across a wider spectrum of social anxiety symptom severity.

Several measurement issues also deserve comment. The current findings were based wholly on self-reported outcomes, some of which comprised single item ratings. On the one hand, self-report affords the benefit of measuring individuals' own subjective experiences of their affective states and feelings of connectedness, which are informative in their own right. Moreover, single item rating scales were selected given our goal of obtaining quick, repeated, and relatively unobtrusive measurements throughout the relationship formation encounter. However, these measures do not capture the full range of anxiety and positive emotional experiences, they may not be as robust as multi-item measures, and they rely on participant introspection. It would be beneficial for future research to bolster the validity of self-reported affective outcomes via additional measurement tools, such as physiological or behavioral assessments of affect (e.g., facial expressions). Future studies could also examine dyad-level outcomes, for example, how positive emotions and anxiety in both the target individual and their conversation partner reciprocally influence the generation of connectedness throughout a new relationship formation encounter. Similarly, in assessing desire for future interaction with conversation partners, self-reported motivation was measured rather than actual behavioral engagement. Although approach motivation has previously been linked to numerous positive social outcomes (e.g., Elliot et al., 2006; Gable,

2006), future studies should utilize behavioral measures of subsequent social interaction, in addition to self-report methods.

The current study examined initial relationship formation within a laboratory setting, with trained research assistants in their early 20s serving as interaction partners. In order to determine the generalizability of these findings, the procedures should be replicated in other contexts, including naturalistic settings (e.g., Kashdan et al., 2013) and with interaction partners that more closely resemble the characteristics of people that a given individual encounters in their daily lives. Moreover, the affective and interpersonal processes under investigation may operate differently within contexts that afford the opportunity for developing a romantic partnership. Accordingly, future studies are needed that match participants and their interaction partner on the basis of sex and other relevant characteristics. Finally, although the internal consistency of the SIAS-SF was unexpectedly low, the LSAS displayed acceptable internal consistency and scores in the current sample were comparable to treatment-seeking samples from prior research. Thus, the LSAS should be used when benchmarking the current sample clinical characteristics against other similar samples.

Those limitations notwithstanding, this work had several strengths, including a controlled laboratory-based relationship formation task, repeated ratings of affect and connectedness throughout the conversation, including ratings of *both* positive emotion and anxiety, and a clinical sample of individuals meeting diagnostic criteria for SAD. Moreover, the theoretical framework guiding the current study drew on clinical (cognitive behavioral) models of SAD as well as social psychology and affective neuroscience theories and empirical findings pertaining to relationship formation. Results were supportive of the role of positive emotions in relationship formation in SAD, thereby supporting relational theories and expanding current clinical models of SAD. The contribution of this work is to challenge the prevailing view that anxiety is the fundamental affective experience that accounts for relationship impairments in SAD, and to demonstrate that positive emotional experiences may be important for promoting relationship formation, even within a group of individuals classically defined by anxiety and fear-related symptoms.

Acknowledgments

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Appendix A

List of questions used for the relationship formation task.

Version A

1. Tell your partner a bit about yourself.

2. What would constitute a perfect day for you?

3. For what in your life do you feel most grateful?

4. Is there something that you've dreamed of doing for a long time? Why haven't you done it?

5. What is your most treasured memory?

6. If you were going to become a close friend with your partner, please share what would be important for him or her to know.

Version B

1. Tell your partner a bit about yourself.

2. What would your ideal or perfect life be?

3. What is the greatest accomplishment of your life?

4. If a crystal ball could tell you the truth about yourself, your life, the future, or anything else, what would you want to know?

5. Can you envision how you are likely to look back upon the things you are doing today? If so, how much do you try to live now as you think you will one day wish you had lived?

6. Do you believe our life is predetermined by fate or is solely a consequence of the choices we make (or both)? Explain why.

