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Attention Training in Individuals with Generalized Social Phobia: A Randomized Controlled Trial

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Abstract

We conducted a randomized, double-blind placebo-controlled trial to examine the efficacy of an attention training procedure in reducing symptoms of social anxiety in forty-four individuals diagnosed with Generalized Social Phobia (GSP). Attention training comprised a probe detection task where pictures of faces with either a threatening or neutral emotional expression cued different locations on the computer screen. In the Attention Modification Program (AMP), participants responded to a probe that always followed neutral faces when paired with a threatening face, thereby directing attention away from threat. In the Attention Control Condition (ACC), the probe appeared with equal frequency in the position of the threat and neutral faces. Results revealed that the AMP facilitated attention disengagement from threat from pre- to post-assessment, and reduced clinician- and self-reported symptoms of social anxiety relative to the ACC. Participants no longer meeting DSM-IV criteria for GSP at post-assessment were 50% in the AMP and 14% in the ACC. Symptom reduction in the AMP group was maintained during four-month follow-up assessment. These results suggest that computerized attention training procedures may be beneficial for treating social phobia.

Keywords

Social Phobia; Attention; Treatment; Information Processing

Social phobia (SP) is a common and debilitating condition, associated with social and occupational impairment, and considerable comorbidity with other psychiatric conditions (e.g., Schneier, Johnson, Hornig, Liebowitz, & Weissman, 1992; Stein & Kean, 2000). In the absence of effective treatment, SP runs a chronic and disabling course (Dewit, Ogborne, Offord, & MacDonald, 1999). Although there are a number of empirically supported psychological (e.g., Clark et al., 2006; Heimberg et al., 1998) and pharmacological treatments for SP (e.g., Blanco

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et al., 2002), many individuals diagnosed with this condition do not access these treatments for a variety of reasons (e.g., unsure of where to go for help, unable to afford treatment, afraid of what others might think; Olfson et al., 2000). Moreover, even when socially anxious individuals actively seek treatment, few initiate treatment (e.g., 15% of initial clinic inquires; Coles, Turk, Jindra, & Heimberg, 2004). These findings highlight the importance of developing effective treatments that have the potential to be widely accessible to individuals suffering from debilitating social anxiety.

In the current paper, we describe a study that translated basic findings from research on cognitive biases in anxiety into a novel computerized intervention for SP. Our goal was to design a procedure intended to target a basic cognitive vulnerability in social anxiety, namely the selective processing of threatening social information (e.g., Williams, Watts, Mathews, & MacLeod, 1997). In brief, the computerized procedure involved repeatedly redirecting participants' attention away from socially relevant threat cues in order to induce selective processing of neutral (non-threat) stimuli. This study was an initial step toward demonstrating the efficacy of a computerized attention training program for SP that ultimately may prove to be a highly transportable and accessible intervention for SP.

According to cognitive theories of emotional disorders, socially anxious individuals are hypervigilant when detecting socially threatening stimuli (e.g., Clark, 2001; Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). In support of cognitive models, a large body of literature demonstrates that socially anxious individuals pay particular attention to threatening social information, including anxiety-related sensations and behaviors (e.g., Pineles & Mineka, 2005), and signs of disapproval from others (e.g., Mogg, Philippot, & Bradley, 2004; Pishyar, Harris, & Menzies, 2004). This selective attention to threat may contribute to the persistence of social anxiety by facilitating preferential processing of negative social information at the expense of benign or positive social cues. In turn, this attentional bias may heighten anxiety, negatively skew judgments of social events, and ultimately prevent disconfirmation of fear-relevant beliefs (e.g., Clark, 2001; Hofmann, 2007; Rapee & Heimberg, 1997).

Although research suggests that socially anxious individuals selectively attend to social threat cues (e.g., anger or disgust faces) relative to neutral cues (e.g., Mogg et al., 2004; Pishyar et al., 2004; see Bögels & Mansell, 2004 for a review), other studies have not found evidence for an attention bias for threat in social anxiety, or found that these individuals avoided paying attention to threatening stimuli under some conditions (e.g., when threat stimuli were paired with neutral (household) objects; Chen, Ehlers, Clark, & Mansell, 2002). Moreover, other studies suggest that attention is not directed more efficiently toward threat, but rather anxious individuals have particular difficulties *disengaging* their attention from threatening stimuli once attended (e.g., Amir, Elias, Klumpp, & Przeworski, 2003; Fox, Russo, Bowles, & Dutton, 2001). Considered together, these findings highlight the complexity of basic attention processes, and point to multiple subcomponents of attention that may influence emotional processing (e.g., Fan, McCandliss, Sommer, Raz, & Posner, 2002; Weierich, Treat, & Hollingworth, 2008).

Weierich et al. (2008) proposed that the apparent discrepancies in the extant literature on anxiety and spatial orientation of attention can be reconciled by considering key differences in the paradigms used to measure attention. They argued that attention tasks that use timescales allowing overt eye movements and that present multiple stimuli that compete for attention resources (e.g., dot probe tasks, MacLeod, Mathews, & Tata, 1986) support the hypothesis that anxious individuals are hypervigilant towards threatening stimuli. In contrast, in tasks in which covert attention is measured and there is no competition among stimuli (e.g., modified Posner cueing task, Posner, 1980), anxiety does not appear to facilitate initial convert shifts in

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attention, but rather slows down disengagement of attention from threat-relevant stimuli (e.g., Amir et al., 2003; Fox et al., 2001). According to Weierich et al. (2008), the extant empirical literature underscores the importance of distinguishing subcomponents of attention as they relate to the development and persistence of pathological anxiety, as well as its treatment outcome.

Another issue of relevance concerns the directionality of the attention-anxiety relationship. While cognitive models of anxiety suggest that selective attention to threat is causally involved in the maintenance of pathological anxiety, this causal hypothesis remains largely untested because previous research has relied on correlational designs (see Bögels & Mansell, 2004 for a review). The most direct test of the causal role of attention bias in the maintenance of anxiety is through the use of research designs in which participants are randomly assigned to conditions and their attention is experimentally manipulated. Researchers have begun to address this issue by using a variation of the probe detection task (MacLeod et al., 1986) designed to create an attention bias either toward or away from threatening cues. In the basic probe detection paradigm, two stimuli (e.g., words or pictures) are presented one above the other (or side by side) on a computer screen. One stimulus is neutral, and the other stimulus is threatening. After the stimuli disappear, a probe appears replacing one of the two stimuli. Participants are asked to identify the probe as quickly and as accurately as possible. Faster response latencies in detecting probes replacing threatening stimuli compared to response latencies in detecting probes replacing neutral stimuli reflects an attention bias toward threatening information.

MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) used a variation of the probe detection task to train attention either toward or away from threat in undergraduate participants scoring in the middle third of the distribution on a self-report measure of trait anxiety. To do so, participants were randomly assigned to conditions in which they were required to repeatedly respond to a visual probe that either consistently followed words depicting threatening or neutral content. After completing one of the attention training tasks, participants were presented with a laboratory stressor that involved solving a series of unsolvable anagrams and were told that their videotaped performance would be shown in classes should they perform particularly well or particularly poorly. Consistent with prediction, participants developed differential attention bias to novel threat stimuli in accordance with their respective training contingency. Moreover, although participants did not differ in the level of self-reported anxiety and depression before and after the training procedure, participants in the Attend Threat condition responded more negatively (higher level of depression and anxiety) to the experimental stressor than did those in the Attend Neutral condition. These results are consistent with the hypothesis that an attention bias toward threat confers a vulnerability to heightened negative affectivity in response to stress. In a follow-up study, Clarke, MacLeod, and Shirazee (2008) found that the ease with which an attention bias toward threat can be transiently evoked by experimental conditions that encourage its acquisition predicts the degree to which trait anxiety later becomes elevated by exposure to a mild stressor (i.e., beginning university). These authors concluded that this finding reflects the fact that such early measures of attention bias plasticity toward threat predict the later naturalistic acquisition of attention bias in response to subsequent stress, which in turn is associated with a consequent increase in trait anxiety level.

