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Modifying Automatic Approach Action Tendencies in Individuals with Elevated Social Anxiety Symptoms

Charles T. Taylor[a] and **Nader Amir**
Center for Understanding and Treating Anxiety, Department of Psychology, San Diego State University

Abstract

Research suggests that social anxiety is associated with a reduced approach orientation for positive social cues. In the current study we examined the effect of experimentally manipulating automatic approach action tendencies on the social behavior of individuals with elevated social anxiety symptoms. The experimental paradigm comprised a computerized Approach Avoidance Task (AAT) in which participants responded to pictures of faces conveying positive or neutral emotional expressions by pulling a joystick toward themselves (approach) or by moving it to the right (sideways control). Participants were randomly assigned to complete an AAT designed to increase approach tendencies for positive social cues by pulling these cues toward themselves on the majority of trials, or to a control condition in which there was no contingency between the arm movement direction and picture type. Following the manipulation, participants took part in a relationship-building task with a trained confederate. Results revealed that participants trained to approach positive stimuli displayed greater social approach behaviors during the social interaction and elicited more positive reactions from their partner compared to participants in the control group. These findings suggest that modifying automatic approach tendencies may facilitate engagement in the types of social approach behaviors that are important for relationship development.

Keywords

Social anxiety; approach-avoidance task; approach training; cognitive bias modification; automatic action tendencies

Social anxiety is characterized by an approach-avoidance conflict – the desire for social affiliation and belonging (approach) coupled with doubts about being able to make a favorable impression on others and fears of rejection (avoidance) (e.g., American Psychiatric Association, 2000; Kashdan, 2007; Leary, 2001). As a result, individuals who experience elevated levels of social anxiety symptoms tend to display fewer approach-oriented behaviors relative to their low anxious counterparts (see Alden & Taylor, 2004, 2010 for reviews); they are less likely to initiate social encounters and exhibit fewer approach behaviors (e.g., nonverbal displays of warmth and friendliness, self-disclosure,

[a]Correspondence concerning this article should be addressed to Charles T. Taylor, Center for Understanding and Treating Anxiety, Department of Psychology, San Diego State University, 6386 Alvarado Court, Suite 301, San Diego CA 92120. cttaylor77@gmail.com Phone: 619.229.3740 FAX: 619.229.3743.

emotion expression) during interactions with strangers (e.g., Alden & Bieling, 1998; Heery & Kring, 2007; Meleshko & Alden, 1993; Voncken, Alden, Bögels, & Roelofs, 2008) and in the context of close relationships (Davila & Beck, 2002; Grant, Beck, Farrow, & Davila, 2007; Sparrevohn & Rapee, 2009; Wenzel, Graff-Dolezal, Macho, & Brendle, 2005). It is notable that these reduced approach tendencies persist even when others display overtly positive social cues (e.g., Campbell et al., 2009). A diminished approach orientation would be expected to limit the availability of potential social contacts as well as interfere with the development and maintenance of positive social relationships. Consistent with this perspective, research suggests that socially anxious individuals tend to garner more negative responses from others relative to low anxious individuals (e.g., Creed & Funder, 1998; Heerey & Kring; Voncken et al., 2008). Moreover, failure to engage in social approach behaviors appears to be an important factor in eliciting these negative social outcomes (e.g., Alden & Bieling; Voncken et al.).

The majority of studies to date have examined *overt* approach tendencies in socially anxious samples (e.g., observable behavior, explicit judgments). However, evidence of a reduced approach orientation also comes from indirect performance-based assessments. For example, researchers have used the Approach Avoidance Task (AAT; Rinck & Becker, 2007) to examine automatic aspects of behavioral approach and avoidance in socially anxious samples (Heuer, Rinck, & Becker, 2007; Roelofs et al., 2010). The basic premise underlying the AAT is that perceptions of stimuli from the environment automatically trigger a motivational orientation and affectively congruent behavioral schemas of approach and avoidance (Strack & Deutsch, 2004). These behavioral schemas can be assessed indirectly in terms of arm flexion (approach – i.e., pulling toward oneself) versus extension (avoidance – i.e., pushing away from oneself) through use of a joystick: Positive stimuli are associated with faster arm flexion than arm extension whereas negative stimuli are associated with faster arm extension than arm flexion (e.g., Cacioppo, Priester, & Berntson, 1993; Solarz, 1960). Recent variants of the AAT also use a zooming feature: pulling the joystick increases the size of the stimuli on the screen whereas pushing decreases it, thereby generating a sensation of approach or avoidance, respectively. Moreover, because individuals are required to generate behavioral movements in response to a feature of the display unrelated to the contents of the presented stimuli (e.g., different colored borders surrounding the target stimuli; Najmi, Kuckertz, & Amir, 2010), the AAT is thought to capture relatively automatic action tendencies.

