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ORIGINAL ARTICLE

Internet-Based Attention Training for Social Anxiety: A Randomized Controlled Trial

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Abstract Several studies suggest that computer-based attention modification programmes can be a promising new approach for the treatment of various anxiety disorders, including social anxiety disorder (SAD). The current study investigates the efficacy of a four-week Internet-delivered version of an attentional training for SAD in a randomized controlled double-blind study. Sixty-eight individuals seeking treatment for SAD were randomly assigned to either an attention training group (ATG, $N = 33$) or a control group (CG, $N = 35$). Participants of the ATG completed modified dot-probe tasks designed to facilitate attentional disengagement from threat. Participants in the CG completed control dot-probe tasks. At post-assessment, participants in both groups showed significant symptom reductions with medium to large within-group effect sizes on social anxiety measures (ATG: Cohen's $d = .47$–$.80$; CG: $d = .56$–$.63$). However, no significant differences between groups were found at post-treatment for any outcome measure. These findings will be discussed along with the results of a 4-months follow-up assessment.

Keywords Internet-based · Web-based · Attention bias modification training · Social anxiety disorder · Randomized controlled trial

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Introduction

Social anxiety disorder (SAD) is characterized by an intense fear of being criticized, judged or rejected by others. It is one of the most common mental disorders, with an estimated lifetime prevalence of 12.1% (Kessler et al. 2005). Untreated, SAD most often takes a disabling and chronic course with mean durations of illness of 10–29 years (Keller 2003).There are effective psychological treatments for SAD, cognitive-behavioural therapies (CBT) in particular (Rodebaugh et al. 2004). Delivered in a group or individual setting, CBT usually involves 12–16 sessions with trained and supervised therapists (Clark et al. 2006; Heimberg et al. 1998).

Recently, two randomized controlled trials presented striking results on a short-term, computer-based intervention for SAD. Schmidt et al. (2009) and Amir et al. (2009) applied an attention modification programme based on the dot-probe paradigm. After only eight 20-min sessions, both studies found substantial improvement in social anxiety. In Schmidt et al.'s trial, 72% of the subjects in the attention modification group did no longer meet criteria for SAD at post-assessment, compared to 11% of the participants in the placebo condition. Accordingly, Amir et al. (2009) reported proportions of 50% in the attention training group and 14% in the control condition. Moreover, in this study, the change of attention processes was identified as a mediator of change in social anxiety.

The computerized attention training programmes aim to target biases in information processing which are thought to be crucial to the maintenance of anxiety disorders including SAD (Clark and Wells 1995; Rapee and Heimberg 1997). Cognitive models of SAD emphasize the importance of biased attention and interpretation processes in social situations. Empirical studies show that individuals

with SAD tend to interpret ambiguous social interactions as negative and mildly negative interactions as catastrophic (e.g. Amir et al. 1998; Constans et al. 1999; Stopa and Clark 2000). Furthermore, patients with SAD allocate their attention to potential social threat cues. These can be either internal cues such as bodily anxiety symptoms and negative self-representations or external cues in the social environment (Rapee and Heimberg 1997).

Selective attention towards external threat cues has been investigated in many studies using different experimental paradigms. Most studies applied either the emotional Stroop or the dot-probe paradigm. Consistently, findings of the emotional Stroop test showed higher response latencies for social threat words compared to neutral words suggesting an impaired ability to disengage attention from threat (e.g. Hope et al. 1990; Lundh and Öst 1996; Maidenberg et al. 1996; Mattia et al. 1993). A recent eye-tracking study confirmed a prolonged disengagement from threat in social anxiety (Buckner et al. 2010).

Results of the dot-probe paradigm are more mixed. In this paradigm, two stimuli (e.g. one neutral and one social threat word) are simultaneously displayed on a screen for a certain length of time. Immediately afterwards, a probe appears in the location of one of the stimuli. Subjects are asked to respond to the probe (by pressing a button on the keyboard) as quickly as possible. Faster responses to probes in the location of the social threat word compared to responses to neutral words indicate a biased attention towards threat. Studies applying the dot-probe paradigm vary regarding the stimulus type (words vs. faces), the length of presentation (80 ms, 200 ms, 500 ms, >1,000 ms), and the population under study (subclinical vs. clinical socially anxious). Not surprisingly, studies have produced inconsistent results.

Most studies present stimuli for 500 ms. Of these, at least four studies found that socially anxious individuals reacted faster to social threat than to neutral cues (Using words as stimuli: Asmundson and Stein 1994; Musa et al. 2003; Using faces as stimuli: Helfinstein et al. 2008; Mogg et al. 2004). On the other hand, four studies revealed no attention bias towards threat cues (Using words: Horenstein and Segui 1997; Roberts et al. 2010; Using faces: Bradley et al. 1997; Pineles and Mineka 2005). Two studies revealed an attention bias away from threat at an exposure time of 500 ms (Using faces: Chen et al. 2002; Using words: Vassilopoulos 2005). In the study of Pishyar et al. (2004), socially anxious individuals showed a biased attention towards threat faces but not towards threat words.

At shorter presentation times of less than 200 ms, three studies revealed an attention bias towards threat cues (Using words: Roberts et al. 2010; Vassilopoulos 2005; Using faces: Mogg and Bradley 2002). At presentation times of 1,000 ms or more, patients with SAD showed no attention bias (Using faces: Gotlib et al. 2004; Using words: Musa et al. 2003).

In summary, the findings of the dot-probe and other paradigms suggest that socially anxious individuals differ from non-anxious controls in attention to social threat information. Results of dot-probe studies suggest that there is some evidence of an attention bias towards threat early in cue detection (≤500 ms) but no attention bias at longer presentation times (>500 ms). Fewer studies suggest that there may be an attention bias away from threat at 500 ms, supported by an eye-tracking study revealing initial and sustained attentional avoidance of social threat faces (Mühlberger et al. 2008).

Negatively biased attention processes are one potential maintaining factor for SAD. Schmidt et al. (2009) and Amir et al. (2009) demonstrated that it is possible to modify this factor and that this modification leads to a decrease of social anxiety. On self-report measures of social anxiety, Schmidt et al. (2009) found a controlled effect size of $d = .35$ at post-treatment and of $d = .52$ at follow-up. Amir et al. (2009) reported a controlled effect size of $d = 1.59$ at post assessment. These effect-sizes range within or even exceed effect sizes reported in meta-analyses of complex cognitive-behavioural treatments (CBT). CBT yielded controlled effect sizes of $d = .74$–$.86$ when compared to wait-list and of $d = .34$ when compared to psychological placebo (Gould et al. 1997; Powers et al. 2008).