Amir, Weber, Beard, Bomyea, and Taylor (2008) examined whether attention training procedures were capable of modifying attention bias and emotional reactivity in individuals with high levels of social anxiety. Using an adaptation of the attention modification procedure used by MacLeod et al. (2002), these researchers examined the effect of a single attention training session designed to facilitate attentional disengagement from threatening (i.e., disgust) faces on anxiety reactivity and behavioral performance in the context of a laboratory-based social stressor (i.e., speech task) in socially anxious participants. In this study, attentional allocation was trained by including a contingency between the location of the non-threat stimuli

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(i.e., neutral face) and the probe in one group (Attention Modification Program, AMP) and not in the other (Attention Control Condition, ACC). Participants also completed an independent measure of attention bias (i.e., modified Posner task, see Posner, 1980; Amir et al., 2003) in order to establish that the AMP changed attention processes that differed from those that were directly manipulated during training. Consistent with the findings of MacLeod et al. (2002), participants in the AMP condition showed significantly less attention bias to threat after training relative to the ACC group. Moreover, AMP participants reported lower levels of anxiety in response to the public speaking task and were judged as having superior speech performance relative to control participants.

Finally, Li, Tan, Qian, and Liu (2008) found that repeatedly training socially anxious students' attention away from socially threatening stimuli over a seven-day period resulted in greater reduction of self-reported social interaction anxiety relative to participants who completed a no-contingency attention control task. In contrast, no between-group differences were observed on measures of social performance-related anxiety and fear of negative evaluation. Given the brief duration of the assessment periods, however, the long-term effects of the attention training procedure remain to be determined. Considered together, these studies provide support for the causal role of attention bias to threat in the maintenance of social anxiety. Moreover, this research highlights the possibility of using such attention training procedures clinically.

To our knowledge, there are two published studies that have examined the effectiveness of computerized attention training programs in reducing anxiety symptoms in individuals presenting with an anxiety disorder diagnosis. In a sample of 29 individuals seeking treatment for Generalized Anxiety Disorder (GAD), Amir, Beard, Burns, and Bomyea (2009) examined the effect of an eight-session attention modification program using a modified dot probe task (see MacLeod et al., 2002) on participants' attentional allocation toward threat-relevant information, as well as symptoms of anxiety. Results revealed that patients who were trained to repeatedly direct their attention away from words representing threatening information displayed a significant reduction in attention bias toward threat as assessed by the dot probe task, and a decrease in anxiety as indicated by both self-report and interviewer measures relative to the control group. Change in attention bias mediated the relationship between attention training and interviewer-rated change in anxiety. Further, 50% of participants who received the attention training program no longer met diagnostic criteria for GAD at post-assessment compared to 13% of control participants.

Using the attention training program described in Amir et al. (2008), Schmidt, Richey, Buckner, and Timpano (2009) randomly assigned 36 individuals meeting criteria for GSP to either the attention modification program or a control condition. Consistent with the study in GAD, GSP patients in the attention training condition exhibited significantly greater reductions in social anxiety and trait anxiety compared to patients in the control condition. At post-assessment, 72% of patients in the active treatment condition no longer met diagnostic criteria for GSP, relative to 11% of patients in the control condition. Clinical gains were maintained at four-month follow-up.

In summary, the above studies suggest that altering attention mechanisms may effectively reduce pathological anxiety symptoms in clinical samples. Accordingly, a primary aim of the current study was to replicate previous findings using a multi-session attention modification program in a sample of patients seeking treatment for GSP. Moreover, while the two previous studies in clinical samples demonstrated that computerized attention training procedures reduced symptoms of anxiety, neither study assessed changes in attention from pre- to post-treatment using an independent measure of attention bias. In the absence of an independent assessment of attention, the most parsimonious explanation for changes in participants' responses in the probe detection task is that they learned to master the task. There is also some

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evidence suggesting that the dot probe task may have limited reliability (Schmukle, 2005). Moreover, as Weierich et al. (2008) suggested the modified dot probe task obscures the interpretation of the attention mechanisms that underlie anxiety reduction because this task does not distinguish whether the intervention targeted differential allocation to or removal of attention from threatening information. In light of research demonstrating that attention biases characteristic of anxiety disorders may in part reflect difficulties disengaging attention once threat-relevant stimuli has been detected (Amir et al., 2003; Fox et al., 2001), we sought to examine the effects of the attention modification program on a measure of covert attention disengagement that used stimuli different from those used in the training task. We predicted that the Attention Modification Program (AMP) would reduce attention bias toward threat, as well as decrease social anxiety symptoms and associated functional impairment from pre- to post-assessment relative to the Attention Control Condition (ACC).

Method

Design

The design of this study was a 2 (Group: AMP, ACC) X 2 (Time: pre-assessment, post-assessment) mixed design. Participants were randomly assigned to the AMP (n = 22) or the ACC (n = 26). They were assessed using self-report and interviewer measures before and after eight sessions of training. Additionally, participants in the AMP condition were assessed once more approximately four months after the post-assessment in order to examine the longevity of any symptom change.

Participants

Participants were recruited through letters sent to health care organizations and physicians, and posted announcements in community settings and local newspapers that described the program and provided a telephone contact number. Diagnostic assessment was based on an initial telephone screening followed by an in-person diagnostic interview using the Structured Clinical Interview for the DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1994). Of the 64 individuals who were assessed for eligibility, 14 did not meet entry criteria and 2 refused to participate. The remaining 48 participants met a principal DSM-IV diagnosis of GSP. All interviews were videotaped for reliability assessment, and a randomly selected portion of the interviews (55%) were rated by a second, independent clinician. Inter-rater agreement for GSP diagnosis was good (Kappa = 0.89). Exclusionary criteria included: (a) evidence of suicidal intent, (b) evidence of current substance abuse or dependence, (c) evidence of current or past schizophrenia, bipolar disorder, or organic mental disorder, (d) any concurrent psychotherapy (e) change in pharmacological treatments during the 12 weeks prior to study entry, and (f) Cognitive Behavioral Therapy within the past 6 months. Participants were re-assessed using the SCID-I at post-assessment (and follow-up for participants in the active condition), and were asked if they had obtained any additional form of treatment during the study. None reported any additional treatment. Participants' progress through the study is summarized in Figure 1.

Eligible participants were randomly assigned to receive either the AMP or ACC. Participants were enrolled in the study serially at two sites, the University of Georgia (UGA, n = 24) and San Diego State University (SDSU, n = 20), between January 2003 and October 2007. Four ACC participants withdrew from the study and were replaced by a participant assigned to that same group. Reasons provided for discontinuing the study were: relocation (n = 1), lack of transportation (n = 1), scheduling conflicts with work (n = 1), and unknown (n = 1). No AMP participants withdrew, leaving 22 AMP and 22 ACC treatment completers. See Table 1 for demographic and clinical characteristics.

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Materials

Attention Bias Modification Stimuli—The faces used in the Attention Bias Modification Task (modified dot probe task) were selected from a standardized set of emotional expressions (Matsumoto & Ekman, 1989). The set includes eight individuals (four male, four female) displaying threatening (i.e., disgust) and neutral expressions. We chose disgust faces as the threat stimuli for several reasons. First, disgust conveys a message of aversion or rejection (e.g., Rozin, Lowery, & Ebert, 1994), a central concern of individuals with social anxiety (APA, 2000), and may be more related to the concerns of socially anxious individuals relative to other emotions. Second, previous research has found that socially anxious individuals demonstrate an attention bias toward disgust faces (Pishyar et al., 2004). Further, compared to non-anxious individuals, socially anxious individuals rate the valence of disgust faces as more negative relative to angry expressions (Amir, Najmi, Bomyea, & Burns, in press). Finally, we used disgust faces to remain consistent with previous research demonstrating the effectiveness of attention training programs in reducing attention bias toward threat and anxiety reactivity (Amir et al., 2008) as well as symptoms of social anxiety (Schmidt et al., 2009) using identical training stimuli.

Attention Bias Assessment Stimuli—The stimuli used for the Attention Bias Assessment Task (modified Posner task) were eight social threat words (e.g., embarrassed, stupid, humiliated), and eight neutral words (e.g., dishwasher, tile, hanger). These words have been used in previous attention bias research in social anxiety (Amir et al., 2003). We used words, rather than pictures, in the assessment trials in order to reduce further any materials effect responsible for the effect of training.

