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Integrating cognitive bias modification into a standard cognitive behavioural treatment
package for social phobia: A randomized controlled trial.

Ronald M. Rapee 1.

Colin MacLeod 2.

Leigh Carpenter 1.

Jonathan E. Gaston 1.

Jacqueline Frei 1.

Lorna Peters 1.

Andrew J. Baillie 1.

1. Centre for Emotional Health, Macquarie University, Sydney.
2. Centre for Advancement of Research on Emotion, University of Western Australia, Perth.

Correspondence to Ron Rapee, Centre for Emotional Health, Department of Psychology,
Macquarie University, Sydney, NSW, 2109, Australia. Ron.Rapee@mq.edu.au

Abstract

Objective: The aim of the current study was to integrate recent developments in the retraining of attentional biases toward threat into a standard cognitive behavioural treatment package for social phobia.

Method: 134 participants (M age – 32.4; 53% female) meeting DSM-IV criteria for social phobia received a 12-week cognitive behavioural treatment program. They were randomly allocated to receive on a daily basis using home practice, either an additional computerised probe procedure designed to train attentional resource allocation away from threat, or a placebo variant of this procedure. Measures included diagnostic severity, social anxiety symptoms, life interference, and depression as well as state anxiety in response to a laboratory social threat.

Results: At the end of treatment there were no significant differences between groups in attentional bias toward threat or in treatment response (all p 's $>.05$). Both groups showed similar and highly significant reductions in diagnostic severity, social anxiety symptoms, depression symptoms, and life interference at post-treatment that was maintained and in most cases increased at 6 month follow-up (uncontrolled effect sizes ranged from $d = 0.34$ to $d = 1.90$).

Conclusions: The current results do not indicate that integration of information processing-derived attentional bias modification procedures into standard treatment packages as conducted in this study augments attentional change or enhances treatment efficacy. Further refinement of bias modification techniques, and better methods of integrating them with conventional approaches, may be needed to produce better effects.

Keywords: Social anxiety disorder; Attention training; Cognitive bias modification;
Randomized controlled trial

Highlights

- Treatment for social phobia was successful through a comprehensive cognitive behavioural package of 12 sessions.
- Attentional bias modification conducted at home and integrated into the homework component of treatment failed to change attentional biases toward threat.
- Attentional bias modification conducted in this way also failed to produce a greater impact on symptoms of social phobia over that produced by the treatment package.

Social anxiety disorder is a debilitating mental disorder that affects a significant proportion of people in most societies (Furmark, 2002). It is one of the more chronic mental disorders with an early onset and unremitting course (Rapee & Spence, 2004; Yonkers, Bruce, Dyck, & Keller, 2003). It is also one of the hardest anxiety disorders to treat showing the smallest treatment effects of any anxiety disorders in both adults and children (Hudson, Rapee, Lyneham, Wuthrich, & Schniering, 2010; Norton & Price, 2007). For these reasons, improvements and new methods for the treatment of social anxiety disorder are imperative.

Ideally, new developments in treatment should come from advances in theory. Following this perspective, some promising developments have been realised by application of cognitive behavioural theories of social anxiety. These theories have pointed to the importance of several factors that can provide a specific focus for treatment including a negative mental representation of the self, a self-focussed attention, and the extensive use of safety strategies and subtle avoidance (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). Treatments that specifically address these factors have been shown to produce stronger effects than more traditional cognitive behavioural programs (Clark et al., 2006; Rapee, Gaston, & Abbott, 2009). For example, in a specific test of the value of including these specific techniques, we showed that a treatment package incorporating these elements was significantly superior to a program that focussed only on simple cognitive restructuring and external exposure (Rapee et al., 2009). Of theoretical importance, two variables, change in the mental representation and change in the cost of negative evaluation were shown to mediate the differences between treatment effects.

A different type of theoretical model that has gained traction in the anxiety literature over the past 20 years has focused on information processing mechanisms. These models suggest that anxiety disorders are maintained by biases in early processing, especially

attention and interpretation (Mathews & MacLeod, 1987). Specifically in terms of attention, it is suggested that people with anxiety disorders (including social anxiety disorder) will allocate excessive attentional resources to (social) threat. A wealth of empirical research has demonstrated associations between social anxiety or diagnoses of social anxiety disorder and attentional bias toward social threat (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007). In a major development of this literature, it has been demonstrated that the relationship between attentional bias and anxiety is more than simply correlational, and attentional bias appears to causally influence anxiety. In one of the first studies to directly modify attentional response to threat, MacLeod and colleagues (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) demonstrated that training individuals to selectively focus attention away from threat attenuated their emotional response to a subsequent stressor, compared to individuals trained to attend towards threat. This beneficial effect of training attentional avoidance of threat has been replicated in the realm of social anxiety (Amir, Weber, Beard, Bomyea, & Taylor, 2008).

In brief, the procedure used in these types of studies involves simultaneous presentation of a threat and non-threat cue on a computer screen, immediately followed by a probe (e.g. a particular letter) in the position of one of the cues (i.e., either replacing the threat or non-threat cue). The participant's task is simply to identify as quickly as possible the nature of the probe (e.g., type the keyboard letter corresponding to the probe). In the assessment version of this task, the probes equally and randomly replace both the threat and non-threat cues. Attentional bias is determined by the relative latency to respond to probes in the two positions. In the training variant of the task, probes replace one cue more than the other. For example, to train attention away from threat, the probe would replace the non-threat cue on the majority of occasions. The participant thereby learns to focus attention toward the non-threat cue in order to be more efficient on the task.