At present, cognitive-behavioural therapies are the treatment of choice for SAD. However, not all patients respond to these treatments. Rodebaugh et al. (2004) conclude that about one sixth of the treated patients with SAD do not improve. This proportion only applies to patients who actually enrol in treatment. Other data suggest that the majority of patients with SAD do not seek treatment (Keller 2003). An Australian study showed that only about one third of patients with SAD consult a mental health professional and only 39.4% receive effective treatment defined as CBT or medication (Issakidis and Andrews 2002). On average, individuals with SAD take 16 years to make initial treatment contact (Wang et al. 2005). Among other reasons, this long delay of treatment seeking may be due to one inherent factor of social anxiety—the fear of being negatively evaluated—and the avoidance of such situations (Olfson et al. 2000).

Internet-based interventions address some of the potential factors underlying the low treatment rate in SAD. The easy access and the anonymity of Internet-based interventions facilitate seeking treatment especially for individuals with SAD. There is culminating evidence for the acceptability and effectiveness of Internet-based interventions in SAD (Andersson et al. 2006; Berger et al. 2009; Carlbring et al. 2006; Carlbring et al. 2007; Titov et al. 2008a, b).

Most online interventions for SAD consist of guided cognitive-behavioural self-help programmes. However, not all patients with SAD respond to CBT, neither in face-to-face settings nor in Internet-based approaches. For instance, Berger et al. (2011) report recovery rates between 52.2 and 58.3% in an Internet-based CBT intervention. Computer-based attention trainings may further improve the efficacy of treatments for SAD.

The goal of the present study is to combine the advantages of Internet-delivered interventions with the innovative approach of attention modification. Programmes of attention modification seem to be especially fit to be adapted for the Internet. They are computer-based and do not require regular therapist contact. If positive results of the attention modification programme could be replicated in an Internet-based adaptation, it would promise a low-threshold, low-cost and highly available intervention for SAD. To evaluate the efficacy of an Internet-based attention training we compared an attention modification condition to a control condition in a double-blind randomized design. We examined the following hypotheses:

1. Participants in the attention modification condition show lower levels of social anxiety at post-treatment compared to the control condition.
2. Participants in the attention modification condition show lower levels of depression and general psychopathology at post-treatment compared to the control condition.
3. The attention modification condition leads to a greater reduction of the attention bias from pre- to post-assessment compared to the control condition.

Method

Participants

Participants were recruited through advertisement in regional newspapers in Germany and Switzerland and through postings in several Internet forums. Advertisements and postings described a scientific study evaluating a cost-free, innovative Internet-based treatment for SAD and provided the address of the study's website. The website gave information on SAD in general and on the study in particular. After registering with their e-mail address, participants obtained detailed information on the theoretical background, the goals and the design of the study and were asked to give written consent. Participants were advised that the study aimed at modifying biased attention processes typical for individuals with social anxiety. No detailed rationale of the attention training was given. Subjects did not receive any kind of monetary compensation for participation in the study.

The selection of participants followed two steps. First, we administered two self-report measures of social anxiety. Only subjects who scored higher than 22 on the Social Phobia Scale or higher than 33 on the Social Interaction Anxiety Scale were included in the study (SPS & SIAS; Stangier et al. 1999). Second, we conducted clinical interviews via telephone to ascertain a primary diagnosis of SAD. All participants were interviewed using the Structured Clinical Interview for DSM-IV—Axis I disorders (SCID-I; Wittchen et al. 1997). Subjects who fulfilled the criteria for any other disorder were asked whether social anxiety was their primary concern. Additionally, the Avoidant Personality Disorder (APD) section of the SCID-II (Fydrich et al. 1997) was administered. Two advanced master students in clinical psychology and the first and second author conducted the interviews. All interviewers had been trained in using the SCID-I. To date, there are no German studies assessing the psychometric properties of the Structured Clinical Interview for DSM-IV. In other studies of our research group, the German version of the SCID showed good to excellent reliability (Renneberg et al. 2005). The high reliability and validity of the Structured Clinical Interview for DSM-III-R has been demonstrated in two German studies (Saile et al. 2000; Wittchen et al. 1991).

We administered the Beck Depression Inventory (BDI-II; Hautzinger et al. 2006) to identify participants with suicidal ideation. A score of ≥ 1 on the suicide item of the BDI led to a detailed assessment of suicidal tendencies by phone. Suicidal participants were referred to local psychiatrists or psychotherapists and subsequently excluded from the study.

A total of 327 individuals applied to participate and 93 returned the signed informed consent. Criteria for inclusion were (a) being at least 18 years old, (b) having access to the Internet, (c) a total of >22 on the SPS or a total of >33 on the SIAS, (d) not participating in any other psychological treatment for the duration of the study, (e) if on prescribed medication for anxiety/depression, dosage had to be constant for 1 month prior to the start of the treatment and (f) meeting diagnostic criteria for a primary diagnosis of social anxiety disorder according to the SCID.

Out of the 93 participants who signed informed consent, 5 did not complete the social phobia self-report measures, 4 did not exceed cut-off scores on the SPS or SIAS, 6 were in an on-going psychological treatment, 1 was unwilling to participate due to time restraints, and 1 could not be reached for the SCID interview. Out of the 76 persons that underwent the SCID interview, 8 were excluded after the interview (see flow chart in Fig. 1).