Measures

We used a battery of clinician- and self-rated measures at pre- and post-assessment. Clinician ratings were made by raters blind to treatment condition. Interviewers were doctoral level graduate students, a postdoctoral fellow, and the first author. Prior to conducting assessments, interviewers were trained to criterion (e.g., 90% or higher) using standardized tapes created at our research center. Interviewer-training meetings also involved the discussion and implementation of specific guidelines for assessing symptoms of social anxiety (e.g., Liebowitz Social Anxiety Scale (LSAS): Fresco et al., 2001; Heimberg et al., 1999). After the raters reached the criterion established for each instrument, they began administering the instruments to patients. Independent assessors' reliability for the primary outcome measure, i.e., LSAS was good (Intra-class correlation coefficient = .88).

Social phobia—Our primary clinician-rated outcome measure was the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987), a 24-item scale that provides separate scores for fear and avoidance of social interaction and performance situations. Our primary self-report outcome measure was the Social Phobia and Anxiety Inventory (SPAI; Turner, Beidel, Dancu, & Stanley, 1989), which consists of 45 items assessing the cognitive, behavioral and somatic dimensions of SP. These measures have strong psychometric properties (Heimberg et al., 1999; Turner et al., 1989) and have been widely used in previous treatment outcome research in SP (e.g., Clark et al., 2006; Heimberg et al., 1998). The Sheehan Disability Scale (SDS; Leon, Olfson, Portera, Faber, & Sheehan, 1997), a three-item measure designed to assess functional impairment, was administered by interviewers to assess current level of interference due to social anxiety. The SDS generally demonstrates satisfactory reliability and correlates highly with other commonly used disability measures in social anxiety (e.g., Hambrick, Turk, Heimberg, Schneier, & Liebowitz, 2004; Leon et al., 1997). Internal consistencies for these measures were within the acceptable range in the current sample (Cronbach's alpha = .92, .97, .61, for the LSAS, SPAI, and SDS, respectively).

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Emotional distress—We used the State Trait Anxiety Inventory-Trait (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) to assess anxious mood, and the Hamilton Rating Scale for Depression (HAM-D; Hamilton, 1960) and Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) to assess depressed mood. Cronbach's alphas in the current sample were .90 and .88 for the STAI-Trait and BDI-II, respectively.

Procedure

Participants provided written informed consent at the beginning of the pre-assessment and again before each session. The consent form stated that the purpose of the study was to "evaluate the usefulness of new computer based treatments for anxiety"; however, no information was provided regarding the rationale for either of the two conditions. The consent form also stated that participants would be "randomly assigned to one of two groups: One group will receive the anxiety treatments and the other group will receive the non-treatment (placebo) condition". Participants completed a baseline assessment that comprised the interviewer and self-report measures. The pre-assessment, as well as post- and follow-up assessments lasted approximately 2–3 hours. After completing the pre-assessment, participants were randomly assigned to one of two conditions: the AMP or the ACC. Condition assignment was determined using two numbers (1 or 2) and a random number generator. A research coordinator then placed the randomly assigned condition number in an envelope in each file (1–44) at the beginning of the study. The condition assignments for the four ACC participants who withdrew from the study were placed back into the spreadsheet. Prior to each experimental session, participants entered the number in their file into the computer, which began the appropriate program. Participants did not know which condition the numbers represented, and the research assistants working with the participants could not see the number in the envelope. Thus, participants, experimenters, and interviewers remained blind to the participant's condition until after all post-treatment assessments were conducted. The protocol included eight 20-minute attention training sessions delivered over a four week period (i.e., twice weekly sessions). After completing eight sessions of the AMP or ACC, participants completed a post-assessment identical to the pre-assessment. Finally, to establish the duration of treatment effects, participants in the AMP group were invited to complete follow-up assessments, which occurred approximately four months later. Participants in the ACC were offered either the AMP or group CBT following the post-assessment. All participants received $10 per hour as compensation for their participation (e.g., for time away from work and expenses incurred). The current procedures were approved by the Internal Review Board (IRB) at both institutions.

To assess whether participants remained blind to their respective experimental condition, we asked participants at post-assessment whether they thought they received the active versus placebo intervention. Of the participants who provided responses, 21% (4/19) of participants in the AMP, and 28% (5/18) of ACC participants thought they had received the active treatment, χ^2 (1) = .23, p = .63. These findings bolster confidence that participants did not systematically predict their respective experimental condition.

Attention Modification Program (AMP)—Participants assigned to the AMP condition received a computer delivered attention training protocol. The probe detection task used to train attention was a variation of the dot probe paradigm developed by MacLeod et al. (1986), which has been used successfully to reduce attention bias toward threat during a single-session trial (Amir et al., 2008). Each probe detection trial began with a fixation cross "+" presented in the center of the monitor for 500 ms. Immediately following termination of the fixation cue, the computer presented two faces of the same individual, one face on top and one on bottom, with each pair displaying one of two combinations of emotions (i.e., neutral and disgust, or neutral and neutral). Faces were positioned 3 cm from the top of the screen and separated by 1.5 cm between the bottom of the top image and the top of the bottom image.

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Both faces were centered horizontally and 17.5 cm from the left edge of the screen. Faces were 3.75 cm tall by 5 cm wide. The program that presented the stimuli was written in Delphi (Borland Inc., 2005). The computer screen's refresh rate was 17 ms.

After presentation of the faces for 500 ms, a probe (either the letter "E" or "F") appeared in the location of one of the two faces. Participants were instructed to decide if the letter was an E or an F and press the corresponding button (left or right) on the computer mouse using their dominant hand. The probe remained on the screen until participants responded, after which the next trial began. Participants were told that it was important that they perform the task as quickly as possible without sacrificing accuracy. In previous research using this paradigm, we have found participants' average accuracy to be 95% or higher. One trial is illustrated in Figure 2.

During each session, participants saw 160 trials that comprised various combinations of probe type (E or F), probe position (top or bottom), face type (neutral or disgust), and person (four male and four female faces). Of the 160 trials, 128 trials (i.e., 80% of trials) included one neutral face and one disgust face where the probe always replaced the neutral face [2 (disgust face position: top or bottom) X 2 (probe type: E or F) X 8 (person) X 4 (repetition)]. Thus, although there was no specific instruction to direct attention away from disgust faces, on 80% of the trials the position of the disgust face predicted the position of the probe (i.e., in the location opposite to the disgust face). The remaining 32 trials (i.e., 20% of trials) included only neutral faces [2 (probe type: E or F) X 2 (probe position: top or bottom) X 8 (person)].

Attention Control Condition (ACC)—The ACC was identical to the AMP procedure except that during the presentation of the trials where a disgust face was present (i.e., neutral-disgust trials), the probe appeared with equal frequency in the position of the disgust face and the neutral face. Therefore, of the 160 trials, 64 trials (i.e., 40% of trials) were neutral-disgust with the probe following the disgust face, 64 trials (i.e., 40% of trials) were neutral-disgust with the probe following the neutral face, and the remaining 32 trials (i.e., 20% of trials) included only neutral faces as in the AMP. Thus, neither the disgust face nor neutral face had signal value regarding the position of the probe.

Attention Bias Assessment: In order to assess the effect of training on participants' attention to threat cues, participants completed an independent measure of attention bias at pre- and post-assessment. We chose to use a modified version of the Posner paradigm (Posner, 1980) identical to that reported in Amir et al. (2003) and Amir et al. (2008), using eight social threat and eight neutral word cues. Words were presented in lowercase (3–5 mm in height), white letters against a black background in the center of a Crystal Scan SVGA color monitor connected to a Gateway 2000 P200 Pentium computer. In this task, social threat or neutral cue words appear in one of two locations on the computer screen (rectangles located to the right or left of a centered fixation cross), thereby directing attention to one of two screen locations (i.e., right or left). After 600 ms, the cue word disappears, and participants are required to detect a probe ("*") that immediately appears in one of the two locations (i.e., right or left). The probe remained on the screen until the participant had responded, and response latencies were recorded from the onset of the probe to the button press. The inter-trial interval was 1650 ms. On some trials the cue word was valid (i.e., the probe appeared in the same location as the cue word). On other trials the cue word was invalid (the probe appeared in the location opposite the cue word). Participants saw 192 trials in random order; 2/3 (128) were valid trials (8 words × 2 word types × 2 word position × 4 repetitions), 1/6 (32) were invalid trials (8 words × 2 word types × 2 word position), and 1/6 (32) were un-cued trials (8 words × 2 word types × 2 word position). In previous research using this paradigm (Amir et al., 2003), socially anxious participants demonstrated significantly longer response latencies on invalidly cued social threat trials compared to non-anxious controls, suggesting that a bias may be due to difficulty disengaging from threatening stimuli.