Two studies provide evidence suggesting a link between social anxiety and reduced automatic approach tendencies for socially relevant stimuli. Heuer et al. (2007) found that participants with high levels of social anxiety displayed greater avoidance (lower approach) tendencies for both positive (smiling) and negative (angry) faces relative to participants with low levels of social anxiety. Groups did not differ, however, on automatic action tendencies for neutral faces or puzzles, or for explicit judgments regarding the valence of the emotional expressions. Thus, although socially anxious participants rated the smiling faces positively, their behavioral responses on the AAT suggested an avoidance of those stimuli. These findings are consistent with the study by Campbell et al. (2009) who found that individuals with generalized social anxiety disorder (GSAD) rated faces displaying positive emotional expressions as less approachable relative to their non-anxious counterparts, even though the groups did not differ in their judgment accuracy about the emotional valence of the faces (nor did they differ on approachability ratings for negative, i.e., disgust and angry faces). Roelofs et al. (2010) replicated and extended the findings of Heuer et al. (2007) such that relative to low anxious participants, individuals with elevated socially anxious symptoms exhibited less approach (greater avoidance) of positive faces, regardless of whether the gaze of the actor depicted in the picture was directed toward or away from the participant.

Considered together, previous studies suggest that social anxiety is characterized by reduced approach tendencies across both indirect and direct measures.

Recent evidence suggests that approach-related motivation and behavior can be modified using an adapted AAT paradigm that manipulates the frequency with which a particular target stimulus is paired with approach versus avoidance behavioral movements. For example, to facilitate automatic avoidance of alcohol stimuli in individuals with hazardous alcohol use behaviors, Wiers and colleagues modified the AAT such that majority of the alcohol pictures were paired with cues dictating a push (avoidance) behavioral response whereas the majority of non-alcohol (soft drink) pictures were in the pull-format (Wiers, Rinck, Kordts, Houben, & Strack, 2010). In the comparison (approach-alcohol) condition, the contingencies were reversed, i.e., pull pictures of alcohol and push pictures of soft drinks on the majority of trials. Participants in the avoid-alcohol condition demonstrated a significantly larger decrease in approach tendencies for alcohol stimuli from before to after training relative to participants in the comparison condition. Changed approach tendencies generalized to stimuli not encountered during training as well as to a novel task (i.e., Implicit Association Test; Wiers, Van Woerden, Smulders, & De Jong, 2002). Moreover, heavy drinkers in the avoid-alcohol condition who demonstrated changed action tendencies to avoid alcohol consumed significantly less alcohol during a behavioral taste test compared to their control counterparts. Wiers, Eberl, Rinck, Becker, and Lindenmeyer (2011) extended these findings in a sample of alcohol dependent inpatients by demonstrating that four sessions of an avoid-alcohol AAT procedure completed prior to treatment decreased participants' approach bias for alcohol stimuli and reduced relapse rates during one-year follow-up relative to participants in the sham and no training control conditions.

More relevant to the current study, Kawakami, Phills, Steele, and Dovidio (2007, Study 4) examined the effects of an approach-avoidance training paradigm on *social* behavior during a laboratory-based interaction. Participants were randomly assigned to one of three conditions designed to manipulate automatic action tendencies for racial categories of Blacks versus Whites: approach-Blacks and avoid-Whites, avoid-Blacks and approach-Whites, or sideways control that required participants to move a joystick to the left or right. Following the manipulation, participants completed an interpersonal closeness task (Aron, Melinat, Aron, Vallone, & Bator, 1997) with a Black confederate in which each person took turns sharing personal information about him or herself to one another. Results revealed that participants in the approach-Blacks condition displayed significantly greater prosocial behaviors (i.e., more immediacy and openness) during the conversation relative to participants in the avoid-Blacks or sideways control groups. These findings suggest that manipulating automatic action tendencies may influence observable social behavior.

The goal of the current study was to examine the effects of experimentally manipulating automatic approach tendencies on the behavior of individuals with elevated social anxiety symptoms. Participants were randomly assigned to complete an AAT procedure designed to increase approach of positive social stimuli by requiring them to repeatedly pull pictures of faces displaying positive expressions toward them using a joystick (approach-positive condition), or to a control condition in which participants pulled pictures of positive versus neutral faces with equal frequency. Following the manipulation, participants took part in relationship-building task with a trained confederate (Aron et al., 1997; see also Kashdan & Roberts, 2004, 2006). We selected this paradigm because it is sensitive to eliciting the types of approach behaviors that are important for relationship development (e.g., self-disclosure) and that have been shown to be problematic for socially anxious individuals (Alden & Taylor, 2004, 2010). Participants and observers rated participant behavior and confederates rated their willingness to engage in future social activities with their partner. Consistent with previous studies demonstrating that manipulating automatic action tendencies can influence

subsequent behavior (e.g., Kawakami et al., 2007), we predicted that participants in the approach-positive condition would display greater social approach behaviors during the interaction relative to participants in the control group. Moreover, in keeping with research suggesting that social approach behaviors elicit positive responses from others (e.g., Alden & Bieling, 1998; Taylor & Alden, 2011), we hypothesized that the approach-positive group would evoke more positive reactions from their conversation partner relative to the control group.