Based on the argument made earlier that treatment innovations should follow theoretical development, it follows that demonstration of a causal association between attentional biases and social anxiety might point to promising treatment directions. Indeed research is now beginning to demonstrate such applications. In one of the first studies using a clinical sample, Amir and colleagues (2009) provided a small sample of participants with generalised social anxiety disorder with eight, 20-minute sessions of attentional training over four weeks. Participants either received a training condition designed to induce an attention bias away from threat, or a placebo condition which introduced no attentional training contingency. Those receiving the condition designed to train away from threat were less likely to meet diagnostic criteria for social anxiety disorder at the end of treatment and showed a very large reduction in social anxiety symptoms. At least one study has replicated this effect with another small sample of socially anxious patients (Schmidt, Richey, Buckner, & Timpano, 2009).

Given these two promising sets of findings, indicating that this attentional bias modification procedure can yield therapeutic benefits for social phobia, it becomes important to determine whether combining such attentional bias modification with conventional cognitive behaviour therapy could improve treatment outcomes. Theoretically, whether the two methods augment or interfere with each other will depend on whether or not they exert their influence through independent mechanisms. If techniques derived from cognitive behavioural theories work through psychological mechanisms that differ from those influenced by direct attentional bias modification techniques, then the two methods might augment each other. On the other hand, it is entirely possible that both methods simply represent alternative ways of altering the same information processing mechanisms, in which case there may be little additional benefits of combining their delivery.

The aim of the current study was to evaluate whether there is therapeutic benefit in adding an attentional bias modification procedure to a "best-practice" cognitive behavioural treatment program for social phobia. All participants received the comprehensive cognitive behavioural package and engaged regularly in a computerised procedure which was delivered either in a condition designed to attenuate attention to threat, or in a placebo condition that did not contain this training contingency.

Method

Participants

Participants for the study were 134 individuals meeting Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSM-IV: American Psychiatric Association, 2000) criteria for social anxiety disorder who were randomly allocated to either an attention bias modification procedure (ABMP) or placebo training (PT). A planned sample size (N=128) was determined to allow a minimum difference of .5 standard deviation units to be detected at an alpha of .05 with 80% power (Faul & Erdfelder, 1992) for main effects.

Participants were included if they were over 18 years and met criteria for social anxiety disorder as their main (or most interfering) disorder. In order to maximize external validity, exclusions were minimized. The only planned exclusions were problems requiring immediate clinical action such as clear suicidal intent, severe substance abuse or dependence, or florid psychosis, identified during the structured interviews. Concurrent pharmacotherapy or psychotherapy were allowed as long as dosages had been consistent for three months and there were no plans to change.

Diagnoses were made by graduate students and clinical psychologists using a structured clinical interview, the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV) (Di Nardo, Brown, & Barlow, 1994). Clinical severity of each disorder was rated on a 0-8 scale reflecting severity relative to other people with the disorder and life impact. Our previous research has indicated strong reliability for diagnosis of social anxiety disorder and clinical severity ratings using these methods in our clinic ($\kappa = .86$; ICC = .85) (Rapee et al., 2009). Following treatment all participants were re-interviewed with the ADIS addressing all anxiety disorders plus any additional disorders that they met criteria for at pre-treatment. Avoidant personality disorder was assessed using the avoidant personality disorder section of the Personality Disorder Examination (Loranger, Janca, & Sartorius, 1997).

Among the current sample, 93% met criteria for the generalized subtype of social anxiety disorder. As would be expected, Axis I comorbidity was also high: 43% met criteria for an additional anxiety disorder and 31% met criteria for an additional mood disorder. The sample ranged from 18-77 years with a mean age of 32.4 years (s.d. = 10.7) and 53% were female. Thirty-four participants (25.4%) were taking some type of psychotropic medication (antianxiety, antidepressant, or antipsychotic).

Questionnaire measures

In addition to the diagnostic measures described above, the following questionnaire measures were administered.

Social Interaction Anxiety Scale (SIAS) and Social Phobia Scale (SPS)(Mattick & Clarke, 1998). These companion scales assess the main fears and avoidance of social anxiety

disorder, respectively focusing on interaction fears and more specific performance-based fears. They have excellent psychometric properties (Peters, 2000).

Depression Anxiety Stress Scales, depression subscale (DASS-D) (Lovibond & Lovibond, 1995). Given the marked comorbidity between social anxiety and depression, the DASS depression subscale was included as an outcome measure. This scale was designed to provide a measure of depression that is psychometrically distinguished from anxiety and stress. The DASS-D has been shown to exhibit good psychometric properties in both clinical and nonclinical populations (Antony, Bieling, Cox, Enns, & Swinson, 1998).

Life Interference Scale (LIS). To provide a measure of the life impact of individuals' social fears, six 0-8 Likert scales asked respondents to indicate the impact of their fears on various components of their life including work, family life, and leisure activities (Rapee, Abbott, Baillie, & Gaston, 2007). The scales were summed to provide a total interference rating from 0 (no interference) to 48 (maximum interference). Previous analysis in our centre has shown that the 6 items show excellent internal consistency ($\alpha = .90$) and the total correlates significantly with the 12-item Short Form Health Survey (SF-12; Ware, Kosinski, & Keller, 1996) mental component subscale ($r = .56$).