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Statistical Analyses

Based on prior research examining the effect of a similar eight-session attention bias modification procedure on symptoms of anxiety in a sample of individuals diagnosed with GAD (Amir et al., 2009), we estimated an average effect size of 1.0 on our primary dependent measures. With alpha set at .05 and power (1-beta) set at .80, a sample size of at least 17 participants per group was needed to detect an effect of this magnitude between the AMP and ACC groups on the primary outcome measures of social anxiety symptoms.

Prior to conducting the main analyses, we confirmed that all statistical assumptions were met. Analyses were conducted on treatment completers (AMP, $n = 22$; ACC, $n = 22$). We chose this approach rather than an intention-to-treat analysis given the differential dropout rate between the AMP ($n = 0$) and ACC groups ($n = 4$). However, intent-to-treat analyses did not differ from the analyses reported on treatment completers only. To ensure that random assignment did not create groups differing in demographic characteristics or symptom severity, we conducted chi-square tests for categorical variables and *t*-tests for continuous variables comparing groups at pre-treatment on each demographic and dependent measure. Next, to establish that the attention training procedure was successful in manipulating attention bias toward threat cues, we submitted participants' response latencies on the Attention Bias Assessment Task (modified Posner) to a 2 (Group: AMP, ACC) X 2 (Word type: social threat, neutral) X 2 (Time: pre-assessment, post-assessment) X 2 (Validity: valid, invalid) ANOVA with repeated measurement on the last three factors. Higher order interactions were followed-up with simple lower-order interaction and main effects as appropriate.

Finally, to examine the effect of the attention training procedure on the dependent variables, we submitted participants' scores on self-report and interviewer measures to a series of 2 (Group: AMP, ACC) X 2 (Time: pre-, post-assessment) ANOVAs with repeated measurement on the second factor. Multivariate ANOVAs were used for conceptually related measures (i.e., social anxiety symptoms: LSAS, SPAI; emotional distress: HAM-D, STAI-T, BDI-II), and a univariate ANOVA was used for disability ratings (i.e., SDS). Significant multivariate effects were followed up with corresponding univariate tests. We followed up significant interactions with within-group simple effects analyses (*t*-tests) as well as analyses of covariance on post-treatment scores covarying pre-treatment scores to determine whether the AMP resulted in a significant change on the relevant dependent measures from pre- to post-assessment (see Clark et al., 2006; Heimberg et al., 1998). A series of 2 (Group) × 2 (Time) × 2 (Site: UGA, SDSU) analyses established that there was no significant effect of site on the primary dependent measures (all $p > .20$). The magnitude of symptom change was established by calculating (a) within-group effect sizes = (pre-assessment mean minus post-assessment mean)/pre-assessment standard deviation, and (b) between-group controlled effect sizes = (post-assessment ACC covariance adjusted mean minus post-assessment AMP covariance adjusted mean)/pooled standard deviation.

Results

Preliminary Analyses

The AMP and ACC groups did not differ on any demographic or clinical characteristics (*p*s > .2). See Table 1. A comparison of demographic characteristics between sites (UGA, SDSU) revealed significant site differences on ethnicity, $\chi^2(4) = 11.57$, $p = .02$, and age, $t(42) = 2.56$, $p = .01$, and a marginally significant difference on gender, $\chi^2 (1)= 3.01$, $p = .08$, but not for education, $t(42) = 1.66$, $p = .10$. Participants from UGA tended to be younger, Caucasian, and female relative to participants at SDSU. Comparison of the AMP and ACC groups at pre-assessment on measures of anxiety and depression revealed no significant differences (*p*s > .2). The means and standard deviations of these measures are presented in Table 2.

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Change in Attention Bias

We first eliminated response latencies for inaccurate trials. Inaccurate trials comprised trials where the probe was presented on the left side and the participant pressed the button corresponding to the right side, or vice versa. This procedure resulted in the elimination of 1% of the trials. In addition, response latencies less than 50 ms and greater than 1200 ms were considered outliers and were also eliminated from the analysis. These ranges were determined based on the inspection of the data using box plots and resulted in eliminating 1% of the trials.

Figure 3 presents participants' performance on the Attention Bias Assessment Task at pre- and post-assessment. Results revealed a significant 2 (Group: AMP, ACC) X 2 (Word type: social threat, neutral) X 2 (Time: pre-assessment, post-assessment) X 2 (Validity: valid, invalid) interaction, [$F(1, 42) = 5.6$, $p = .022$, $\eta_p^2 = .12$]. To follow-up this 4-way interaction we conducted separate Group X Time X Validity ANOVAs for social threat and neutral words. For neutral words this analysis revealed main effects of Time [$F(1, 42) = 28.5$, $p < .001$, $\eta_p^2 = .40$] and Validity [$F(1, 42) = 94.5$, $p < .001$, $\eta_p^2 = .69$] that were modified by an interaction of Time X Validity [$F(1, 42) = 27.9$, $p < .001$, $\eta_p^2 = .40$]. Examination of the means suggested that all participants became faster in responding to neutral valid trials than neutral invalid trials from pre- to post-training. The Group X Time X Validity interaction was not significant, $F(1, 42) = .55$, $p = .46$, $\eta_p^2 = .01$.

For social threat words, this analysis revealed main effects of Time [$F(1, 42) = 17.2$, $p < .001$, $\eta_p^2 = .29$] and Validity [$F(1, 42) = 101.0$, $p < .001$, $\eta_p^2 = .71$] that were modified by an interaction of Time X Validity X Group [$F(1, 42) = 4.2$, $p = .048$, $\eta_p^2 = .09$]. To follow up this 3-way interaction, we conducted separate Group X Time ANOVAs for valid social threat and invalid social threat words. For valid social threat words this analysis only revealed a main effect of Time [$F(1, 42) = 12.7$, $p = .001$, $\eta_p^2 = .23$]. More central to the present study hypothesis, the analysis for invalid social threat words revealed a main effect of Time [$F(1, 42) = 15.8$, $p < .001$, $\eta_p^2 = .27$] that was modified by an interaction of Time X Group [$F(1, 42) = 4.3$, $p = .044$, $\eta_p^2 = .09$]. Simple effects of Group revealed that although groups did not differ in their response latency to invalid social threat words before training [$t(42) = 0.84$, $p = .41$, $d = 0.07$], the AMP group was marginally faster in their response latency to invalid social threat words than the ACC group after training [$t(42) = 1.87$ $p = .069$, $d = 0.56$]. Consistent with our prediction, simple effects of Time revealed that the AMP group became faster on invalid social threat words from pre- to post-training [AMP: $t(21) = 4.0$, $p < .001$, $d = 0.77$], while the ACC did not differ in their responses to invalid social threat words before and after training [$t(21) = 1.47$, $p = .16$, $d = 0.26$].

Effect of Attention Training on Measures of Social Anxiety

Table 2 presents the means, standard deviations, and the results of the multivariate and univariate Group (AMP, ACC) X Time (pre-, post-assessment) ANOVAs of the SP measures[1]. The multivariate Group X Time interaction was significant ($p < .001$). Univariate ANOVAs revealed significant Group X Time interactions on the LSAS, SPAI, and SDS (all $p < .05$). Follow-up paired *t*-tests conducted within each group revealed that participants in the AMP group showed a significant decrease in scores from pre- to post-assessment on the LSAS, [t (21) = 11.80, $p < .001$, $d = 1.71$], SPAI, [t (21) = 7.55, $p < .001$, $d = 1.92$], and SDS, [t (21)

[1]Some research recommends the use of an LSAS cutoff of 60 in addition to a diagnostic assessment to establish the generalized subtype of social phobia (Mennin et al., 2002). To facilitate comparability of the current findings with previous clinical trials that used this LSAS cutoff as part of their inclusion criteria, we re-analyzed our primary outcome measures (LSAS, SPAI) in the subgroup of participants with a pre-assessment LSAS ≥ 60 (AMP, $n = 17$; ACC, $n = 16$). Results of the Group (AMP, ACC) X Time (pre-, post-assessment) MANOVA revealed a significant interaction, $F(2, 30) = 12.49$, $p < .001$, $\eta_p^2 = .45$. Follow-up univariate ANOVAs for the LSAS and SPAI also revealed significant Group X Time interactions, $F(1, 31) = 25.70$, 6.19, both $p < .05$, $\eta_p^2 = .45$, .17, respectively. These findings are consistent with the results reported for the overall sample.