Method

Participants

Participants were 47 undergraduate psychology students drawn from a pool of undergraduate students at a large university. Data from three participants were excluded from the analysis: two participants displayed less than 50% accuracy on the AAT assessment or training tasks, and one participant had response latencies on the AAT tasks that were greater than three *SDs* from the sample mean. Thus, the final sample comprised 44 participants (18 men, 26 women). Participants were selected on the basis of their scores on the Liebowitz Social Anxiety Scale–Self-Report version (LSAS-SR; Liebowitz, 1987). The LSAS-SR consists of 24 social situations, and 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. The LSAS-SR displays strong psychometric properties that converge with the interviewer-administered LSAS (Fresco et al., 2001). To be eligible for the study, participants were required to score 27 or higher on the LSAS (Amir, Weber, Beard, Bomyea, & Taylor, 2008). This selection criterion resulted in a mean LSAS score of 53.23 (SD = 23.38), placing the current sample mean LSAS score more than three standard deviations above the mean for individuals with no Axis-I diagnosis (M = 13.61, SD = 11.10; Fresco et al., 2001). Students received course credit for their participation or $20 if they had already fulfilled the course subject pool requirements. See Table 1 for participant demographic and clinical characteristics.

Measures

Self-report Symptom Measures—In addition to completing the LSAS-SR, participants completed the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) and the Mood and Anxiety Symptom Questionnaire-Anhedonic Depression scale (MASQ-AD; Watson & Clark, 1991) to measure symptoms of depression and anhedonia, respectively. These scales were included to ensure that groups did not differ at baseline on clinical characteristics that could confound interpretation of hypothesized between-group differences on the main outcomes. Internal consistency was adequate in the current sample (Cronbach's α = .94, .88, and .92 for the LSAS-SR, BDI-II, and MASQ-AD, respectively).

Dependent Measures

Social Approach Behavior—The participant, confederate, and independent evaluator rated the participant's behavioral performance during the social interaction task on five items (talk openly about yourself, convey interest in your partner, appear actively engaged in the conversation, appear friendly, talkative) written to reflect the type of behaviors shown to be important in facilitating friendship development during first-meeting encounters (e.g., Collins & Miller, 1994) and were taken from prior research (Taylor & Alden, 2011). Each item was rated on a 7-point scale with anchors of *not at all* and *very much*. Internal consistency of this set of items was adequate in this sample (Cronbach's α range = .85 – .90). Inter-rater agreement for confederate and independent evaluator ratings of participant behavior was also satisfactory (the two-way random intraclass correlation coefficient for the

absolute agreement of the average measure was .78,$p < .01$). Therefore, these ratings were averaged to create a single observer-rated index of social approach behavior.[1]

Social Outcomes—The Desire for Future Interaction Scale (DFI; Coyne, 1976) was used to assess confederate's reactions to participants. The DFI consists of eight items 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), which is generally interpreted as reflecting liking versus rejection of the target individual. Items were rated on a 7-point scale with anchors of *not at all* and *very much*. Higher scores reflected greater liking of the target individual. The Cronbach's α for this sample was .94.

State Anxiety—The Spielberger State-Trait Anxiety Inventory – State subscale (STAI-State; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was administered to participants at baseline, following the experimental manipulation, and following the social interaction. The STAI-State comprises 20 items and participants were asked to rate the items according to how they *currently feel*. Each item is rated on a 4-point Likert-type scale ranging from *not at all* to *very much so*. Higher scores reflect higher levels of anxiety. Internal consistency of this scale was adequate in this sample (Cronbach's α range = .87 to . 92).

Stimuli for AAT Assessment and Training Tasks

The stimuli used in the AAT comprised pictures of faces displaying different emotional expressions taken from the NimStim Set of Facial Expressions (Tottenham et al., 2009). We created two picture sets (A and B) of 8 actors (4 female, 4 male) displaying a range of emotional expressions. We used positive, neutral, and disgust faces for the AAT assessment and positive and neutral faces for the experimental manipulation.[2] Half of the participants in each group saw a particular picture set during training (e.g., set A) and were tested using a different picture set (setB).[3] We divided the picture set used for assessment into two sets of 4 faces each with one subset used for the pre-training assessment (e.g., A1) and one subset used for the post-training assessment (e.g., A2). Thus, each of the two assessments of action tendencies was conducted using pictures not encountered during training, thereby allowing us to test for generalizability of the experimental manipulation. To control for order effects, the testing sets were counterbalanced across pre- and post-training assessments.