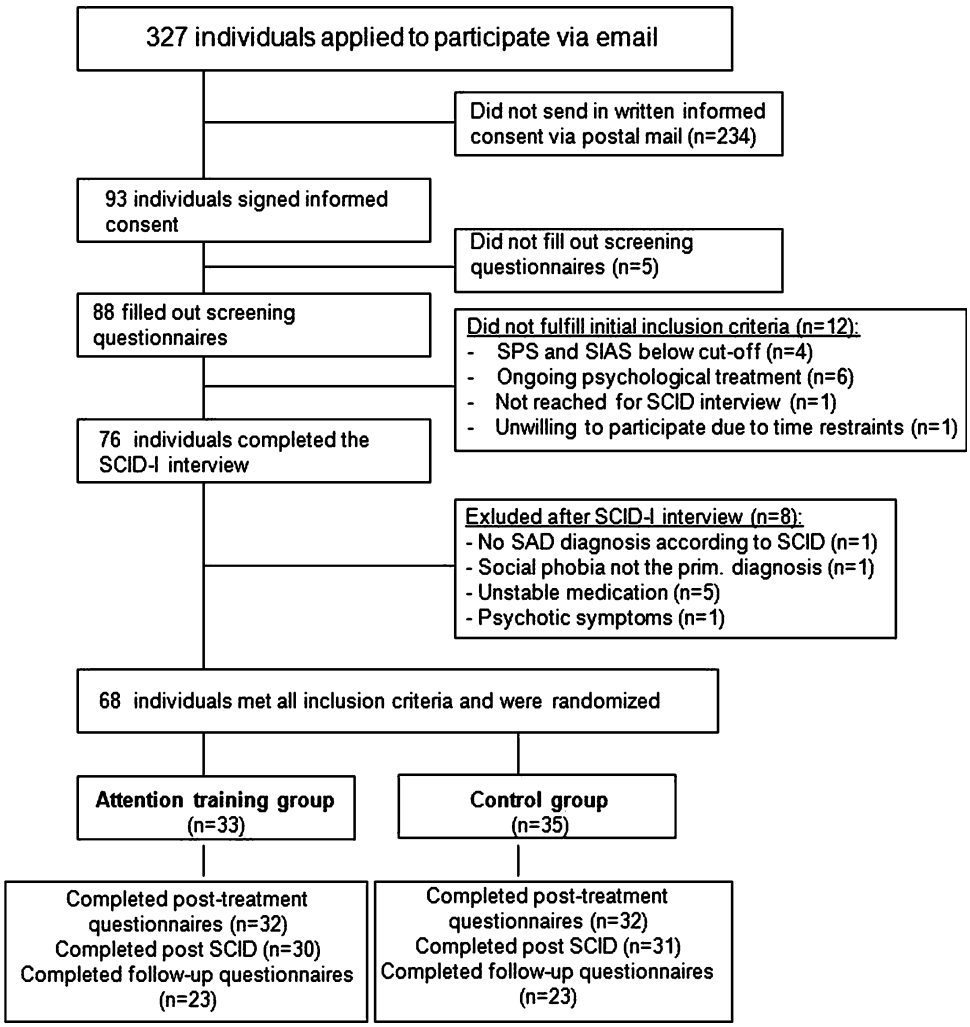

Fig. 1 Participant flow

Sixty-eight participants met all inclusion criteria and were randomly assigned to the attention training group (ATG, $N = 33$) or the control group (CG, $N = 35$). One participant in the attention training condition and 3 participants in the control condition did not complete the post-assessment. Another two in the active group and one other participant in the control group were unavailable for the post SCID interview. Four months after the training, 10 persons in the active group (30.3%) and 12 persons in the placebo group (34.3%) failed to complete the follow-up assessment. The amount of drop-outs did not differ between the two groups at post-assessment ($\chi^2(1) = .10$, $P = .54$) or at follow-up ($\chi^2(1) = .12$, $P = .46$).

Participants of the study were between 18 and 69 years old. Mean age in the attention training group was 38.3 years (SD = 9.54) and 37.5 years (SD = 12.38) in the control group. The majority of participants in both groups were men. Groups did not differ on any assessed demographic variable. Table 1 presents demographic characteristics, comorbid disorders, and scores on primary and secondary outcome measures at pre-assessment. Groups did not differ regarding social anxiety measures, depression and general psychopathology.

Procedure

After the pre-assessment, a computer algorithm randomly assigned participants to either the attention training or the control condition. The allocation schedule was unknown to the investigators and the participants. Participants then received access to a website, where the respective tasks for the training and the control condition were presented. The tasks rely on the dot-probe paradigm and are described in detail below. On the website, participants could follow their progress through the tasks and got feedback on how fast and accurate the tasks were solved. The feedback was designed to enhance participants' motivation in the completion of the tasks. We asked participants to carry out the attention modification/control tasks twice a week to total an amount of eight training sessions. Each training session

Table 1 Characteristics of participants and co-morbid disorders at pre-assessment

	Attention training $N = 33$	Control condition $N = 35$	Test statistics
M (SD) Age	38.3 (9.54)	37.5 (12.83)	$t(66) = .31$; $P = .75$
N (%) Male	21 (63.64)	22 (62.86)	$\chi^2(1) = .004$; $P > .99$
N (%) Higher education	23 (68.70)	19 (54.29)	$\chi^2(1) = 1.71$; $P = .22$
N (%) Living alone	10 (30.30)	14 (40.00)	$\chi^2(1) = .70$; $P = .45$
N (%) Former psychotherapy	12 (36.36)	16 (45.71)	$\chi^2(1) = .61$; $P = .41$
N (%) On stable medication	0 (0)	4 (11.43)	$\chi^2(1) = 4.01$; $P = .12$
N (%) Mood disorders	17 (51.51)	14 (40.00)	$\chi^2(1) = .91$; $P = .47$
N (%) Substance use disorders	3 (9.10)	2 (5.71)	$\chi^2(1) = .28$; $P = .67$
N (%) Other anxiety disorders	11 (33.33)	12 (34.29)	$\chi^2(1) = .01$; $P > .99$
N (%) Eating disorders	0 (0)	1 (2.90)	$\chi^2(1) = .96$; $P > .99$
N (%) Somatoform disorders	1 (3.00)	1 (2.90)	$\chi^2(1) = .002$; $P > .99$
N (%) Avoidant personality disorder	24 (72.70)	26 (74.30)	$\chi^2(1) = .21$; $P > .99$
M (SD) Social anxiety			
SPS	35.24 (13.52)	36.40 (12.29)	$t(66) = .37$; $P = .71$
SIAS	51.45 (11.62)	50.00 (13.17)	$t(66) = .48$; $P = .63$
LSAS	83.12 (22.88)	80.49 (25.41)	$t(66) = .45$; $P = .66$
M (SD) Depression			
BDI	19.33 (9.86)	16.26 (14.22)	$t(66) = 1.03$; $P = .31$
M (SD) General psychopathology			
BSI	1.19 (.61)	1.17 (.51)	$t(66) = .21$; $P = .84$

took about 10 min. Primary and secondary outcome measures were administered before and after the training period. Four months after the training, participants were invited by e-mail to complete the follow-up assessment. Telephone SCID interviews were conducted before and after the attention/control training. Both groups completed an attention bias assessment (see below) at the beginning and at the end of the four-weeks training period.

After the training, at post-treatment telephone SCID, participants in both groups were asked whether they were interested to enrol in another free Internet-based self-help programme. We explained that this programme, developed and evaluated by Berger et al. (2011), was based on cognitive-behavioural therapy and had already proven efficacious in previous studies. We decided to offer this opportunity as, at the time of the study, the Internet-based attention training was of unknown efficacy and acceptability.