Social Tasks

Given evidence that the effects of cognitive bias modification procedures are more apparent when confronting a current stressor (Hallion & Ruscio, 2011), state anxiety in response to two social threats was also assessed. Both tasks were conducted by a research assistant who was blind to group allocation and study hypotheses. In the first task participants were instructed to deliver a speech about a topic of their own choosing to the experimenter and a video camera. They were given two minutes' preparation time and were instructed to talk for three minutes. Any participant who stopped in less than three minutes was briefly

encouraged by the experimenter to continue, but if they refused, the post speech measures were administered at that point. The second task comprised a social interaction with a confederate. Participants were introduced to the confederate and told to act as though they were at a function and to get to know the other person as best they could within a period of five minutes. Confederates were trained to act politely but not to take the lead. At the conclusion of each task, participants completed a 10-item measure of current anxiousness (see Rapee et al., 2009). Items were scored on a scale from 0 to 4 and participants were instructed to complete the items indicating how they felt during the task. The social tasks were not repeated at follow-up.

Assessment of Attentional Bias

Dot Probe Attentional Assessment Task. In order to determine whether attention modification shifted attention away from threat, 13 standard dot probe assessments (MacLeod et al., 2002; Shuhui & MacLeod, 2006) were carried out, the first immediately prior to the commencement of treatment, and the remainder at the end of each of the 12 weeks of treatment. These attentional bias assessment sessions were conducted in the clinic in the presence of a research assistant. Each attentional assessment session consisted of 192 word pairs presented simultaneously on a computer screen. Each pair of words consisted of one social threat word (eg foolish) and one neutral word (eg pillow). Selection of words is described in more detail below. On each trial, a fixation cross was first presented for 500 ms, following which a pair of words was presented above and below the position of the fixation, subtending a visual angle of less than 2° (when seated at 60 cm.). The threat word appeared in the top or bottom position with equal frequency, and the word pair was presented for 500 ms.. Following this a probe symbol pointing to the left (<) or right (>) replaced one of the words randomly, and the subject's task was to indicate which direction the probe was

pointing by pressing either the left or right arrow key. The next trial commenced following an inter-trial interval of 500 ms. Reaction times were recorded, and the degree to which reaction times to the probes appearing in the locus of threat words were speeded, relative to reaction times for probes appearing in the locus of neutral words, provided an index of attentional bias.

Treatment

All treatment was conducted in groups of approximately six participants. Therapists were clinical psychologists with specific expertise in the treatment of social anxiety disorder. In most cases a graduate psychology student acted as co-therapist. All primary therapists conducted groups in both of the treatment conditions. Therapists received regular weekly supervision from the fourth author (JG). Groups extended for 12, weekly, 2-hour, sessions. Treatment protocols were guided by manuals for the therapists and were supported by printed materials and handouts for participants. Treatment for both groups was equivalent - in fact, therapists were completely blind to which condition their patients were in.

The basic treatment protocol has been reported previously (Rapee et al., 2009) and was developed by members of our unit based on a similar earlier program (Rapee & Sanderson, 1998). Components included modification of explicit beliefs through evidence-gathering, hypothesis testing and examination of core beliefs, training in redeployment of controlled attentional resources away from threat and onto the task at hand, realistic appraisal and feedback of social performance, and in vivo exposure including elimination of safety behaviours and subtle avoidance. It should be noted that attentional training within this treatment protocol was conceptualised as a conscious process in which the client was encouraged to effortfully shift their focus of attention in social situations toward the task at

hand (e.g., Bögels, Mulkens, & De Jong, 1997). Thus, this technique is distinguished from the attention bias modification procedure described below (see Bar-Haim, 2010).

Attention bias modification procedure (ABMP). The procedure designed to modify attentional response to threat was that described by Shuhui & MacLeod, (2006). This involved exposing participants to a variant of the attention probe task in which probes consistently appeared in the opposite locus from threat words. Each training session consisted of 192 trials lasting approximately 10 minutes. For participants in the attention bias modification procedure, the probe always appeared in the location previously held by the neutral word. This was intended to encourage participants to focus attention on the neutral word and away from the threat word, as this would facilitate task performance. The first attentional bias modification session was conducted at the clinic under the supervision of a research assistant, immediately following delivery of the first attentional bias assessment session. Thereafter, all further bias modification sessions were set as homework exercises to be conducted by the participant in their own home.

Placebo procedure (Plac). The placebo procedure followed exactly the same structure as the ABMP with one exception. In the placebo condition, the probe appeared in the position vacated by the threat word on 50% of trials and in the position vacated by the neutral word on 50% of trials. Hence participants in the Plac group experienced all of the same training contexts as those in the ABMP, but were not exposed to the contingency designed to train attentional focus away from threat.

Construction and assignment of stimuli to probe tasks: Across the 12 weeks of the study participants received 13 weekly attentional bias assessment sessions, each interspersed by one week of the home accessed probe task delivered in either the ABMP or Placebo condition. These tasks made use of word pairs as stimuli. Each pair consisting of one social threat

word (eg foolish) and one neutral word (eg pillow). A total set of 104 such word pairs was assembled based on ratings from five experts in social anxiety for relevance to social threat (threat words) vs neutrality (neutral words). The assignment of word pairs to sessions followed the approach adopted by See et al. (2009), and was designed such that: i. each bias assessment session used only word pairs not previously exposed during any preceding home accessed probe task (ie novel word pairs); ii. each successive week of the home-accessed probe task employed an increasing number of stimulus word pairs, to maximize generalization of training effects to new stimuli. This was achieved by dividing the 104 word pairs into thirteen subsets each comprising eight pairs of words. A different subset was used in each of the weekly attentional bias assessment sessions. On each intervening week, the home accessed probe task employed all the word pairs previously used across all previous bias assessment sessions to date. Thus, on the first week this home-accessed task employed 8 word pairs, and on the second week 16 word pairs, with this number increasing weekly up to a maximum of 96 pairs, employed during the twelfth week.