Manipulation Check

To examine whether the experimental manipulation was successful in creating differential automatic action tendencies to approach positive versus neutral stimuli between the two conditions, participants completed an AAT assessment before and after the experimental manipulation. The computer program was written in Delphi (Embarcadero, Inc.) for this experiment. Consistent with previous research (e.g., Najmi et al., 2010), we used colored frames surrounding each picture to guide participants' direction of movement. Participants were seated in front of a computer screen with a joystick situated on the desk. They were instructed that for each picture they should pull the joystick if the border was green and push

[1]Due to a technical problem, one of the social interactions was not video recorded. As a result, confederate ratings were the only available data for this participant when computing the observer index of social approach behavior.
[2]Disgust faces were not relevant to the primary study hypotheses and were therefore not included in the analysis.
[3]We first conducted all analyses with stimuli set (A vs. B) included as a factor. However, because stimuli set did not significantly interact with condition in any analyses (all ps > .10), the analyses reported in the main text do not include stimuli set as a factor.

the joystick if the border was blue. Thus, participants were asked to respond only to the color of the border framing each picture, rather than to the content within the image itself.

Participants completed 12 practice trials, which comprised a different set of pictures than those used in the assessment. In the assessment task, participants completed 96 trials [4 Pictures × 3 Picture Type (positive, neutral, disgust) × 2 Border Color (green, blue) × 4 Repetition]. Trials were presented in a new random order to each participant. To begin each trial, participants were required to press a button on the joystick which resulted in the appearance of a medium-sized picture (400 × 400 pixels) in the center of the screen. The computer program logged the position of the joystick and the images were fluidly resized proportionally as the joystick was moved from the central position as follows: The pictures became increasingly larger if the participant pulled the joystick, simulating approach, and increasingly smaller if the participant pushed the joystick, simulating avoidance. Moving the joystick to the right or left did not change the size of the picture. When the joystick reached approximately a 30° position in either direction, the picture disappeared, regardless of whether the participant responded correctly. The next trial began once the joystick was brought fully back to the central position and the participant pressed the trigger button. Response latencies were calculated based on the length of time the image remained on the screen, that is, from the time the picture appeared on the screen to the time it disappeared.

Experimental Conditions

To experimentally manipulate automatic action tendencies, the assessment AAT was changed in several ways. First, we used only positive and neutral face stimuli. Second, we replaced push (avoidance) trials with sideways control trials (see Kawakami et al., 2007) in which participants were required to move the joystick to the right when presented with a beige colored border. We eliminated push trials during the manipulation phase for two main reasons: First, our primary aim was to manipulate the approach dimension of automatic action tendencies rather than manipulating *both* approach and avoidance dimensions. Thus, we wanted to isolate the effects of increasing approach tendencies for positive stimuli as opposed to both increasing approach for positive stimuli and increasing avoidance of neutral stimuli. Second, we speculated that requiring participants in the approach-positive condition to push social cues of any valence away from themselves on the majority of trials, i.e., increasing avoidance of neutral cues, may dilute the potency of the manipulation. During the sideways movement the size of the picture remained constant until it disappeared. In the experimental phase, participants were instructed to pull the joystick if the border was green and move the joystick to the right if the border was beige. Prior to the experimental manipulation phase, participants completed 12 practice trials following the new task instructions using different stimuli than those used during training.

Approach-Positive AAT—To modify automatic action tendencies to approach positive social cues, the majority of positive pictures (92%) were presented in the pull format versus 8% in the sideways format, with reversed contingencies for neutral pictures (8% in the pull format and 92% in the sideways format). Note that the total number of pull and sideways trials was 50%. The experimental phase comprised 384 trials with a short break in between: 8 Pictures × 2 Picture Type (positive, neutral) × 2 Border Color (green, beige) × 12 Repetitions. The training phase was approximately 15 minutes in duration.

Control AAT—The control condition was identical to the approach-positive AAT except that participants were required to make an *equal number* of approach (pull) and sideways (move to the right) movements for both positive and neutral social stimuli.

Personnel

Five undergraduate students (2 men, 3 women) served as experimenters. Experimenters were trained to follow a scripted protocol to deliver instructions to participants and were responsible for implementing the laboratory procedures, administering questionnaires, and conducting debriefing at the conclusion of the experiment. Three female undergraduate students served as experimental confederates who were trained to provide a set of scripted verbal and nonverbal behaviors designed to convey a pleasant, but reserved social response (see Taylor & Alden, 2011). Confederates were trained to interact so their behavior appeared natural rather than scripted, and to behave consistently across participants. Training involved viewing videotapes of interactions from prior pilot work as well as several sessions of mock interactions between confederates and research staff. Experimenters, confederates and independent evaluators were blind to the study hypotheses and participants' experimental condition.

Confederate Consistency Check

To evaluate consistency of confederate performance, undergraduate research volunteers rated confederate behavior from the videotaped interactions using items written to reflect displays of warmth and friendliness (5 items: talkative, disinterested, self-disclosive, distant, friendly). Ratings were made on a 7-point scale with anchors of *not at all* and *very much* and items were combined to create a total score representing overall confederate warmth and friendliness (Cronbach's α range = .72). Examination of the mean and standard deviation for experimenter ratings of confederate warmth and openness suggested that confederates adhered to the expected behavior ($M = 30.40$, $SD = 2.10$). An independent-samples t-test revealed that confederate behavior did not differ across conditions, $t(38) = .42$, $p = .68$.