Intervention

The goal of the present study was to extend the results of previous attention modification studies (Amir et al. 2009; Schmidt et al. 2009), now using an Internet-based approach. According to this goal, we applied the same modified dot-probe task used in previous studies to change the attentional bias (Amir et al. 2009; Schmidt et al. 2009). The modified dot-probe task aims at linking a probe to a *neutral* cue, hence turning the attention away from the simultaneously presented *negative* cue. Administration of attention training and control tasks was browser-based (e.g. Internet Explorer, Firefox, Safari). All programmes were developed with a client-sided programming language (javascript), which means that presentation and reaction times did not depend on the Internet connection speed.

Modified Dot-Probe Task

Each dot-probe trial began with a fixation cross ("+") presented in the centre of the monitor for 500 ms. Immediately after the fixation cross, the computer presented two faces of the same individual for 500 ms, one face on top and one at the bottom. We used faces from the NimStim face stimuli set (Tottenham et al. 2009) and selected faces of eight individuals (4 men, 4 women). The faces displayed either a neutral and a disgust expression (in 80% of the trials) or two neutral expressions (in 20% of the trials). Faces were 6.0 cm high and 4.7 cm wide. Both faces were centred horizontally and vertically, and they were separated by 1 cm between the bottom of the top image and the top of the bottom image. After the presentation of the faces, a letter (E or F) appeared in the location of one of the faces. Participants were asked to decide whether the letter was an E or an F and to press the corresponding button (left or

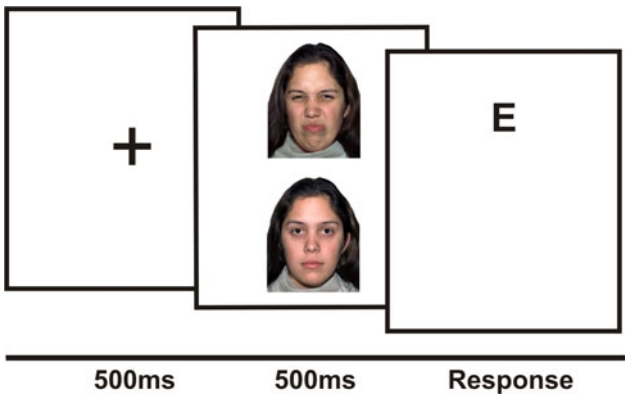

Fig. 2 Example of a dot-probe trial

right arrow button) on the keyboard. After the decision was made, the next trial began. Figure 2 shows an example of a dot-probe trial. The instruction was to react as quickly and accurately as possible.

Attention Training and Control Condition

Every training session consisted of 160 dot-probe trials. Participants were asked to carry out eight training sessions within four weeks. The attention training and the control condition differed in the 80% of trials where neutral and disgust faces were presented simultaneously. In 80% of these trials, in the training condition, the probe replaced the neutral face. In contrast, in the control condition, the probe replaced either the neutral or the disgust face equally as much. Consequently, only the attention training established a link between the probe and the neutral cue.

Attention Bias Assessment

Before and after the training sessions, an attention bias assessment was administered applying a modified version of the Posner task (Amir et al. 2003; Posner 1980). To reduce the effect of the materials on the training progress, we used words rather than faces as stimuli in the attention bias assessment. We chose eight social threat words (e.g., "criticized," "embarrassed") and eight neutral words (e.g., "original," "governmental") out of an evaluated set of words (Schiller 2004). Social threat and neutral words were matched according to length and frequency in the German language. The modified Posner task started with the presentation of a fixation cross centred between two rectangles (width: 11 cm, height: 12 cm). Following the fixation cross, the computer displayed a neutral or a social threat word in one of the two rectangles for 600 ms. After the presentation of the word, a cue (*) appeared either in the location of the word or opposite of the location of the word. Participants were asked to detect the cue (*) as quickly as possible. The bias assessment consisted of 192 trials. Two thirds (128) of these trials were valid trials, one sixth (32) were invalid trials and one sixth (32) were uncued trials (no word preceded the cue). In valid trials the cue appeared in the location of the word. In invalid trials it appeared opposite the location of the word.

Outcome Measures

We used the following social anxiety scales as primary outcome measures of the study: the self-report version of the Liebowitz Social Anxiety Scale (LSAS; Baker et al. 2002; German version: Stangier and Heidenreich 2003), the Social Phobia Scale, and the Social Interaction Anxiety Scale (SPS & SIAS; Mattick and Clarke 1989; German versions: Stangier et al. 1999). The SPS & SIAS are companion scales that assess fear of social interactions and performance situations, respectively. Each scale contains 20 items rated on 0-to-4 Likert-type scales. The SPS and the SIAS show high internal consistency and proved useful to classify SAD patients and healthy controls (Stangier et al. 1999). The LSAS is a 24-items scale designed to assess fear in and avoidance of social situations. The total score ranges between 0 and 144. The scale proved reliable and valid in assessing social anxiety (Fresco et al. 2001). In addition, as secondary outcome measures, we administered the Beck Depression Inventory (BDI-II; Beck et al. 1996; German version: Hautzinger et al. 2006) and the Brief Symptom Inventory (BSI; Derogatis and Melisaratos 1983; German version: Franke 2000). The BDI-II assesses depression on 21 items. Total scores of 14 or more indicate clinically relevant depression. The BDI proved highly reliable and valid in German samples (Kühner et al. 2007). The BSI is a short version of the Symptom-Checklist (Derogatis and Cleary 1977) and consists of 53 items. It is designed to assess general psychopathology on nine subscales. The total score (Global Severity Index) ranges between 0 and 4.

In the present sample, internal consistencies of primary and secondary outcome measures were high ranging from $\alpha = .86$ for the SPS to $\alpha = .94$ for the BSI. All questionnaires were administered via the Internet, which is a procedure with appropriate psychometric properties (Holländare et al. 2008).

Statistical Analyses

All analyses on primary and secondary outcome measures were conducted as intention-to-treat analyses, applying the Last Observation Carried Forward method by replacing the missing post-assessment with the pre-assessment score and the missing follow-up score with the post-assessment score or, if missing, with the pre-assessment score. Participants

in both groups had the opportunity to receive another active treatment after the training (Internet-based CBT self-help, see Procedure). As the majority of participants enrolled in this further treatment and the attendance was likely to affect follow-up social anxiety scores, we conducted ITT follow-up analyses on those participants who attended CBT self-help ($N_{ATG} = 29$, $N_{CG} = 29$).