a
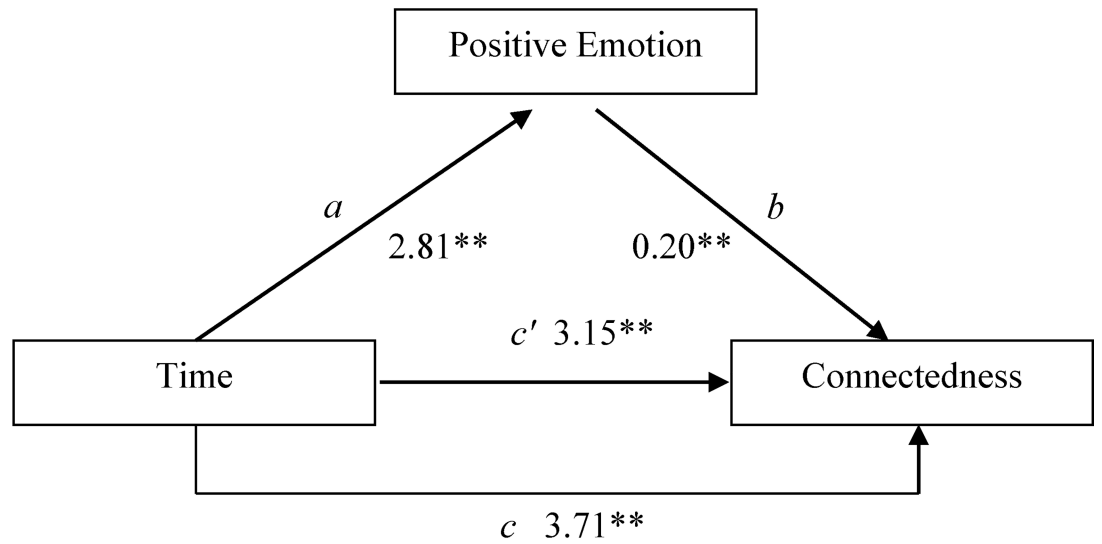
b
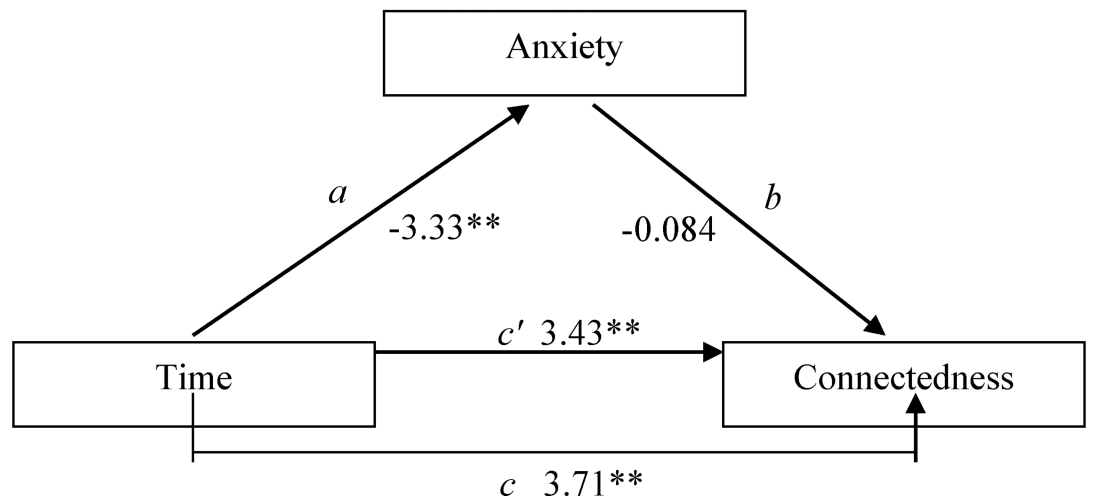
Figure 1.
Results of the hypothesized mediation models with the effect of time on change in connectedness mediated by change in positive emotion (pleasantness, Figure 1a) and change in anxiety (Figure 1b; ***p < 0.001, **p < 0.01, *p < .05). The indirect effect (ab) was significant for change in pleasantness (Figure 1a: *ab* = .5620; 95% CI [.2588, .9245]). The indirect effect for change in anxiety was not significant (Figure 1b: *ab* = .2797; 95% CI [−.0105, .6034]).
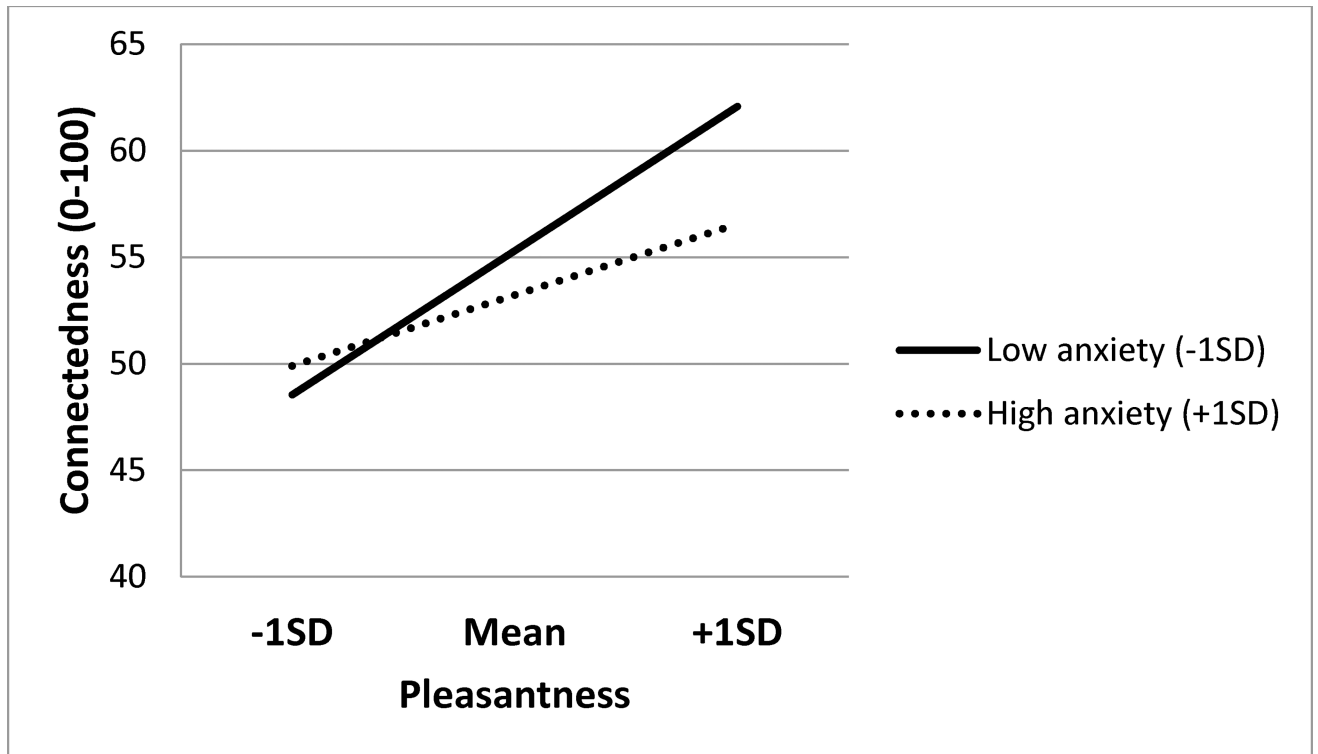
Figure 2.
Estimated connectedness scores at the mid-point of the social interaction plotted at different levels of pleasantness and anxiety, that is, at one standard deviation below and above the sample mean.