Treatment Integration. The integration of the two treatments was crucial to produce a treatment package that appeared coherent and credible. Both groups received identical rationales for the technique in terms of the cyclical interaction between top down and bottom up processes in controlling our emotions and in learning new information. They were told that the computer practice represents a new breakthrough in learning that provides a more automatic and “below awareness” shifting of attitudes. They were taught about the role of attention and distraction in social anxiety and how the computer training would help them to strengthen their attention and learn to focus their attention in more appropriate directions. This latter explanation also fitted perfectly with the rationale they received later during the

effortful attention training component of the CBT program. All participants received a USB that contained the relevant dot probe task (ABMP or Plac) and were instructed to find a quiet, distraction-free room in which to practice the task as part of homework each day for the entire 12 weeks of the program. The USB was returned each week in therapy sessions to allow the researchers to objectively monitor homework practice. However, the conditions under which home practice was done were not monitored.

Procedure

The procedures were approved by the Macquarie University Human Research Ethics Committee and all participants gave informed consent. Potential participants contacted the Centre for Emotional Health at Macquarie University between August 2007 and May 2010 through usual referral sources, including general practitioners, mental health professionals, occasional media coverage, and word of mouth. They were screened via telephone and those who appeared to have anxiety-related difficulties were invited in for a structured interview and behavioural assessment. 134 participants who met inclusion criteria were randomly allocated to the two conditions. Randomization was done on a group basis by the first author via a pre-assigned random schedule. Thus, the participants and all research personnel were blind to condition. Participants were allocated in blocks of six to eight to allow for group delivery and group start times. An individual participant was not allocated to a condition until after they were accepted into the study – ie after initial diagnostic and questionnaire assessment. Following the structured diagnostic interview, participants completed the questionnaire measures and were scheduled for the behavioural assessment, usually within a week. Treatment generally began within the following few weeks. At the conclusion of treatment (12 weeks), questionnaire, diagnostic interview and laboratory measures were

repeated. Follow-up assessment was conducted six months following the start of treatment. All assessment was conducted by clinicians who were blind to participants' group allocations.

Statistical Analysis

Primary outcomes for this trial were a change in clinical diagnoses and severity of social anxiety disorder as assessed by the ADIS-IV. Additional outcomes assessed social phobia symptoms, symptoms of depression, state social anxiety in response to a public speech and social interaction, and self rated life interference.

Because the main purpose of this trial was to test an improvement to treatment efficacy, analyses were based on participants who completed an acceptable minimum number of home training sessions. Based on previous research that has shown significant attention retraining effects with social phobia following 8 practice sessions (Amir et al., 2009; Schmidt et al., 2009), final analyses for the current trial included all participants who completed a minimum of 8 sessions of the home attentional training procedure (in either condition). Every attempt was made to collect 12-week (post-treatment) data on all participants, even those who did not complete all sessions of treatment. The flow of participants through the study is presented in Figure 1.

Differences between treatments in the reductions on continuous data were examined using hierarchical mixed models containing random intercept and random slope terms as well as fixed effects for treatment received (Gibbons et al., 1993). Due to the pre-treatment difference between groups on avoidant personality disorder and gender (see below), clinician rated severity of avoidant personality disorder at pre-treatment and participant gender were

included as covariates in these analyses¹. All analyses were conducted with SPSS version 18.0.

Results

Descriptive data

Descriptive data on the sample across the two groups are presented in Table 1. As can be seen from the table, the groups differed significantly on two demographic features: the ABMP group contained more males and more participants with avoidant personality disorder.

Training sessions completed and impact on attentional bias

The number of attention training task sessions completed at home across the entire sample over the 12 weeks ranged from 0 to 79, with a median of 39. The two groups did not differ significantly in their mean number of attention training task sessions (ABMP group $M = 38.3$, s.d. = 18.4; Plac group $M = 36.2$, s.d. = 20.2), $t(132) = 0.65$, $p = .52$.

A total of 7 participants in ABMP (10.3%) and 11 in Plac (16.7%) failed to complete 8 or more attention training task sessions and were excluded from the analyses. This difference was not significant, $\chi^2(1, N=134) = 1.17$, $p = .28$.

As per the method, participants performed an attentional bias test in the clinic, at the end of each week of the program. These 12, weekly attentional bias test scores were

¹ Analyses were later repeated including total amount of attention practice as an additional covariate with no change to the pattern of results.

subjected to a mixed model analysis of variance (ANOVA) comparing groups over time (12 weekly points) and including avoidant personality and gender as covariates. There was no significant main effect for group, $F(1,1237) = 0.00, p=.95$, or time, $F(11,1237) = 1.18, p = .29$, and no significant group by time interaction, $F(11, 1237) = 1.26, p = .25$.

In order to render these 12 attentional bias time points more understandable, attention bias scores were averaged over sessions 1-2 (pre-treatment and psychoeducation session) and compared to the average bias over the remaining sessions that were completed by the participant. Participants in the ABMP moved from a slight threat focus ($M = 0.98, s.d. = 9.00$) to a slight avoidance focus ($M = -0.20, s.d. = 5.47$). Participants in Plac moved from a slight threat focus ($M = 0.75, s.d. = 11.76$) to a slight avoidance focus ($M = -0.19, s.d. = 6.92$). However, there was no significant main effect of time, $F(1, 118) = 0.92, p=.34$, no significant group effect, $F(1, 118) = 0.01, p=.92$, and no significant group by time interaction, $F(1,118) = 0.01, p=.92$.