= 6.85, $p < .001$, $d = 1.5$]. Similar analyses in the ACC group revealed a significant decrease in scores from pre- to post-assessment on the LSAS, [t (21) = 2.94, $p = .008$, $d = .49$], SPAI, [t (21) = 3.36, $p = .003$, $d = .85$], and SDS, [t (21) = 2.94, $p < .001$, $d = .55$]. Analyses of covariance conducted on post-treatment scores covarying pre-treatment scores using the LSAS, SPAI, and SDS as the dependent variables revealed that the AMP group was less socially anxious, LSAS, [F(1, 41) = 27.35, $p < .001$, $d = 1.59$], SPAI, [F(1, 41) = 5.21, $p = .028$, $d = .69$], and less functionally impaired relative to the ACC group at post-assessment, SDS, [F(1, 41) = 15.92, $p < .001$, $d = 1.22$].

Effect of Treatment on Emotional Distress

Table 2 presents the means, standard deviations, and the results of the multivariate and univariate Group (AMP, ACC) X Time (pre-, post-assessment) ANOVAs for measures of general emotional distress. Results revealed a significant multivariate main effect for Time ($p < .001$). Follow-up univariate ANOVAs revealed significant main effects of Time on the HAMD, BDI-II, and STAI-T[2] (all $p < .001$), which indicated that all participants experienced reductions in symptoms of general anxiety and depression from pre- to post-assessment. However, the multivariate Group X Time interaction was not significant ($p = .49$), suggesting that the decrease in general emotional distress did not occur differentially across groups.

Maintenance of Treatment Gains

Follow-up data collected approximately four months following the post-assessment were obtained from 18 of 22 participants in the AMP group. See Table 2. Results revealed that although participants' LSAS scores at follow-up were not significantly different from their post-assessment scores, [t(17) = 0.73, $p = .47$, $d = .24$], they were significantly lower than their pre-assessment scores, [t(17) = 6.43, $p < .001$, $d = 1.86$]. Similarly, participants' SPAI scores at follow-up were not significantly different from their post-assessment scores, [t(17) = .78, $p = .44$, $d = .16$]; however, participants' SPAI scores at follow-up were significantly lower than their pre-assessment scores, [t(17) = 5.99, $p < .001$, $d = 2.52$]. Thus, the decrease in social anxiety symptoms after training appears to be an enduring effect, at least during a several month follow-up period. A similar pattern of findings emerged for measures of anxious and depressed mood (HAM-D, BDI-II, STAI-T). However, interpretation of these findings is tempered given the absence of a significant Group X Time interaction for these measures.

Clinical Significance

Diagnostic status after treatment was examined. At post-assessment, 50% of participants in the AMP group no longer met diagnostic criteria for GSP compared to 14% of participants in the ACC group, $\chi^2(1) = 6.71$, $p = .01$. We followed the procedures outlined by Jacobson and Truax (1991) to evaluate clinically significant change on the primary outcome measures (LSAS and SPAI). A participant was classified as meeting criteria for clinically significant change if (a) their post-treatment score fell within the range (mean ± two standard deviations) of the non-clinical population using Fresco et al.'s (2001) non-patient LSAS data and Franklin et al.'s (2005) non-patient SPAI data (see Clark et al., 2006), and (b) if they displayed a statistically reliable reduction in scores from pre- to post-assessment using the reliable change index (Jacobson & Truax, 1991). The percentage of patients who had achieved clinically significant improvement on the LSAS was 27% in the AMP and 5% in the ACC, $\chi^2(1) = 4.25$, $p = .04$, and on the SPAI was 32% in the AMP and 18% in the ACC, $\chi^2(1) = 1.09$, $p = .30$.

[2]Previous research suggests that the STAI-Trait scale assesses depression as well as anxiety (Bieling, Antony, & Swinson, 1998). Accordingly, we re-analyzed the STAI-T data using the subset of empirically derived anxiety items recommended by Bieling et al. (1998). Results of this Group (AMP, ACC) X Time (pre-, post-assessment) ANOVA revealed a similar pattern of findings to the overall analyses. A significant main effect emerged for Time, $F(1, 42) = 52.07$, $p < .001$, $\eta_p^2 = .56$, but not for Group or the Group X Time interaction, both $F(1, 42) = .02$, $p > .80$, $\eta_p^2 = .00$.

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Mediational Analyses

To examine whether change in attention bias resulting from the AMP was associated with change in social anxiety symptoms, we conducted a mediation analysis following the procedure described by MacKinnon and colleagues (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). To remain consistent with previous research examining change in attention following an attention training procedure (Amir et al., 2008) we computed an attention bias score by subtracting response latencies for invalid social threat trials from invalid neutral trials on the Attention Bias Assessment Task. Change in attention bias and change in social anxiety symptoms were computed using simple difference scores (Maris, 1998). The MacKinnon et al. (2002) procedure tests the product of the coefficients for the effects of (1) the independent variable (group: AMP, ACC) to the mediator (change in attention bias from pre- to post-assessment) (α path: $b = .38$, $SE = .143$), and (2) the mediator to the dependent variable (change in LSAS and SPAI from pre- to post-assessment) when the independent variable is taken into account (β path: $b = .28, .42$, $SE = .121, .144$, for the LSAS and SPAI, respectively). This procedure accounts for the non-normal distribution of the αβ path through the construction of asymmetric confidence intervals (MacKinnon, Fritz, Williams, & Lockwood, 2007). Results revealed that the 95% confidence interval of the indirect path (αβ) did not overlap with zero for change in LSAS from pre- to post-assessment (lower limit = .010, upper limit = .243), which suggested that change in attention bias due to the AMP was associated with a reduction in social anxiety symptoms. The 95% confidence interval did overlap with zero for change in SPAI (lower limit = −.005, upper limit = .247).

Discussion

As predicted, attention training successfully facilitated attention disengagement from threat from pre- to post-assessment, as well as reduced symptoms of social anxiety in individuals diagnosed with GSP. At post-treatment, independent assessor and participant ratings converged in demonstrating that participants completing the AMP were significantly less socially anxious and less functionally impaired than the ACC group. Finally, 50% of participants in the AMP group no longer met DSM-IV criteria for GSP after training, compared to 14% of participants in the control condition. Considered together, the present findings are consistent with earlier work using attention training procedures to modify emotional vulnerabilities in the context of laboratory stressors (Amir et al., 2008; MacLeod et al., 2002), and support the utility of using computerized attention modification programs with clinically anxious populations.

The current study adds to a small but growing empirical literature demonstrating the efficacy of computerized attention training procedures in reducing clinical symptoms in individuals meeting diagnostic criteria for an anxiety disorder (Amir et al., 2009; Schmidt et al., 2009). The finding that similar treatment outcomes were obtained within the current study at separate sites with differing demographic profiles, as well as in an independent laboratory (Schmidt et al.), supports the generalizability of the attention modification program across settings. Moreover, the robustness of the attention training procedure is bolstered by the extension of earlier findings in analogue samples of socially anxious students during brief training procedures (e.g., Amir et al., 2008; Li et al., 2008) to treatment-seeking samples presenting with greater severity of symptoms and functional impairment. Although the training stimuli used in the current study comprised faces conveying signs of disgust, there is evidence to suggest that disgust-relevant stimuli activate brain regions also implicated in the processing of other emotional stimuli such as fear (e.g., Stark et al., 2007). Research is needed to establish whether the current treatment effects are unique to disgust stimuli, or generalize to other types of emotional training stimuli. Furthermore, assessments completed approximately four-months after completion of the post-assessment revealed that participants maintained symptom

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reduction after completing the training, suggesting that the beneficial effects of the AMP were enduring (see also Schmidt et al.). However, follow-up data should be interpreted with caution because assessors and participants were no longer blind to condition. Future research should investigate the long-term impact of the attention training procedure, including an assessment of symptoms as well as attention bias.