Social Interaction Task

To assess the effects of manipulating automatic action tendencies on social approach behavior, participants completed a social interaction task with a trained experimental confederate. The interaction comprised an abbreviated version of a previously validated relationship-building task (Aron et al., 1997) in which the participant and confederate took turns responding to a series of questions that gradually increased in the emotional content and level of self-disclosure elicited by each item (see Kashdan & Roberts, 2004; 2006 Study 1 for a similar shortened version of this paradigm). The participant and confederate were informed that their task was to get to know one another by taking turns answering a series of questions about themselves. Interactions began with an open-ended ice-breaker question ("Tell your partner a bit about yourself") followed by five relationship-building questions selected from Aron et al. (1997). See Appendix for the list of questions. Confederates were instructed to answer the first question, followed by the participant answering the same question. Next, the participant answered the second question, and then the confederate answered the same question. The confederate and participant alternated asking and answering questions in this format until both had responded to each question. Prior to the start of the interaction, the experimenter pressed the record button on a camcorder that was placed outside of the direct view of the participant and confederate. The videotaped interactions were later rated to assess confederate and participant behavior. The experimenter exited the room prior to the start of the conversation.

Procedure

Upon arriving to the laboratory, participants provided informed written consent and completed the baseline demographic and symptom measures. The consent form stated that the purpose of the study was "To examine the usefulness of new computer based treatments for anxiety." Participants were further informed that we are interested in understanding how

people process and respond to emotional information, and that the study involves completing several computer tasks and several different types of assessments. Participants were randomly assigned to either the approach-positive AAT (n = 20) or the control AAT (n = 24). Condition assignment was determined using four numbers (one for each combination of condition and stimuli set) and a random number generator. Experimenters, confederates, and participants were blind to group assignment. Next, participants completed three blocks of the AAT – pre-assessment, experimental manipulation (approach-positive vs. control), and post-assessment. Instructions for these tasks were presented on the computer and were identical for both conditions. Next, participants completed the social interaction task. Following the interaction, participants and confederates completed the post-interaction ratings. Participants were also given a feedback form that asked about their hypotheses concerning the purpose of the study and whether they detected any patterns between the colored borders and face types presented during the computer tasks. No participants correctly ascertained the true purpose of the study or the training contingency in the approach-positive AAT. Finally, participants were debriefed and thanked for their participation.

Results

Preliminary Analyses

Demographic and Clinical Characteristics—Table 1 presents demographic information and self-report symptom scores for participants in the approach-positive and control groups. Participants in the two conditions did not differ on any of the demographic or symptom measures, all $p > .10$.

Manipulation Check—The experimental manipulation comprised a difference in the frequency with which positive versus neutral pictures were presented in the pull (approach) format. Thus, to establish that groups differed following the manipulation on automatic action tendencies to approach positive relative to neutral social cues, we computed an AAT approach index by subtracting each participant's median response latency to pull positive pictures from their median response latency to pull neutral pictures (Najmi et al., 2010). Higher scores reflect relatively faster automatic approach tendencies for positive relative to neutral stimuli. See Table 2. We submitted the post-assessment AAT approach index to an analysis of covariance while covarying scores on the pre-assessment AAT approach index.[4] Results revealed that participants in the approach-positive group displayed a larger approach bias for positive versus neutral social cues following the manipulation relative to participants in the control group, $F(1, 40) = 5.50$, $p = .024$, $\eta_p^2 = .12$. These findings indicated that the experimental manipulation was successful in creating differential automatic action tendencies to approach positive relative to neutral social cues across groups.

Main Analyses

Social Behavior—To test our main hypothesis concerning the effect of manipulating automatic approach tendencies on social approach behavior, we conducted a multivariate analysis of variance (MANOVA) on participant and observer ratings of participant behavior. Results revealed a significant multivariate effect of condition, $F(2, 41) = 4.89$, $p = .013$, $\eta_p^2 = .19$. Follow-up univariate tests revealed that participants in the approach-positive training

[4]Post-assessment AAT data is missing for one participant in the control condition due to a computer problem that corrupted the file when saving the data. Thus, this analysis was conducted on n=20 participants in the approach-positive condition and n=23 participants in the control condition. We re-analyzed the main outcomes excluding the one participant with missing AAT data, which revealed an identical pattern of findings to those reported in the main text.

group displayed greater social approach behavior during the interaction relative to participants in the control group on both participant ratings [$F(1, 42) = 4.39$, $p = .042$, $\eta_p^2 = .10$] and observer ratings [$F(1, 41) = 9.82$, $p = .003$, $\eta_p^2 = .19$]. See Table 2.