Diagnostic data

The number of participants who no longer met criteria for a diagnosis of social anxiety disorder at the end of treatment was 11 (20.0%) in the ABMP group and 18 (36.7%) in the Plac group. This difference, which was in the opposite direction to that expected, did not quite reach significance, $\chi^2(1,N=104) = 3.61, p=.057$. These proportions increased at 6 month follow-up and the difference between groups was not significant, (ABMP = 23 (42.6%), Plac = 26 (54.2%)), $\chi^2(1,N=102) = 1.36, p=.24$.

Continuous clinical measures

Mixed model ANOVAs comparing the two groups across time (three points: pre-treatment, post-treatment, 6-month follow-up) on the clinician rating of social anxiety disorder severity and including severity of avoidant personality and gender as a covariates showed a significant main effect of time, $F(2, 135.1) = 134.31, p < .001$, but no significant main effect of group, $F(1, 77.7) = 1.67, p = .20$, and no significant group by time interaction, $F(2, 135.1) = 0.36, p = .70$. Estimated marginal means, standard errors and effect sizes are presented in Table 2. The significant time effect was examined in more detail in two follow-up analyses comparing results from pre- to post-treatment and from post-treatment to follow-up. Comparison of pre and post-treatment results indicated a significant main effect of time, $F(1, 75.4) = 148.24, p < .001$. The comparison of post-treatment to follow-up showed a further significant reduction in diagnostic severity over this period, $F(1, 60.4) = 15.99, p < .001$

The groups were also compared across time on the SIAS. There was a significant main effect of time, $F(2, 126.3) = 57.56, p < .001$, but no significant difference between groups, $F(1, 77.5) = 0.36, p = .55$, and no significant group by time interaction, $F(2, 126.3) = 0.13, p = .88$ (see Table 2). Following up the significant time effect showed a significant reduction from pre to post-treatment, $F(1, 71.7) = 72.96, p < .001$, and further reduction from post-treatment to follow-up, $F(1, 54.9) = 4.61, p < .05$. On the SPS there was a significant main effect of time, $F(2, 122.3) = 48.89, p < .001$, but no significant difference between groups, $F(1, 76.2) = 0.03, p = .87$, and no significant group by time interaction, $F(2, 122.3) = 0.97, p = .38$. Following the significant time effect showed a significant reduction from pre to post-treatment, $F(1, 66.3) = 66.89, p < .001$, but no significant further change from post-treatment to follow-up, $F(1, 56.2) = 0.43, p = .516$. Finally, on the related symptoms of depression (DASS depression scale) there was a significant main effect of time, $F(2, 122.0) = 14.91, p < .001$, but no significant difference between groups, $F(1, 75.6) = 0.03, p = .87$, and no significant group by time interaction, $F(2, 122.0) = 0.29, p = .75$. Following up the significant

time effect showed a significant reduction from pre to post-treatment, $F(1, 66.3) = 24.31$, $p < .001$, but no significant further change from post-treatment to follow-up, $F(1, 54.4) = 1.23$, $p = .272$.

Examination of effects on the life interference scale (LIS) indicated a significant main effect of time, $F(2, 127.0) = 54.18$, $p < .001$, but no significant difference between groups, $F(1, 78.3) = 0.64$, $p = .43$, and no significant group by time interaction, $F(2, 127.0) = 0.19$, $p = .83$ (see Table 2). Following up the significant time effect showed a significant reduction from pre to post-treatment, $F(1, 70.2) = 71.12$, $p < .001$, and a significant further change from post-treatment to follow-up, $F(1, 56.1) = 8.52$, $p = .005$.

Social Tasks

The groups were compared across two time-points on state anxiety in response to the speech and social interaction and including severity of APD and gender as covariates. In response to the speech task, there was a significant reduction in state anxiety over time, $F(1, 65.1) = 109.04$, $p < .001$, but no significant difference between groups, $F(1, 69.4) = 0.26$, $p = .61$, and no significant group by time interaction, $F(1, 65.0) = 2.66$, $p = .11$ (see Table 2). In response to the social interaction there was a significant reduction in state anxiety over time, $F(1, 64.1) = 130.64$, $p < .001$, but no significant difference between groups, $F(1, 66.9) = 0.27$, $p = .60$, and no significant group by time interaction, $F(1, 64.0) = 0.56$, $p = .46$.

Effects for participants showing initial attentional vigilance for threat

Previous research has shown that the effects of attentional bias modification is greater among those participants who show an initial attentional bias towards threat (Amir, Taylor, & Donohue, 2011). Therefore all analyses were repeated selecting only those participants who showed an attentional bias toward threat on the pre-treatment dot probe assessment task. A

total of 65 participants (37 in ABMP and 28 in Plac) showed an attentional bias score greater than 0 (attention to threat). Repeating the preceding analyses using only these participants showed a similar pattern of results - all variables showed marked reductions across time with no significant differences between groups and no significant group by time interactions.

Discussion

Cognitive bias modification procedures have begun to show some promising effects in reducing symptomatology across a range of anxiety disorders, including social anxiety disorder (Hallion & Ruscio, 2011). To date, these experimental techniques have not been combined with standard cognitive behavioural treatment programs for anxiety. The current study represents the first attempt at such integration. According to the current results the incorporation of a home-based probe task attention bias modification procedure into a "best practice" treatment package for social phobia did not result in additional benefits.