Participants in the current study had clinical characteristics and symptom severity scores in the range of previous treatment studies (e.g., Clark et al., 2006; Davidson et al., 2004; Heimberg et al., 1998). Moreover, the controlled post-assessment between-group effect sizes for the current study (LSAS, d = 1.59; SPAI, d = .69) are comparable to those reported in previous studies, suggesting that the AMP may be an effective intervention for reducing symptoms of social anxiety. These findings speak to the utility of the AMP, given the brevity of the intervention (eight sessions over four weeks, 20 minutes each) and absence of therapist contact. Although empirically supported treatments for SP already exist, many people do not have access to therapists trained in CBT, while others opt not to take medication for their symptoms (e.g., Huppert, Franklin, Foa, & Davidson, 2003). The ease of delivery of the current intervention suggests that the AMP may serve as a transportable and widely accessible treatment for individuals with SP who are unable to or choose not to access existing treatments.

Although accumulating evidence suggests that computerized attention training procedures are efficacious in reducing symptoms of anxiety in treatment-seeking samples, little is known about the attentional mechanisms underlying clinical improvement. Because previous studies either have not employed a measure of attention bias (Schmidt et al., 2009) or have assessed change in attention using the same task as employed during training (Amir et al., 2009), they have not been able to identify attention mechanisms underlying the observed treatment effects (see Weierich et al., 2008). The current study extended previous research by including an independent assessment of attention that comprised a different task and stimuli, as well as a distinct attention process (i.e., covert attention allocation) relative to that used in training. The results suggested that the AMP facilitated participants' ability to disengage their attention from social threat cues from pre- to post-training. Although participants as a whole did not differ at pre-assessment in their response latencies on invalid social threat compared to invalid neutral trials, the AMP group became faster to identify probes following invalidly cued threat words at post-assessment, making their responses closer to the performance that non-anxious individuals have been shown to display in previous research using this task (see Amir et al., 2003). Moreover, change in attention bias from pre- to post-assessment was associated with change in clinician-reported social anxiety symptoms. These results mirror those reported in Amir et al. (2008) using an identical attention modification program in an analogue sample during a single-session training procedure in the context of a laboratory social stressor. The results of the mediation analysis, however, should be interpreted with caution, given that change in the putative mediator (attention bias) and change in social anxiety symptoms were assessed at the same time, and temporal precedence was therefore not established. Thus, although causal inferences can be made about change in attention resulting from the AMP, we cannot make such claims about the relationship between change in attention and symptom change. Future research should administer assessments of attention at multiple points during the course of treatment to better address these issues.

Several explanations may account for the reduction in social anxiety associated with attention training. Previous research indicates that socially anxious individuals preferentially process negative social information (see Bögels & Mansell, 2004). To the extent that attention biases toward threat are causally involved in the maintenance of anxiety (e.g., Clarke et al., 2008; MacLeod et al., 2002), then any procedure that normalizes this bias would be expected to also reduce anxiety symptoms. Consistent with this hypothesis, participants in the AMP group displayed a reduction in attention bias to threat-relevant cues over the course of training. In

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keeping with findings from previous work, it may be that the attention training procedure reduced participants' emotional vulnerability in the context of real-life social encounters (e.g., Amir et al., 2008; MacLeod et al., 2002).

If attention acts as an initial filter on the processing of environmental cues, then reducing selective attention to threat would be expected to allow for increased processing of other types of social information, or may alter the perception of threat early in the appraisal process (e.g., Gross, 2002) before the cascade of maladaptive cognitive, behavioral, and emotional events associated with anxiety is fully activated. Previous research suggests that the attention bias characteristic of anxious individuals may be moderated by individual differences in attentional control, such that anxious participants with poor attentional control remained slow in disengaging from threat, whereas those with good attentional control were better in shifting away from threat (Derryberry & Reed, 2002). The enhanced disengagement evident in anxious people with good attentional control may limit the buildup of anxiety elicited by threatening stimuli, while allowing those individuals to access other information related to safety or the absence of the feared outcome, and facilitate more effective coping (e.g., Eysenck, Derakshan, Santos, & Calvo, 2007). As a result of our training, participants in the AMP group may have come to view external social situations as less threatening. In turn, diminished threat appraisals may lead to fewer avoidance behaviors, and may have provided AMP participants with greater opportunities to practice social skills and more objectively evaluate social situations, resulting in reductions in anxiety symptoms. Future studies should examine the cognitive and behavioral sequelae of attention training in naturalistic settings over time.

A large body of research suggests that cognitive and behavioral therapies (CBT) are effective in treating a range of anxiety-related conditions, including SP (e.g., Clark et al., 2006; Heimberg et al., 1998). A central component of these treatments is repeated exposure to fear-provoking stimuli designed to facilitate emotional processing of threat information in order to allow the individual to experience a reduction in anxiety (i.e., habituate) and test the hypothesis that the feared stimuli may not be as threatening as initially predicted (e.g., Foa, Huppert, & Cahill, 2006). Contrary to this model of anxiety reduction, our training directed participants' attention away from threatening cues. One might argue that this approach, through encouraging attentional avoidance of threatening stimuli, would stand in contrast to the goal of exposure by interfering with elaborative processing of emotional material thought to be necessary for symptom reduction.

A review of the extant empirical literature, however, paints a more complex picture. Although some studies have found that attentional focus during exposure facilitated fear reduction (e.g., Grayson, Foa, & Steketee, 1982), others have found that distraction produced greater fear reduction (e.g., Oliver & Page, 2008). These results suggest that not all forms of attentional avoidance are anti-therapeutic, and suggest that a more precise understanding of the distinct mechanisms involved in attentional avoidance is needed (see Craske et al., 2008; Rachman, Radomsky, & Shafran, 2008 for reviews). As proposed by Weierich et al. (2008), different subcomponents of attention may influence emotional processing in distinctive ways. Thus, it may be that focusing away from threat stimuli under some conditions is beneficial, while avoidance of threat stimuli is detrimental in other cases. This issue is of considerable theoretical and clinical importance, and requires greater empirical attention.

Our study has limitations. First, our sample size was small. This provided limited power to conduct mediational analysis, and prevented an examination of moderators of treatment response (e.g., comorbidity). Second, we did not collect data regarding interviewers' or experimental assistants' guess regarding group assignment, and therefore cannot definitively establish that interviewers and assistants remained blind to participant condition in all cases. However, it is unlikely that awareness of group assignment accounted for our results for the

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following reasons. First, experimental assistants were not aware of the participant's condition assignment, and did not view any of the computerized trials. Second, interviewers met with participants exclusively during pre-, post-, and follow-up interviews and had little to no contact with participants during the computerized training sessions. Further, inter-rater reliability was conducted using ratings from judges who were blind to condition and corroborated the results. It is also notable that data collected from participants suggested they did not systematically predict their condition assignment, and the pattern and magnitude of treatment effects were consistent across participant and interviewer measures. Nonetheless, future research should include an assessment of assessors' prediction about group assignment.