Social Outcomes—To examine whether the experimental manipulation influenced confederate willingness to interact with their conversation partner again, we submitted confederate DFI ratings to an independent-samples *t*-test. Results revealed that confederates displayed a greater willingness to engage participants in the approach-positive group in future social activities relative to participants in the control group, $t(42) = 2.65$, $p = .001$, $d = .79$. See Table 2.[5]

State Anxiety—One explanation for the between-group differences in social approach behavior and confederate DFI is that the experimental manipulation resulted in greater reductions in subjective anxiety in the approach-positive group relative to the control group. Accordingly, we submitted participants' self-reported state anxiety scores to a 2 (Condition: approach-positive vs. control AAT) × 3 (Time: baseline, post-training, post-interaction) ANOVA with repeated measurement on the second factor. Results revealed a significant main effect of Time, [$F(2, 41) = 4.31$, $p = .020$, $\eta_p^2 = .17$]. Follow-up contrasts revealed that participants did not differ in self-rated anxiety from before to after the experimental manipulation, [$F(1, 42) = 0.98$, $p = .33$, $\eta_p^2 = .023$]. However, participants were significantly less anxious following the conversation relative to before the conversation, [$F(1, 42) = 7.87$, $p = .008$, $\eta_p^2 = .16$]. The main effect of Condition [$F(1, 42) = 0.75$, $p = .39$, $\eta_p^2 = .018$] and the Condition × Time interaction were not significant, [$F(2, 41) = 0.52$, $p = .60$, $\eta_p^2 = .025$]. These findings suggest that the experimental manipulation did not differently affect participants' subjective anxiety following training or in the context of the social interaction task.

Relationship between the AAT Approach Index, Behavior, and Social Outcomes

We computed Pearson's correlations to explore whether the AAT approach index for positive stimuli following training predicted participant behavior during the social interaction and confederate DFI. Results revealed a marginally significant association between the AAT approach index and observer-rated social approach behavior, $r(43) = .28$, $p = .065$. Thus, participants who displayed stronger approach tendencies for positive relative to neutral stimuli post-training tended to exhibit more approach behaviors during the interaction as rated by observers. The relationship between the post-training AAT approach index and participant-rated social behavior [$r(43) = .19$, $p = .23$] and confederate DFI [$r(43) = .24$, $p = .12$] was not significant, although in the expected direction.

Finally, we used bootstrapping procedures (Preacher & Hayes, 2008) to examine whether the post-training AAT approach index for positive stimuli statistically mediated the between-group differences in social approach behavior and confederate DFI. We report accelerated bias-corrected (Efron, 1987) 95% confidence intervals of the indirect path (*ab*) obtained using 5000 resamples. Results revealed that the indirect effect of condition on social approach behavior or confederate DFI through post-training AAT approach index for positive stimuli was not significant such that the 95% confidence interval overlapped with zero (participant-rated social approach behavior: lower value = −1.4390, upper value = .

[5]Following the suggestion of an anonymous reviewer, we explored whether participant gender moderated the main outcomes. Results revealed that gender did not interact with experimental condition in the analyses for social approach behavior, [$F(2, 39) = 0.12$, $p = .89$, $\eta_p^2 = .01$] or confederate DFI, [$F(1, 40) = 0.04$, $p = .85$, $\eta_p^2 = .00$]. The magnitude of between-group differences for females (same-gender dyads) and males (opposite-gender dyads) is as follows: participant-rated social approach behavior ($d = 0.48$ and 0.93 for females and males, respectively); observer-rated social approach behavior ($d = 0.93$ and 1.13 for females and males, respectively); confederate DFI ($d = 0.91$ and 0.82 for females and males, respectively).

4650; observer-rated social approach behavior: lower value = −1.7954, upper value = .3633; confederate DFI: lower value = −3.0847, upper value = .8336). These findings suggest that mediation of the effect of condition on social approach behavior or confederate DFI by post-training approach index for positive stimuli was not confirmed.

Discussion

The goal of the current study was to examine the effects of manipulating automatic action tendencies on the behavior of individuals with elevated levels of social anxiety during a controlled social interaction. Consistent with our prediction, participants trained to repeatedly pull pictures of faces displaying positive emotional expressions toward them displayed greater social approach behavior during the relationship-building task relative to participants in the control group. Groups differed in behavior from the perspective of *both* the objective observers and from the participant themselves. Moreover, participants in the approach-positive group elicited more positive post-interaction reactions from their conversation partner. Considered together, the present findings suggest that procedures aimed at modifying automatic approach tendencies for positive social cues in socially anxious individuals may facilitate engagement in the types of behaviors that are important for relationship development.