Clearly the main limitation to interpretation of the current results was the present failure of this intended training procedure to attenuate attentional bias toward threat, as measured by the dot probe assessment task used in this study. These findings do not challenge the validity of previous demonstrations that the successful attenuation of negative attentional bias can yield therapeutic benefits for socially anxious patients. Rather, they demonstrate that such attentional bias modification is not consistently produced by the training procedure most widely employed for this intended purpose. Our apparent inability to successfully modify attentional bias is somewhat surprising, given the evidence from recent meta-analyses that the application of this training procedure has reliably altered attentional response to threat in previous studies (Hakamata et al., 2010; Hallion & Ruscio, 2011). Of

course, it could be the case that attentional bias was modified by the present training procedure, but that this attention change was not sensitively detected by the attentional probe task. The fact that at the initial, pre-treatment assessment, the sample as a whole did not show a marked attentional bias could lend weight to the possibility that such bias may not have been sensitively assessed by this task. However, although some researchers have questioned the reliability of this attentional assessment task (Kindt, Bierman, & Brosschot, 1996; Staugaard, 2009), the large body of literature that has now demonstrated attention to threat across the anxiety disorders suggests that this task appropriately indexes biased attentional response to threat. Hence, while it is possible that attentional modification did occur but was not reliably assessed by the selected assessment task, it is more likely that the current paradigm failed to produce a training effect. It is appropriate for us to consider why this may have been the case, and certain features of the present protocol provide candidate explanations.

One possibility is that we may have over-exposed participants to the task intended to alter attentional selectivity and to concurrent additional home practice requirements. None of the previous studies demonstrating the therapeutic efficacy of attentional bias modification have delivered such extensive exposure to the attentional training task, and it may be that this feature of the current study paradoxically reduced the efficacy of the procedure. Anecdotal comments from a number of participants suggested that they found repeated practice in attention modification to be tedious and excessive. No participants completed all possible attentional training sessions and more than half of participants (54%) completed less than half these sessions. It is not yet clear how much exposure to attention procedures is required to produce attentional changes, but clearly the amount required in the current study was considerably greater than in most experimental trials and could be reduced in future evaluations. On a related note, standard CBT packages also require extensive homework

practice and the amount of homework engagement has been shown to predict response to treatment (Kazantzis, Whittington, & Dattilio, 2010). Many participants in the current study reported that the total amount of home practice was too much and expressed confusion at which was a priority. Several participants also reported that the exposure and cognitive restructuring homework made more intuitive sense and hence they were more likely to drop the attention training sessions. It is therefore vital that future studies invest adequate time in educating participants about the purpose and value of cognitive bias modification in order to ensure optimal compliance in completing such bias modification tasks. Recent work is beginning to evaluate the benefits of adding motivational enhancements to treatment for anxiety (Westra, Arkowitz, & Dozois, 2009) and it may be that these additions will be especially important when practice requirements are high.

A second possibility is that our use of home-based practice may have compromised the effective modification of attentional bias in this clinical sample.. The majority of previous successful demonstrations of this method with social anxiety have conducted training entirely in the laboratory (e.g., Amir et al., 2009; Schmidt et al., 2009). Nevertheless, previous research carried out using non-clinical participants has demonstrated the ability to modify attentional bias through home practice (See, MacLeod, & Bridle, 2009; MacLeod, Soong, Rutherford, & Campbell, 2007). Therefore we considered it appropriate to adopt this approach. However, it may be that implementing training in the home environment reduces its capacity to alter attention in clinically anxious individuals, due to their greater sensitivity to factors such as distraction and environmental variability. Consistent with this possibility, Carlbring et al. (2012) also recently failed to modify attentional bias when they delivered a home-based version of Amir et al.'s attentional training task to social anxiety patients. The capacity of home-based training to alter attentional bias in clinical patients may be increased by employing more rigorous and systematic schedules to ensure it is completed in a

consistent environment without distraction. Another possibility would be to develop training tasks in ways that make them highly engaging, and thus more resistant to the detrimental effect of distraction. A third option would be to employ combinations of clinic-based and home-based practice, favouring the former to initially induce bias change and the latter to maintain such change.

Another distinctive feature of the present bias modification procedure that potentially could have compromised its capacity to alter attentional selectivity was that participants were given an explicit rationale that informed them this was designed to influence their attentional response to emotional stimuli. In most previous studies, participants have not been informed of the task's intended function, and it is not impossible that the provision of this rationale led them to adopt strategies during task performance that could have interfered with the implicit learning of the intended attentional response to the training contingency. A further potentially important feature of the present study is that approximately a quarter of participants were taking anxiolytic medication during the trial. Previous research has demonstrated that anxiolytic medication can directly suppress attentional bias to threatening information (c.f., Browning, Holmes, & Harmer, 2010), and one plausible mechanism for this is that such medication may attenuate the registration of this information's threat value. The attentional bias modification approach employed in the present study requires that participants are able to register the emotional tone of the presented stimuli, as only then will they be able to learn from the training contingency. Thus, the capacity of the attentional bias modification procedure to induce a change in attentional response to threat may be compromised in participants taking anxiolytic medication. Lending weight to this possibility, Browning (2010) recently has reported that combining attentional training with anti-depression medication serves to erode its cognitive impact. In order to determine whether this factor may

have influenced the results, we re-ran the analyses including only the subset of participants who were free of medication. The overall pattern of results remained the same².