To examine changes in social anxiety from pre- to post-assessment, a composite score of social anxiety measures (SPS, SIAS, and LSAS) was calculated. Following the procedures recommended by Rosnow and Rosenthal (1991) and applied by Clark et al. (2006), the composite score was generated by converting each social phobia scale across both assessment points to z-scores, and then by averaging across the measures. Due to the attendance of a further self-help programme after the training, we excluded the follow-up assessment from the calculation of the composite score. Separate repeated measure ANOVAs were conducted using the composite score and the single social phobia scales (SPS, SIAS, and LSAS) as dependent variables to analyse change in social anxiety from pre- to post-assessment in both groups. Post-hoc analyses consisted of *t* tests. Alpha levels were corrected for multiple comparisons (number of comparisons = 4, $\alpha < .01$). Effect sizes for *t* tests were calculated using Cohen's formula based on pooled standard deviations (Cohen 1988). Secondary outcome measures were analysed using repeated measure ANOVAs, followed by *t* tests.

Clinical significant change at post- and follow-up assessment was calculated based on the completer sample. Clinical significance was determined for the SPS and the SIAS since these are two of the most widely used social anxiety measures. In a first step, reliable change according to the Reliable Change Index (Jacobson and Truax 1991) was determined by using retest reliabilities reported for the German versions of the questionnaires (Stangier et al. 1999). In a second step, cut-off scores were calculated on the basis of Formula 'c' reported by Jacobson and Truax (1991). Normative data were taken from a German data set (Lincoln et al. 2003). Based on these assumptions, clinically significant improvement for a given participant was defined as showing a pre-post/pre-follow-up change score of 8 or greater and a post/follow-up test score below 21 on the SPS, and a pre-post/pre-follow-up change score of 9 or greater and a post/follow up test score below 31 on the SIAS.

Maintenance of treatment effects was scrutinized using repeated measure multivariate and univariate ANOVAs followed by *t* tests for primary and secondary outcome measures. Effect sizes (Cohen's d) were calculated from post- to follow-up-assessment.

The attention bias assessment produced reaction times for every participant to the four kinds of trials: valid social threat trials, valid neutral trials, invalid social threat trials, and invalid neutral trials. We calculated the mean reaction time for each participant for each type of trial, eliminating response latencies for inaccurate trials and response latencies less than 50 ms or greater than 1,200 ms. This led to an exclusion of 1.2% of the trials. Explorative data analyses identified three outliers in the valid social threat condition at post-treatment which were excluded from the analyses of attention bias. One participant did not complete the post bias assessment. To examine changes in attention bias, we conducted a 2 (pre-assessment/post-assessment) × 2 (attention training/control condition) × 2 (valid/invalid) × 2 (social threat/neutral) ANOVA.

Results

Training

During the four weeks of training, participants in the active group completed on average 11.0 training sessions (range 6–23) and participants in the control group completed on average 9.1 training session (range 4–14). The study protocol prescribed two training sessions a week. On average, the attention training group completed 3.6 training sessions in week one, 2.7 in week two, 2.8 sessions in week three, and 1.9 training sessions in week four. The control group trained 2.7 times in week one, 2.4 times in week two, 2.3 times in week three, and 1.7 times in week four. A repeated measure ANOVA revealed no significant group differences regarding the amount of training sessions over the weeks (effect of group × time: $F(3,198) = 1.18$, $P = .32$, $\eta_p^2 = .02$). Neither was there a significant group difference on the total amount of training sessions (main effect of group: $F(1,66) = 3.59$, $P = .06$, $\eta_p^2 = .05$) even though there was a trend indicating that participants in the ATG trained more often than participants in the control group. Mean training durations lasted from 7.36 (SD = .18) to 7.84 (SD = .33) minutes per training session.

Primary Outcome Measures

The repeated measure ANOVA using the social anxiety composite score as dependent variable revealed a significant main effect of time ($F(1,66) = 66.26$, $P < .001$, $\eta_p^2 = .50$), indicating a substantial decrease in social anxiety from pre- to post-assessment. However, there was no significant main effect of group ($F(1,66) = .08$, $P = .79$, $\eta_p^2 < .001$) nor a significant interaction effect of time × group ($F(1,66) = .03$, $P = .87$, $\eta_p^2 < .001$). There were no differences between the attention training group and the control condition. Repeated measure ANOVAs on the individual social phobia measures yielded the same results.

ANOVAs on all three measures showed a significant effect of time (SPS: $F(1,66) = 47.57$, $P < .001$, $\eta_p^2 = .42$; SIAS: $F(1,66) = 39.19$, $P < .001$, $\eta_p^2 = .37$; LSAS: $F(1,66) = 62.22$, $P < .001$, $\eta_p^2 = .49$), but no main effect of group (SPS: $F(1,66) = .02$, $P = .88$, $\eta_p^2 < .001$; SIAS: $F(1,66) = .44$, $P = .51$, $\eta_p^2 = .01$; LSAS: $F(1,66) = .06$, $P = .81$, $\eta_p^2 = .001$) nor a significant interaction effect of time × group (SPS: $F(1,66) = .36$, $P = .55$, $\eta_p^2 = .01$; SIAS: $F(1,66) = .19$, $P = .67$, $\eta_p^2 = .003$; LSAS: $F(1,66) = .34$, $P = .56$, $\eta_p^2 = .01$).

We followed up the main effect of time by paired-sample t tests for the composite score and all three social anxiety measures in both groups. Reductions of social anxiety were significant for all measures in both groups (ATG: $t(32) = 4.54$–6.61, all $P < .001$; CG: $t(34) = 4.26$–5.53, all $P < .001$). Table 2 shows means, standard deviations and effect sizes for both groups. Pre-post effect sizes in the attention training group ranged between .47 and .80 indicating medium to large effects. In the control condition, effect sizes ranged from .56 to .67.

Secondary Outcome Measures

Depression (BDI)

The repeated measure ANOVA revealed a significant main effect of time ($F(1,66) = 36.03$, $P < .001$, $\eta_p^2 = .35$). Participants in both groups were less depressed at post-treatment. There was no significant main effect of group ($F(1,66) = 3.38$, $P = .07$, $\eta_p^2 = .05$) nor a significant interaction effect of group × time ($F(1,66) = 1.18$, $P = .28$, $\eta_p^2 = .02$). Paired sample t tests proved a significant decline of depression in both groups (ATG: $t(32) = 3.96$, $P < .001$; CG: $t(34) = 4.57$, $P < .001$). Pre-post effect sizes were $d = .57$ for the active group and $d = .71$ for the control group (see Table 2).