Results of the current study add to a small but growing literature suggesting that the experimental manipulation of automatic action tendencies can impact subsequent behavior. Previous studies have demonstrated that computerized approach-avoidance training procedures can decrease alcohol consumption in hazardous drinkers (Wiers et al., 2010), reduce vulnerability to relapse in individuals meeting diagnostic criteria for alcohol dependence (Wiers et al., 2011), and increase nonverbal displays of prosocial behavior in unselected volunteers (Kawakami et al., 2007). Given research suggesting that social anxiety is characterized by a reduced approach orientation for positive social cues on both explicit (e.g., Campbell et al., 2009) and implicit measures (e.g., Heuer et al., 2007), we sought to examine the effects of increasing automatic approach tendencies on the behavioral responses of individuals with heightened social anxiety symptoms. Participants in the approach-positive condition displayed greater approach behaviors relative to the control group, a finding that was robust across both participant and observer ratings. Considered together with previous studies, these findings suggest a possible causal link between automatic action tendencies of approach-avoidance and actual behavior.

The experimental modification of automatic approach tendencies for positive social cues also had an interpersonal impact: Confederates were more open to engaging participants in the approach-positive condition in future social interactions relative to participants in the control condition, a reflection of greater social acceptance and liking (e.g., Segrin, 1993). These findings suggest that relatively automatic action tendencies have downstream effects on the responses of others and therefore may have implications for the development and maintenance of positive social relationships. It is well-documented that socially anxious individuals are more likely to experience social rejection relative to their non-anxious counterparts (e.g., Alden & Bieling, 1998; Creed & Funder, 1998; Heerey & Kring, 2007; Voncken et al., 2008). The present results converge with earlier research demonstrating that experimental manipulations that increase social approach behaviors in socially anxious samples elicit more positive responses from others (Taylor & Alden, 2011). However, whereas previous studies have manipulated explicit behavioral strategies (e.g., safety behaviors), the current study demonstrated that modifying automatic motivational tendencies influences the evaluations of others. These findings contribute to the extant literature by implicating relatively automatic cognitive-motivational processes in generating the negative social outcomes characteristic of SAD.

The experimental manipulation did not influence participants' subjective level of anxiety immediately following AAT training or after the social interaction. Thus, the observed between-group differences in social approach behavior and confederate desire for future interaction were not the result of differential changes in state anxiety. Instead, participants across both groups experienced a significant reduction in self-rated anxiety from before to after the conversation. In keeping with prior research (Kashdan & Roberts, 2006), one interpretation of those findings is that the friendship-building task used in the current study was not sensitive to eliciting heightened states of anxiety in our socially anxious sample. It is also possible that manipulating automatic approach/avoidance tendencies has a more direct impact on behavior compared to state affect. One avenue for future research is to establish whether changes in subjective emotions following AAT training procedures occur more downstream, as individuals gain experience engaging in social approach behaviors and eliciting positive responses from others.

The critical factor that we manipulated in the current study was the frequency with which positive relative to neutral social stimuli were presented in the pull (approach) format, i.e., 92% versus 50% of pull trials. Accordingly, between-group differences on subsequent behavior and interpersonal outcomes can be interpreted as reflecting the relative difference in the frequency of pulling (approaching) positive compared to neutral social cues. Because participants in both conditions made an equal number of pull movements for social stimuli *in general*, i.e., regardless of valence, these findings suggest specificity for the role of approaching *positive* social stimuli in the observed pattern of findings. Future research is needed to examine the effects of different experimental conditions in order to clarify the importance of approaching positive social cues per se on approach behavior. For example, individuals with social anxiety have also been shown to display automatic avoidance tendencies for negative social stimuli (e.g., angry faces; Heuer et al., 2007; Roelofs et al., 2010). Thus, future research should examine the effects of training socially anxious individuals to approach negative social stimuli. It may also be informative to establish whether modifying automatic approach tendencies for either positive or negative faces influences behavior when interacting with a confederate displaying behavior of the opposite valence.

The current study also contributes to the broader field of cognitive bias modification (CBM) research (see Koster, Fox, & MacLeod, 2009 for an overview) that uses paradigms derived from cognitive science to manipulate information processing styles implicated in the development and maintenance of various forms of psychopathology. The majority of previous CBM studies, however, have manipulated the processing of negative emotional information. These studies have demonstrated that reducing selective processing biases for negative stimuli reduces vulnerability toward negative emotions under stress (Amir et al., 2008; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; See, MacLeod, & Bridle, 2009) and reduces symptoms and associated functional impairment in individuals meeting diagnostic criteria for an anxiety disorder (Amir, Beard, Burns, & Bomyea, 2009; Amir, Beard, Taylor et al., 2009; Schmidt, Richey, Buckner, & Timpano, 2009). The current study adds to a nascent body of CBM research demonstrating the effects of manipulating the processing of *positive* emotional information on both positive (e.g., Holmes, Coughtrey, & Connor, 2008; Holmes, Lang, & Shah, 2009; Pictet, Coughtrey, Mathews, & Holmes, 2011) and negative (e.g., Taylor, Bomyea, & Amir, 2011; Wadlinger & Isaacowitz, 2008) domains of functioning.