Two additional candidate explanations for the lack of CBM impact in the present study also deserve consideration. First, it must be recognised that our failure to detect significant differences between the AB-MP and placebo conditions could result from limited power. Although the sample size in this study was relatively large for a comparison of clinical populations, it may not have been sufficient to detect the predicted differences. Our sample of around 65 per condition was sufficient to detect a medium or slightly lower effect size difference. But two highly active and efficacious treatments would be unlikely to differ by so much and we were underpowered to detect small differences. To determine whether CBM can augment the efficacy of an already effective intervention it would be appropriate to employ greater numbers of participants, and for this reason such research might require multi-site collaboration. Second, several of the previous studies delivering attention retraining for social anxiety have employed pictorial rather than verbal stimuli (e.g., Amir et al., 2009), raising the possibility that our own use of verbal stimuli may have hindered efficacy. However, the evidence provides little basis for such a conclusion. Sensitivity of attentional bias assessment does not differ when using verbal or pictorial stimuli (Bar-Haim et al., 2007). Indeed, Amir et al. (2009) demonstrated the attentional impact of their image-based bias modification task using a dot probe assessment that employed verbal stimuli. Furthermore, on the basis of a thorough meta-analysis, Hakamata et al. (2010) concluded that variants of attentional bias modification employing verbal stimuli actually produce greater attentional change than do variants employing images. Thus it seems unlikely that our use of verbal stimuli can account for the lack of induced attentional change in the present study.

² Mixed model analyses on this subset of participants (N=100) showed significant main effects of time and no significant group by time interactions on any variable.

Whatever the reason for its failure to influence our measure of attentional bias, the addition of the cognitive bias modification did not increase the efficacy of the overall treatment package on diagnoses, symptoms, or life interference. Given the apparent lack of impact on attentional bias, this is not unexpected. If the training procedure had attenuated negative attentional bias, without such attentional change yielding additional therapeutic benefit, this would indicate that adding direct alteration of attentional bias to standard cognitive behavioural treatment packages does not enhance outcomes. It remains to be seen whether successful attentional bias modification augments the benefits of CBT, but it is entirely plausible that this may not be the case, especially if the cognitive behavioural components of the treatment package influences the same attentional mechanisms as are targeted by the attention bias modification procedure. Studies have shown that cognitive behavioural treatments for anxiety itself can reduce attentional bias to threat (Browning et al., 2010; Tobon, Ouimet, & Dozois, 2011). Thus, it is possible that standard cognitive behaviour therapy may already alter attentional bias strongly enough for ceiling effects to limit the degree to which such change can be further augmented by an additional attentional bias modification procedure. This may be especially the case in the current study since our treatment package contained a conscious attention retraining procedure. However contrary to this argument, in our current results, although there appeared to be a slight adjustment of attentional bias from a minor threat focus to a minor avoidance focus in both groups, the standard deviations were large and this effect did not reach significance. Thus in the current study we do not seem to see the same change in attentional bias shown in previous CBT programs and we think it is most likely that the multiple homework priorities weakened the retraining effect.

On a positive note, treatment worked. Both active treatment conditions showed marked and significant reductions in prevalence of social anxiety disorder as well as in self-

reported symptoms and overall life interference. Six months following treatment around half of participants were free of their social anxiety disorder and the size of the effects were generally consistent with those from the broader treatment literature (Norton & Price, 2007). It is possible that the changes are close to the limit for this type of treatment approach. If this is the case, then perhaps briefer treatment packages of this type may be more likely to have their efficacy augmented by additional treatment elements. Attentional bias modification procedures are not the only additional elements that could be considered. Augmented treatment efficacy may come from new paradigms such as the integration of memory consolidation agents (Bentz, Michael, de Quervain, & Wilhelm, 2010) or careful integration with pharmacotherapy (Rapee, 2011). There also may be more effective ways of integrating attention bias modification procedures with CBT that can be explored in future research. For example, the sequential delivery of CBM and CBT plausibly could prove more effective than their parallel delivery. Initial exposure to CBM may increase the subsequent benefits of CBT, by altering attentional selectivity in ways that enable patients to more effectively engage in cognitive restructuring. Alternatively, CBM could prove to be a more effective adjunct when it is delivered after the completion of CBT, and so can contribute to the maintenance of treatment gains. We believe it will be of value to empirically address these interesting and potentially important possibilities. However, in the light of the present findings, we would caution against designs that involve excessive exposure to CBM procedures, and would suggest that it may be imprudent to rely exclusively on home-based delivery of these bias modification procedures when undertaking such future investigations.