Table 1

Descriptive Summaries of Affect and Connectedness Ratings Following each Relationship Formation Question.

Variable	
Mean pleasantness by question (SD)	
Question 1	50.46 (21.71)
Question 2	53.21 (20.78)
Question 3	57.13 (21.17)
Question 4	59.43 (21.04)
Question 5	61.39 (21.03)
Question 6	63.71 (21.20)
Mean anxiety by question (SD)	
Question 1	58.39 (21.71)
Question 2	51.11 (20.86)
Question 3	50.79 (21.77)
Question 4	45.29 (21.15)
Question 5	44.66 (22.41)
Question 6	39.50 (21.27)
Mean connectedness by question (SD)	
Question 1	41.21 (21.11)
Question 2	46.52 (20.73)
Question 3	51.96 (21.66)
Question 4	54.86 (22.62)
Question 5	58.57 (23.12)
Question 6	61.77 (23.05)

Table 2

Summary of Multilevel Regression Analyses for Mediational Models of Positive Emotion (top) and Anxiety (bottom) Mediating Connectedness.

Path	Predictor	Outcome	B	SE B	t	p
c	Time	Connectedness	3.71	.42	8.84	<.001
a	Time	Pleasantness	2.81	.46	6.16	<.001
b	Pleasantness	Connectedness	.20	.051	3.88	<.001
c'	Time	Connectedness	3.15	.42	7.49	<.001
c	Time	Connectedness	3.71	.42	8.84	<.001
a	Time	Anxiety	−3.33	.51	−6.55	<.001
b	Anxiety	Connectedness	−.084	.045	−1.87	.063
c'	Time	Connectedness	3.43	.43	7.90	<.001

Table 3

Hierarchical Regression Analyses of (a) Change in Affect (Slope) and (b) Endpoint Affect (Intercept) Predicting Participant Desire for Future Interaction.

Predictor	(a) Change in Affect (slope)				(b) Endpoint Affect (intercept)			
	B	SE B	β	R^2	B	SE B	β	R^2
Regression model				.16 *				.25 ***
Pleasantness	1.1	.45	.35 *		.20	.053	.48 ***	
Anxiety	–.22	.41	–.08		–.03	.053	–.07	

*
$p < .05$.

**
$p < .01$.

***
$p < .001$.