General Psychopathology (BSI)

The ANOVA showed a significant main effect of time ($F(1,66) = 66.35$, $P < .001$, $\eta_p^2 = .50$), no main effect of

Table 2 Means, standard deviations and effect sizes for primary and secondary outcome measures

	Attention training			Control condition		
	Mean	SD	Within ES	Mean	SD	Within ES
Social anxiety composite						
Pre	.31	.76		.27	.77	
Post	−.26	.87	0.69[a]	−.32	.98	0.67[a]
Social phobia scale						
Pre	35.24	13.52		36.40	12.29	
Post	28.39	15.55	0.47[a]	28.26	16.53	0.56[a]
Follow-Up	21.79	13.79	0.45[b]	23.76	14.33	0.29[b]
Social interaction anxiety scale						
Pre	51.45	11.62		50.00	13.17	
Post	43.55	14.48	0.60[a]	40.91	15.78	0.63[a]
Follow-Up	34.41	12.99	0.66[b]	36.07	15.50	0.31[b]
Liebowitz social anxiety scale						
Pre	83.12	22.88		80.49	25.41	
Post	64.73	23.18	0.80[a]	64.63	28.50	0.59[a]
Follow-Up	47.45	25.68	0.71[b]	56.03	24.57	0.32[b]
Beck depression inventory						
Pre	19.33	9.86		16.26	14.22	
Post	13.67	10.12	0.57[a]	8.09	7.95	0.71[a]
Follow-Up	9.83	9.92	0.38[b]	7.79	8.13	0.04[b]
Brief symptom inventory						
Pre	1.19	.61		1.17	.51	
Post	.77	.52	0.75[a]	.69	.48	0.95[a]
Follow-Up	.57	.46	0.41[b]	.61	.50	0.17[b]

Pre/Post: $N(\text{ATG}) = 33$, $N(\text{CG}) = 35$ Follow-Up: $N(\text{ATG}) = 29$, $N(\text{CG}) = 29$

[a] $d = (M_{\text{PRE}} - M_{\text{POST}})/\text{SD}_{\text{POOLED}}$

[b] $d = (M_{\text{POST}} - M_{\text{FOLLOW-UP}})/\text{SD}_{\text{POOLED}}$

group ($F(1,66) = .21$, $P = .65$, $\eta_p^2 < .001$) and no interaction effect of time × group ($F(1,66) = .21$, $P = .65$, $\eta_p^2 < .001$). The groups did not differ in the decline of general psychopathology from pre- to post- treatment. Paired-sample t tests were significant in both groups with medium to large effect sizes of $d = .75$ in the attention training group and $d = .95$ in the control condition (ATG: $t(32) = 4.77$, $P < .001$; CG: $t(34) = 7.10$, $P < .001$).

Clinical Change

Two measures were used to assess clinical change. First, the number of participants who no longer fulfilled the criteria for social anxiety disorder according to the SCID interview at post-assessment was determined. Second, clinically significant improvement for the SPS and SIAS was calculated (see method section).

Thirty (90.9%) participants in the ATG and 31 (88.6%) participants in the CG were available for the SCID interview at post-assessment. Twenty-three participants in both groups completed the follow-up assessment.

According to the SCID, 13.3% in the attention training group and 23.3% in the control group did no longer meet the diagnostic criteria of SAD. Table 3 shows the proportion of participants who fulfilled the criteria of clinical significant change. At post-treatment, proportions did not differ between the groups (ATG: 15.6–21.9%; CG: 18.8–34.4%). Percentages were higher at follow-up and ranged between 47.8 and 52.2% in the ATG and between 39.1 and 47.8% in the CG.

We also calculated the agreement between the two measures of clinical significance at post-treatment (clinical interview and self-report).The percentage of agreement between clinical significance obtained using self-report measures (SPS and SIAS) and clinical significance as judged by the SCID interview was 77.1% (SPS) and 81% (SIAS). These acceptable to high concordance rates provide support for the validity of our judgments on clinical significance.

Attention Bias

Figure 3 illustrates the main result of the 2 × 2 × 2 × 2 ANOVA regarding change in attention bias. There were no differences between the attention training and the control group (no significant main effect of group, no significant interaction effects with group, all $P > .05$). Over all types of trials, participants in both groups responded more quickly at post-assessment than at pre-assessment (significant main effect of time: $F(1,32) = 37.88$, $P < .001$, $\eta_p^2 = .38$). Participants in both groups reacted faster to valid trials than to invalid trials (significant main effect of validity: $F(1,32) = 78.52$, $P < .001$, $\eta_p^2 = .56$). In invalid trials, participants reacted more slowly to neutral words than to social threat words (significant interaction of validity × emotion: $F(1,32) = 16.27$, $P < .001$, $\eta_p^2 = .21$). The interaction of validity and emotion remained significant in two separate ANOVAs at pre- and post-assessment ($F_{pre}(1,64) = 8.22$, $P_{pre} = .01$, $\eta_{ppre}^2 = .11$; $F_{post}(1,63) = 6.50$, $P_{post} = .01$, $\eta_{ppost}^2 = .09$). The results suggest that participants in both groups showed a biased attention away from threat at pre- and at post-assessment.

To follow up the differences between reaction times to neutral and social threat words in invalid trials, we calculated an individual bias score subtracting reaction times to invalid social threat trials from reaction times to invalid neutral trials (Bias score = RT(Invalid neutral) − RT(Invalid Social Threat)) (see Amir et al. 2009; Amir et al. 2003). A positive bias score indicates a bias away from threat whereas a negative score indicates a bias towards threat. The higher the absolute value of the bias score the more pronounced the bias.

In line with the results of the ANOVA, participants in both groups showed a biased attention away from threat before and after treatment. Average bias scores were positive at pre-assessment (M $(SD)_{ATG} = 5.85$ (27.98); M $(SD)_{CG} = 17.91$ (30.30)) and at post-assessment (M $(SD)_{ATG} = 5.93$ (29.54); M $(SD)_{CG} = 12.30$ (23.61)). A repeated measure ANOVA failed to detect any significant differences between groups ($F(1,62) = .38$, $P = .54$,

Table 3 Clinical significant change at post and follow-up assessment

	Attention Training *N* (%)	Control condition *N* (%)	
% not meeting SAD diagnosis			
Post	4 (13.3)	7 (23.3)	$\chi^2(1) = .88$ n.s.
SPS			
Post	7 (21.9)	11 (34.4)	$\chi^2(1) = .12$ n.s.
Follow-up	11(47.8)	11(47.8)	$\chi^2(1) = .00$ n.s.
SIAS			
Post	5 (15.6)	6 (18.8)	$\chi^2(1) = .11$ n.s.
Follow-up	12 (52.2)	9 (39.1)	$\chi^2(1) = .79$ n.s.