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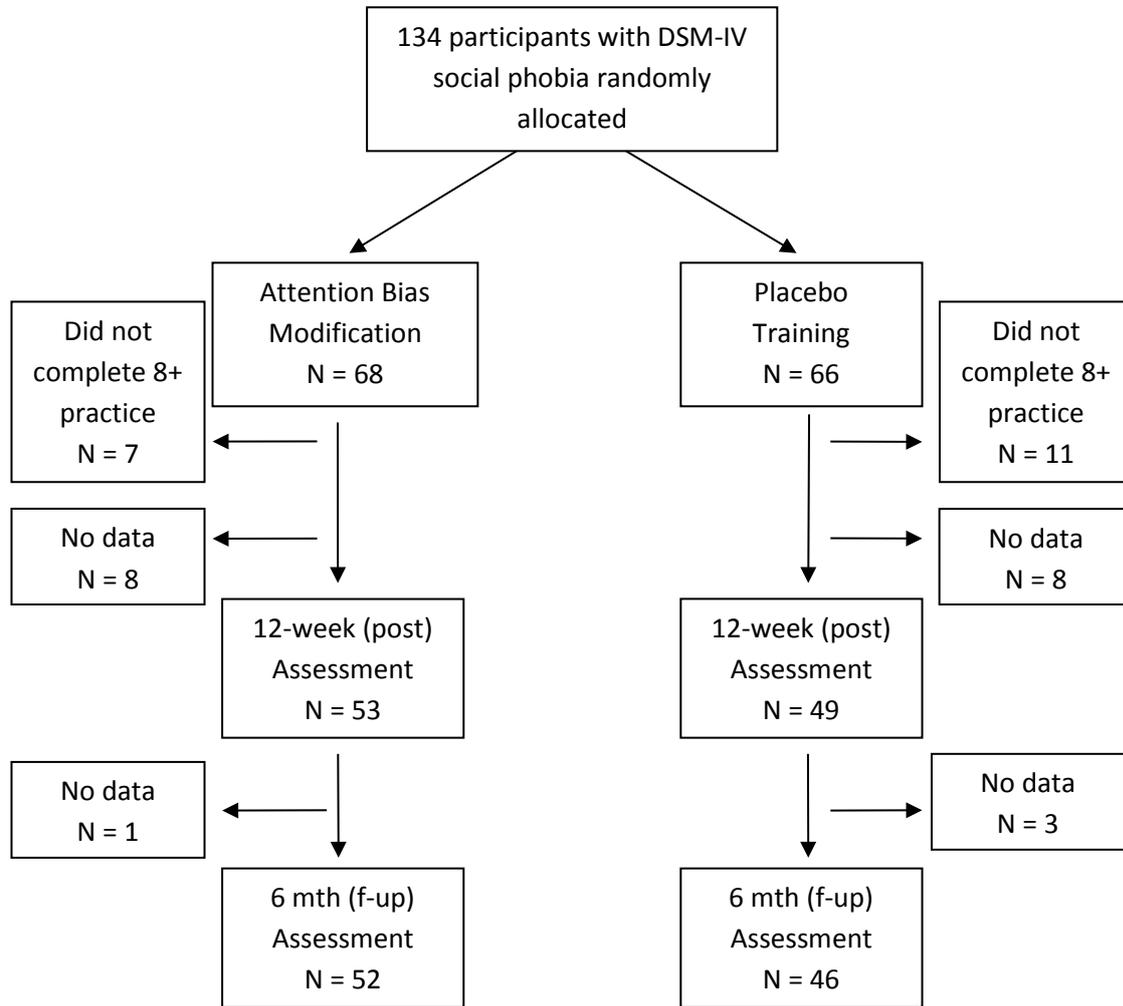


Figure 1: Flow of participants through the trial.

Table 1: Descriptive data across the two groups.

	ABMP	Plac	Statistic
Mean age (s.d.)	31.5 (10.2)	33.0 (10.3)	$F(1,114)=0.63, p=.43, \eta^2<.01.$
Female (%)	41.0	60.0	$\chi^2(1, N=116) = 4.18, p=.04.$
Never Married (%)	67.2	60.0	$\chi^2(2, N=116) = 1.00, p=.61.$
University (%)	45.9	43.6	$\chi^2(3, N=116) = 1.68, p=.64.$
Employed (%)	73.8	63.6	$\chi^2(1, N=116) = 1.39, p=.24.$
Avoidant PD (%)	74.1	49.1	$\chi^2(1, N=116) = 7.51, p=.01.$
Additional anxiety disorder (%)	41.0	45.5	$\chi^2(1, N=116) = 0.24, p=.63.$
Additional mood disorder (%)	32.8	32.7	$\chi^2(1, N=116) = 0.00, p=.99.$
Psychotropic medication (%)	23.0	19.2	$\chi^2(1, N=116) = 0.23, p=.63$

Table 2: Estimated Marginal Means and standard errors for continuous outcome measures over time, controlling for avoidant personality and gender.

		Attention Bias Modification Procedure			Placebo Training		
		Mean	Std. Dev.	Effect size *	Mean	Std. Dev.	Effect size
Clinician-rated diagnostic severity	Pre-treatment	6.23	1.24		6.54	1.40	
	Post-treatment	4.56	1.31	1.31	4.69	1.61	1.23
	Follow-up	3.81	1.31	1.90	4.20	1.54	1.59
Social Interaction Anxiety Scale	Pre-treatment	56.43	15.22		55.63	17.36	
	Post-treatment	43.91	16.02	0.80	41.74	19.18	0.76
	Follow-up	40.83	15.00	1.03	38.54	19.46	0.93
Social Phobia Scale	Pre-treatment	32.90	15.73		32.81	17.99	
	Post-treatment	21.53	16.38	0.71	20.35	19.46	0.66

	Follow-up	19.12	16.89	0.84	21.99	19.67	0.57
DASS Depression	Pre-treatment	10.50	5.75		10.59	6.51	
	Post-treatment	8.51	5.97	0.34	7.83	7.14	0.40
	Follow-up	7.70	6.19	0.47	7.74	7.21	0.41
Life interference scale	Pre-treatment	34.99	12.08		33.29	13.86	
	Post-treatment	25.24	12.74	0.79	24.13	15.33	0.63
	Follow-up	22.50	13.25	0.99	19.72	15.54	0.92
State anxiety - speech	Pre-treatment	20.73	9.61		21.52	11.34	
	Post-treatment	11.14	9.90	0.98	8.39	12.60	1.10
State anxiety - interaction	Pre-treatment	26.81	9.90		24.83	11.76	
	Post-treatment	10.73	10.56	1.57	10.73	13.37	1.12

Note * Effect size expressed as Cohen's d, based on pre-post and pre-follow-up treatment change within conditions.