Although previous AAT manipulation studies have yielded reliable between-group behavioral differences, they have failed to find evidence that automatic action tendencies were associated with the main behavioral outcomes (e.g., Wiers et al., 2011) or did not report data concerning such relationships (Wiers et al., 2010; Kawakami et al., 2007). In the

current study, our index of automatic approach tendencies for positive social cues following training displayed only a modest and marginally significant relationship with observer-rated social approach behavior and did not statistically mediate the between-group differences in behavior or confederate desire for future interaction. Thus, although we found medium to large between-group differences on social approach behavior and confederate post-interaction evaluations, consistent with previous studies, our AAT approach index did not reliably predict those outcomes. Several explanations may account for those findings. First, the AAT is a relatively new assessment instrument with uncertain psychometric properties. The only published study examining the reliability and validity of the AAT (Reinecke, Becker, & Rinck, 2010) suggests that although this task may be sufficient to assess group differences, it is not yet optimal for detecting reliable change within individuals (MacLeod, Koster, & Fox, 2009). It is also possible that the mechanism that accounts for changes following approach-avoidance training may be better captured by a different cognitive task. Finally, given the modest relationship between our AAT approach index and outcomes of interest, our sample size was too small to adequately test for mediation (see Fritz & MacKinnon, 2007). Future research is needed to clarify the underlying mechanism(s) through which manipulating automatic action tendencies influences subsequent behavior.

Several caveats should be noted when drawing conclusions from the current study. First, the present sample comprised undergraduate students with a moderate mean level of social anxiety. Thus, generalizability to community and clinical samples of individuals diagnosed with SAD is needed. Second, we carefully scripted confederate behavior so that all participants would be exposed to similar social cues. However, given that the experimental manipulation differentially affected confederates' internal reactions to participants, research is needed to determine the effects of manipulating automatic approach tendencies when participants are exposed to the naturally occurring responses of others. Similarly, this study examined the effects of an AAT procedure in the context of a structured relationship-building interaction with a female confederate in a laboratory setting. Accordingly, generalizability to naturalistic settings and different types of relationship partners (e.g., acquaintances, friends, romantic partners) needs to be established. Future studies should also examine the effects of multi-session interventions that modify automatic approach tendencies (e.g., Wiers et al., 2011) on relationship formation and quality. For example, previous research suggests that patients with SAD continue to experience impairments in relationship functioning following treatment (Eng, Coles, Heimberg, & Safran, 2005) and interventions that directly target social approach behaviors increase relationship satisfaction (Alden & Taylor, 2011). Thus, the effects of increasing automatic approach tendencies on the types of behaviors that are important for relationship development may have clinical utility in socially anxious populations. The current study represents an initial step in that direction.

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Appendix

List of questions used for the social interaction task.

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

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Research Highlights

- We manipulated automatic action tendencies in socially anxious participants.
- A computerized Approach Avoidance Task modified approach of positive social cues.
- We examined differences in behavior and partner reactions during a social task.
- Approach-positive training led to greater approach behavior and partner liking.
- Increasing automatic approach tendencies may facilitate relationship development.

Table 1

Means and Standard Deviations for Demosravhic and Symptom Measures

Variable	Approach-Positive AAT	Control AAT
Age	20.15 (2.21)	19.33 (.96)
Years of Education	14.20 (1.58)	13.83 (.96)
Gender (% female)	55%	63%
LSAS-SR	53.75 (29.03)	52.79 (18.05)
BDI-II	10.00 (8.65)	9.33 (4.92)
MASQ-AD	56.25 (15.72)	49.08 (13.40)

Note. Standard deviations in parentheses. AAT = Approach Avoidance Task; LSAS = Liebowitz Social Anxiety Scale – Self report; BDI-II = Beck Depression Inventory II; MASQ-AD = Mood and Anxiety Symptom Questionnaire – Anhedonic Depression. Participants in the two conditions did not differ on any of the demographic or symptom measures, all $p > .10$.

Table 2

Means and Standard Deviations for Dependent Measures

Variable	Approach-Positive AAT	Control AAT
AAT Approach Bias[a]		
Pre-assessment	.70 (72.10)	.48 (70.55)
Post-assessment	35.43 (73.24)	−7.04 (43.36)
Social Approach Behavior		
Participant-rated	28.10 (4.02)	24.96 (5.61)
Observer-rated	27.68 (3.29)	23.75 (4.72)
Confederate DFI	41.15 (8.03)	35.33 (6.54)
STAI-State		
Baseline	37.95 (8.12)	35.63 (10.24)
Post-manipulation	37.20 (6.07)	34.67 (8.82)
Post-social interaction	34.60 (5.72)	33.46 (9.32)

Note. Standard deviations in parentheses. AAT = Approach Avoidance Task; DFI = Desire for Future Interaction. STAI-State = Spielberger State-Trait Anxiety Inventory – State subscale.

[a]AAT Approach Bias = median response latency to pull neutral pictures minus median response latency to pull positive pictures.