Post: SCID: $N(ATG) = 30$, $N(CG) = 31$ SPS&SIAS: $N(ATG) = 32$, $N(CG) = 32$

Follow-Up: $N(ATG) = 23$, $N(CG) = 23$

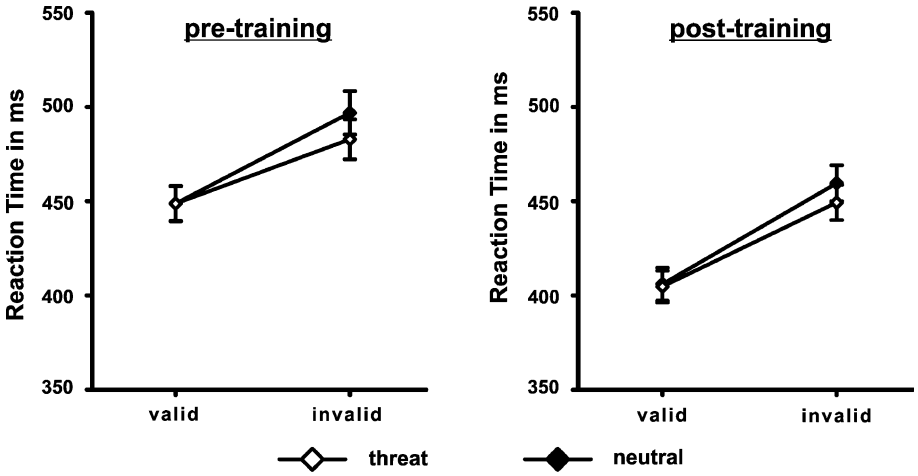

Fig. 3 Response latencies for the attention bias assessment before and after training

$\eta_p^2 = .01$) or assessment points ($F(1,62) = .40$, $P = .53$, $\eta_p^2 = .01$). However, individual bias scores varied considerably in both groups and results should be interpreted carefully.

Predictors of Change

We investigated if post-treatment and follow-up outcomes could be predicted by (a) change in attention bias, (b) change in overall reaction times, and (c) amount of training sessions. We calculated separate regression models for each group. To analyse predictors of change at post-assessment, we entered simple change scores on the social anxiety composite measure as dependent variable. Change in individual bias scores, change in mean reaction times from pre- to post-assessment, and amount of training sessions were entered as predictor variables in a stepwise regression model. None of these predictors proved significant, neither in the attention training group nor in the control group. To determine predictors of change at follow-up assessment, we calculated separate stepwise regression models for each social anxiety measure in each group. Dependent variables were change from pre- to follow-up-assessment on the SPS, the SIAS, and the LSAS. Again, predictor variables were change in individual bias scores, change in mean reaction times and amount of training sessions. For both groups, none of these variables predicted change on the SPS, the SIAS, or the LSAS. Table 4 shows the correlation coefficients between predictors and social anxiety change scores.

Assumed Group Affiliation

After the training, participants were asked whether they thought they had received the active or the control intervention. About one fifth of the participants in both groups believed that they had been in the active group (21.9% in the ATG, 18.8% in the CG). To evaluate the impact of the conviction of being in the active group, we conducted a repeated measure ANOVA including the assumed group affiliation as independent variable and the social anxiety composite as dependent variable. Results suggest that participants who believed to be in the active group showed significantly more improvement on social anxiety measures than those who believed to be in the placebo group (time × group interaction: $F(1,62) = 28.52$, $P < .001$, $\eta_p^2 = .32$). After the post assessment, participants received an e-mail disclosing their actual group affiliation.

Assumed group affiliation was also predictive of social anxiety scores at follow-up assessment. Regression analyses with the follow-up SPS, SIAS, and LSAS scores as dependent variables revealed that the assumed group affiliation was a significant predictor for the SPS ($R^2 = .07$, $\beta = .27$, $P = .04$) and the SIAS ($R^2 = .10$, $\beta = .31$, $P = .02$). For the LSAS, the regression showed a trend towards significance ($R^2 = .06$, $\beta = .24$, $P = .07$).

Maintenance of Treatment Effects

Data of the 29 participants in each group who attended the additional CBT self-help programme were analysed four months after the training. Table 2 depicts means, standard deviations and within effect sizes for primary and secondary outcome measures from post- to follow-up-assessment. All three social phobia measures were entered in a repeated measure MANOVA. There was a main effect of time ($F(1,56) = 30.30$, $P < .001$, $\eta_p^2 = .35$) and a trend towards a significant interaction effect of time × group ($F(1,56) = 2.77$, $P = .10$, $\eta_p^2 = .05$). There was no main effect of group ($F(1,56) = .14$, $P = .71$, $\eta_p^2 = .003$). Bonferroni corrected follow-up t tests revealed that participants in the active group improved significantly from

Table 4 Pearson correlation coefficients (*r*) for predictors of change in social anxiety

	Social anxiety post	SPS FU	SIAS FU	LSAS FU
ATG				
Attention bias change	−.25	−.14	−.26	.08
Change in mean RT	.07	−.07	−.03	−.26
Amount of training sessions	−.18	−.24	−.07	−.10
CG				
Attention bias change	.11	−.07	.03	.01
Change in mean RT	.26	−.18	.03	−.04
Amount of training sessions	.06	.30	.41	.27

Social anxiety Post, Social Anxiety Composite Change from Pre- to Post-Assessment, *SPS FU* Social Phobia Scale Change from Pre- to Follow-Up-Assessment, *SIAS FU* Social Interaction Anxiety Scale Change from Pre- to Follow-Up-Assessment, *LSAS FU* Liebowitz Social Anxiety Scale Change from Pre- to Follow-Up-Assessment

post to follow-up ($t(28) = 2.87$–5.03, all $P < .017$) with medium effect sizes of $d = .45$–$.71$. There were no significant changes in the control condition ($t(28) = .00$–2.51, all $P > .017$, $d = .29$–$.32$). To analyse change in secondary outcome measures from post- to follow-up-assessment, repeated measure ANOVAs were conducted for the BDI and the BSI. Data of the BDI revealed a significant main effect of time ($F(1,56) = 5.79$, $P = .02$, $\eta_p^2 = .10$) which was qualified by a significant interaction effect of time × group ($F(1,56) = 5.79$, $P = .02$, $\eta_p^2 = .10$). The attention training group improved significantly from post- to follow-up-assessment ($t(28) = 2.87$, $P = .01$, $d = .38$), the control group remained stable ($t(28) = .00$, $P > .99$, $d = .04$). Regarding general psychopathology, there was a significant main effect of time ($F(1,56) = 11.37$, $P = .001$, $\eta_p^2 = .17$) but no interaction effect of time × group ($F(1,56) = 1.54$, $P = .22$, $\eta_p^2 = .03$). Participants in the ATG improved significantly from post- to follow-up assessment ($t(28) = 3.49$, $P = .002$, $d = .41$), whereas participants in the control group did not ($t(28) = 1.42$, $P = .17$, $d = .17$).