We also did not include an assessment of significant others, or a behavioral assessment (e.g., social stressor, see Amir et al., 2008). These additional sources of data would increase our confidence in the generalizability of the current results beyond indices of symptom reduction and impairment. We also did not assess change in attention using the same probe detection task used during training, which limits comparability to some previous studies (e.g., Amir et al., 2009). Research is needed to examine the effects of the AMP on change in different subcomponents of attention hypothesized to be involved in the pathophysiology of GSP, as well as use more ecologically valid tests of attention. Finally, it should be noted that significant Group X Time interaction effects were obtained only on measures of social anxiety symptoms, whereas the two groups did not respond differentially on measures of general emotional distress. These results suggest that the training was more specific to social anxiety symptoms, consistent with other placebo-controlled clinical trials in SP (e.g., Heimberg et al., 1998; Schmidt et al., 2009). Although the AMP group displayed significant reductions in these symptom domains, the ACC group also exhibited similar, and in some cases, large treatment effects from pre- to post-assessment. Although treatment effects of this magnitude are not entirely inconsistent with previous treatment studies in SAD using credible placebo-controlled comparison conditions (e.g., Davidson et al., 2004), it is nonetheless important to consider possible explanations for the placebo effects exhibited by the ACC group in this study. One possibility is that any procedure involving repeated attention focusing, particularly in the presence of threatening stimuli, may have some therapeutic benefit (see also Wells, 2000). It is also possible that the scheduling demands of the current study (i.e., attending sessions twice weekly) served as a form of behavioral activation. Future research is needed to clarify the effect of similar attention bias modification procedures on anxious and depressed mood, and to explore the use of alternate attention control conditions in anxious populations.

In summary, the results of the present work suggest that the translation of basic psychopathology research to address a clinical condition may prove useful in developing new interventions. Moreover, these procedures may help identify the mechanisms that are involved in the pathogenesis of psychiatric conditions. The current findings are promising considering the short duration of the intervention and absence of therapist contact, and suggest that this type of attention training procedure may show promise as an efficacious and portable intervention for social anxiety. Future studies should examine the additive and/or interactive effects of attention training and currently efficacious interventions, as well as the combination of other types of information-processing training (e.g., interpretation training, see Beard & Amir, 2008).

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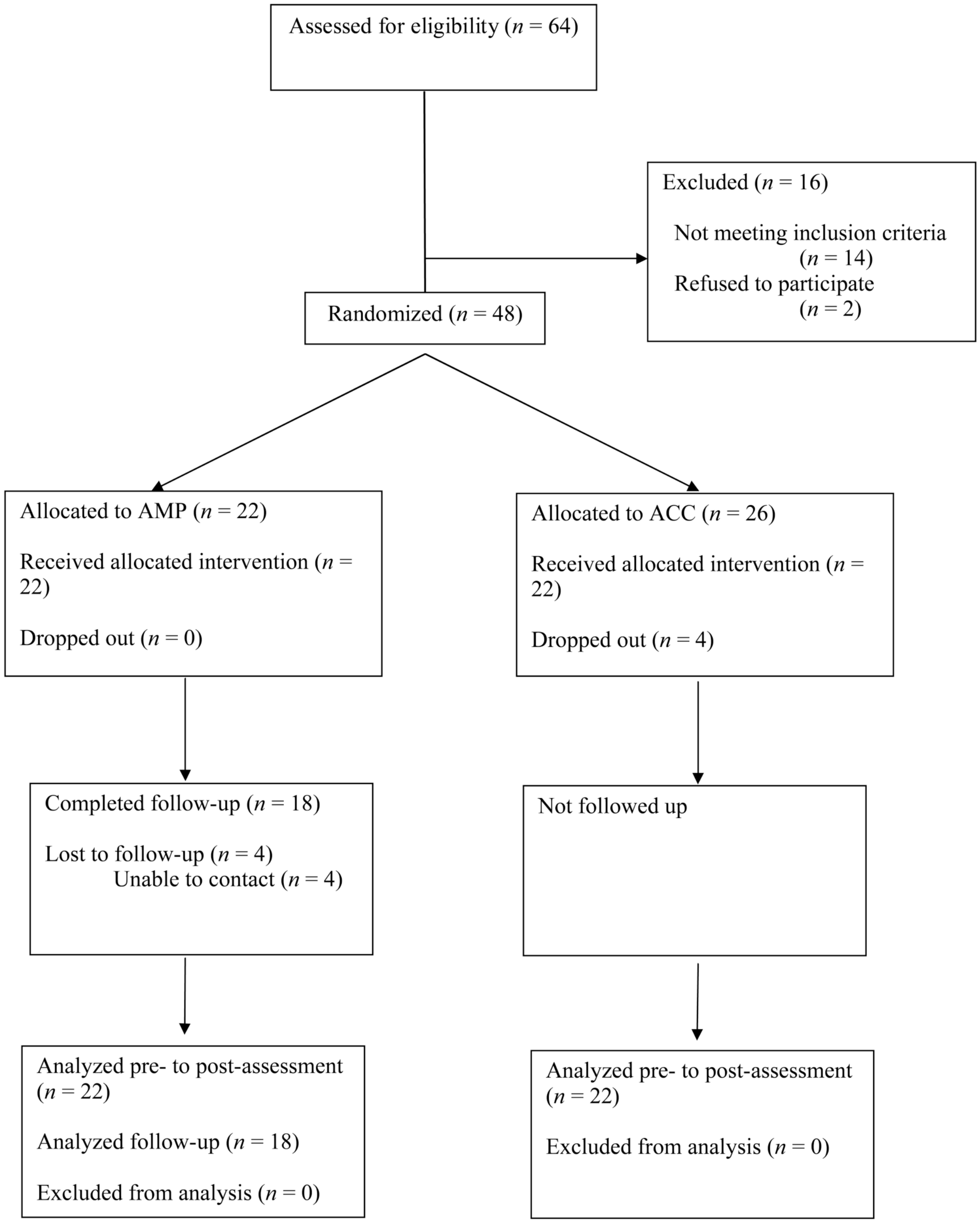

Figure 1.

Diagram of participants' progress through phases of the study

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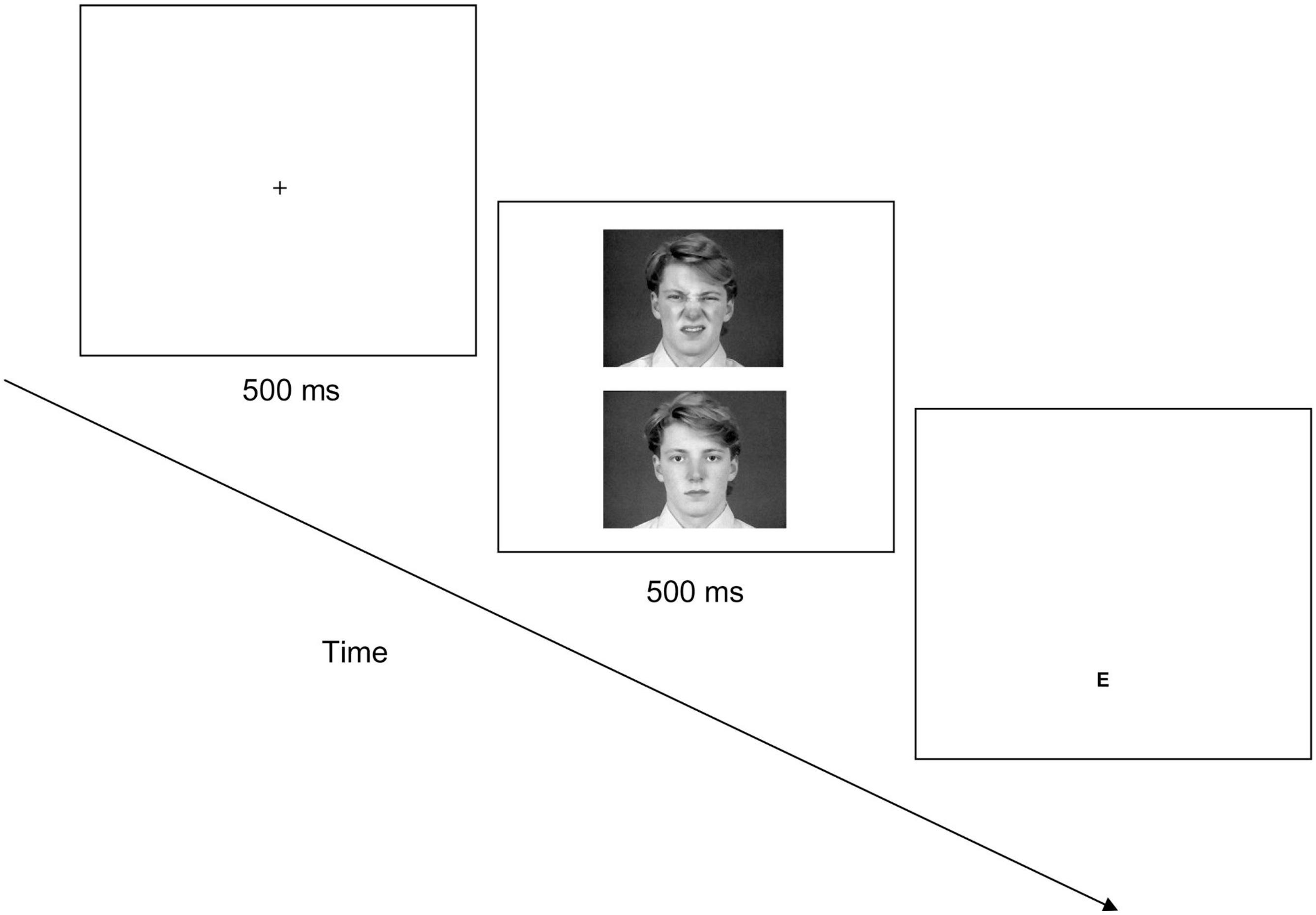

Figure 2.
Attention bias modification task

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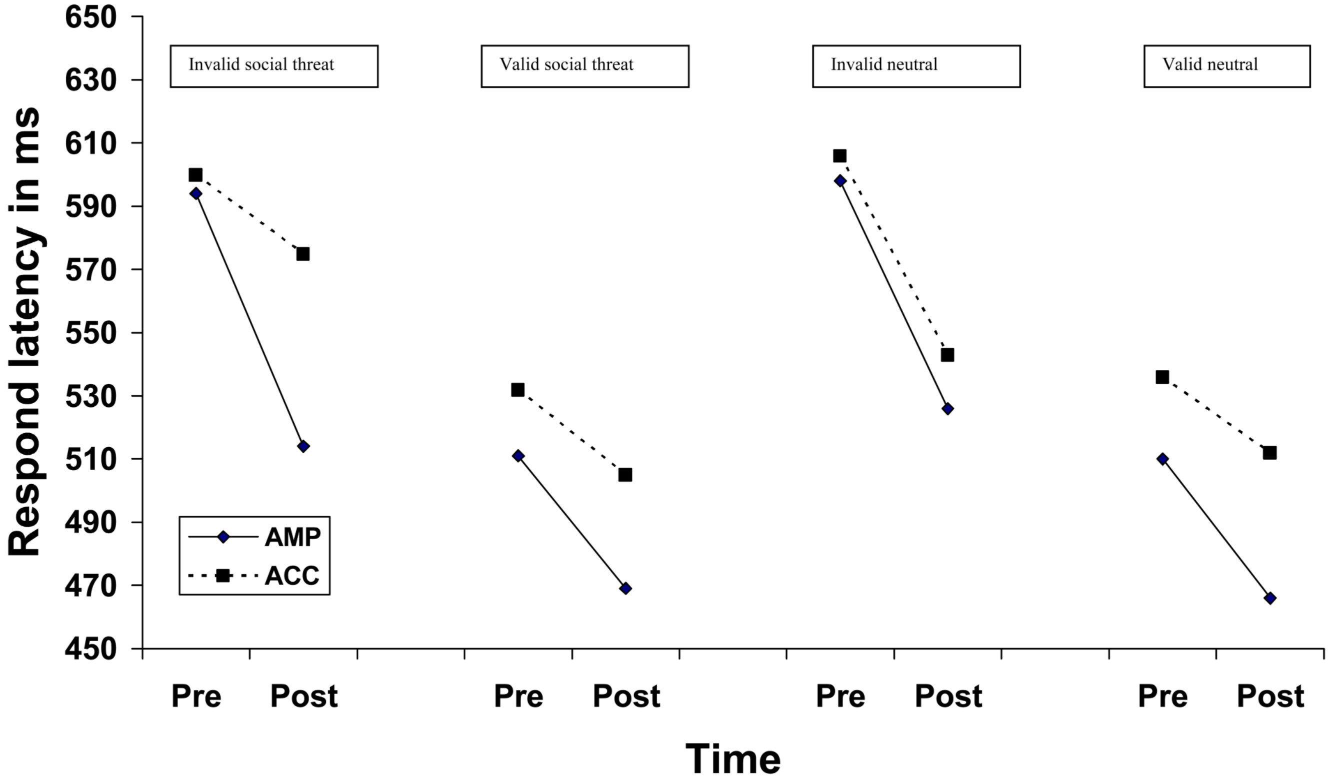

Figure 3.
Response latencies on the modified Posner task before and after training

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Table 1

Patient Demographics and Clinical Characteristics

Variable	**AMP**	**ACC**
Gender (% female)	63.6	54.5
Age	27.6 (8.3)	31.1 (13.2)
Years of Education	15.4 (2.6)	15.2 (1.9)
Ethnicity (%)		
Caucasian	63.6	81.8
Asian American	13.6	0
African American	9.1	0
Latin American	9.1	13.6
Other	4.5	4.5
Comorbid Diagnoses (%)		
Any	50.0	40.9
Generalized Anxiety Disorder	22.7	13.6
Specific Phobia	13.6	4.5
Past Treatment for SP (%)	50.0	45.5

Note. Standard deviations in parentheses. SP = social phobia.

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Table 2

Means and standard deviations for self-report and interviewer measures.

	Pre-assessment M (SD)		Post-assessment M (SD)		Follow-up M(SD)	Results		
	AMP (n = 22)	**ACC (n = 22)**	**AMP (n = 22)**	**ACC (n = 22)**	**AMP (n = 18)**	**Group F (p) (η_p^2)**	**Time F (p) (η_p^2)**	**Group X Time F (p) (η_p^2)**
Social Anxiety (multivariate)						0.30 (0.74) (η_p^2) = .01	55.18 (0.00)** (η_p^2) = .73	14.84 (0.00)** (η_p^2) = .42
LSAS	74.5 (16.6)	68.1 (16.7)	46.1 (16.6)	60.0 (18.2)	41.48 (17.3)	0.61 (0.43) (η_p^2) = .01	99.02 (0.00)** (η_p^2) = .70	30.41 (0.00)** (η_p^2) = .42
SPAI	132.3 (17.3)	126.7 (20.9)	99.1 (30.8)	109.0 (30.9)	88.82 (33.9)	0.10 (0.75) (η_p^2) = .00	55.06 (0.00)** (η_p^2) = .57	5.07 (0.03)* (η_p^2) = .12
Functional Impairment (univariate)								
SDS	18.5 (5.2)	16.6 (4.4)	10.7 (5.5)	14.2 (5.6)	8.8 (5.6)	0.19 (0.67) (η_p^2) = .01	64.84 (0.00)** (η_p^2) = .63	18.70 (0.00)** (η_p^2) = .33
Emotional Distress (multivariate)						0.27 (0.85) (η_p^2) = .02	17.04 (0.00) (η_p^2) = .57	0.82 (0.49) (η_p^2) = .06
HAM-D	9.0 (4.9)	7.8 (4.2)	4.9 (3.4)	5.8 (3.6)	4.1 (4.0)	0.2 (0.89) (η_p^2) = .00	23.55 (0.00)** (η_p^2) = .36	2.78 (0.10) (η_p^2) = .06
BDI-II	20.4 (11.6)	19.2 (8.3)	12.4 (9.4)	10.7 (6.7)	11.2 (8.5)	0.45 (0.51) (η_p^2) = .01	28.40 (0.00)** (η_p^2) = .41	0.06 (0.81) (η_p^2) = .00
STAI-T[2]	54.9 (9.8)	55.0 (8.5)	45.4 (11.4)	45.6 (10.2)	43.1 (11.8)	0.00 (0.99) (η_p^2) = .00	40.11 (0.00) (η_p^2) = .50	0.0 (0.99) (η_p^2) = .00

Note: AMP: Attention Modification Program; ACC: Attention Control Condition; LSAS: Liebowitz Social Anxiety Scale; SPAI: Social Phobia and Anxiety Inventory; SDS: The Sheehan Disability Scale; HAMD: The Hamilton Rating Scale for Depression; STAI-T: The State Trait Anxiety Inventory - Trait; BDI-II: The Beck Depression Inventory II.

$^{**}p < .01$.

$^{*}p < .05$