Between post- and follow-up-assessment, the large majority of participants in both groups enrolled in the Internet-based self-help programme, offered to them at post-telephone SCID (ATG: $N = 29$ (88%), CG: $N = 29$ (83%), $\chi^2(1) = .34$, $P = .74$). Participants who attended the CBT self-help did not differ in their post-assessment social anxiety scores from those who did not attend the CBT programme ($t(66) = 2.92$, $P = .77$).To further our understanding of the changes from post- to follow-up assessment, we analysed whether the attention training and the control group differed in the use of the new self-help programme. There were no group differences regarding the amount of time spent in the programme ($M(SD)_{ATG} = 5.46$ h(7.48), $M(SD)_{CG} = 5.39$ h(4.35); $t(56) = .04$, $P = .97$) and the number of CBT modules completed ($M(SD)_{ATG} = 3.83(1.65)$, $M(SD)_{CG} = 4.10(1.74)$; $t(56) = -.62$; $P = .54$).

Discussion

In the present study, a four-week attention modification programme was adapted for the Internet, realising a low-cost and easy-access innovative approach for treating SAD. The first aim of the study was to evaluate the efficacy of the Internet-based attention training. Both groups, the attention training and the control group, improved significantly from pre- to post-assessment. They showed moderate to large effect sizes on social anxiety measures as well as on depression and general psychopathology measures. However, changes did not differ between the two groups.

The second aim of the study was to examine the hypothesized agent of the training: change in attention bias. At pre-assessment, participants in both groups allocated their attention away from threat. This did not change to post-assessment. Again, groups did not differ. Apart from an overall training effect, resulting in decreased average reaction times, there were no significant differences between pre- and post-assessment. These findings contrast with results of previous studies. In their report on attention modification, Schmidt et al. (2009) and Amir et al. (2009) both found substantial differences on social anxiety measures between the attention training and the control group. Amir et al. (2009) also reported significant group differences in the change of the attention bias. Participants in the attention training group disengaged more easily from social threat cues at post-assessment than did participants in the control group. Integrating several attention modification studies in anxiety disorders, Hakamata et al. (2010) reported an average controlled effect size of $d = .78$ on anxiety measures. Where did the differences between our study and previous reports lie? Participants in the present study were older than those in the study of Schmidt et al. (2009) and Amir et al. (2009). However, Hakamata et al. (2010) failed to identify age as moderator variable in attention modification trials. One major difference between

our study and previous reports constitutes the setting. Whereas previous researchers invited their participants into the laboratory, our participants conducted the attention exercises at home. The Internet-based deliverance of the tasks holds many advantages regarding availability, anonymity and costs of the programme. Yet, there are various ways in which the different setting may reduce the efficacy of the attention training. Presentation times of stimuli and assessment of the response latencies could be controlled using client-sided programming (javascript). However, monitor size and distance to the monitor could not be standardized. Furthermore, participants may be exposed to interruptions and diversions while completing the training tasks. Confounding variables of that sort would probably lead to increased duration of the individual training sessions. In the present study, however, sessions lasted 7–8 min on average, less than half of the 20 min per session reported by Schmidt et al. (2009). Hence, participants in the present study completed the training tasks rather swiftly. Still, inferring from excluded trials in the attention bias assessment tasks, the participants did not work less accurately. 1.2% of the trials of the attention bias assessment were excluded due to inaccurate reactions and time-outs. This rate ranges well within percentages reported in other dot-probe studies (e.g. Amir et al. 2009; Roberts et al. 2010).

Another important difference between laboratory and home settings is the level of stress and arousal. The unfamiliar lab surrounding most probably evokes higher levels of stress. The presence of a research assistant supervising the progress in the attention tasks should be particularly agitating for patients with SAD. In their model of stress and learning, Joels et al. (2006) integrate recent empirical findings and emphasize the beneficial role of stress and arousal within the learning experience on learning and memory. One possible explanation for the lack of change in the attentional bias could therefore be that the home setting did not evoke sufficient arousal to facilitate the training of the attention bias. Following this line of thought, the training failed to modify the attention bias and therefore failed to improve social anxiety. With this explanation, the substantial change in social anxiety (effect sizes $d = .69$ in the active and $d = .67$ in the control group) could be considered as placebo effect. This notion is supported by the strong effect of the assumed group affiliation. Participants convinced to be in the active group scored significantly lower on social anxiety measures than participants convinced to be in the placebo group. On the other hand, the reported effect sizes exceed the effects of psychological placebo conditions reported in meta-analyses (e.g. $d = .44$ for attention placebo in Fedoroff and Taylor 2001) even if they fall short compared to most of the cognitive behavioural treatments (Rodebaugh et al. 2004).

The similar decrease of social anxiety in the active and the control group could also be viewed as a result of a shared mechanism of change such as enhanced attentional control. In a recent review of attention modification studies in anxiety, Bar-Haim (2010) suggests that the applied programmes do not train specific value-related attentional biases but, more generally, improve control over attention processes. The very similar attention training and control conditions in the present study could both lead to an improvement of attentional control. Furthermore, one could hypothesize that the specific training effect that led to significant group differences in Amir et al. (2009) did not apply to the participants in the present study. The attention modification programme aims at facilitating disengagement from threat. However, participants in our study showed a biased attention away from threat prior to the intervention. It is possible that participants in the active group failed to improve their disengagement from threat because they did not need it. This would explain why both groups improved similarly to post-assessment and, at the same time, why effect sizes on social anxiety measures were considerably smaller than those reported by Schmidt et al. (2009) and Amir et al. (2009). Albeit, it would not explain the results at four-month follow-up. After the training, more than 80% of the participants in both groups enrolled in the additional self-help programme consisting of six modules of information and CBT exercises. After four months, there was a trend towards a group difference indicating that the attention training group showed substantial additional improvement on social anxiety and depression. The control group, in contrast, remained stable from post to follow-up showing none or little further improvement. These tentative group differences at follow-up could be a result of the applied research procedure. After the post-assessment, participants remained no longer blind to their initial group affiliation. Expectancy of positive change could lead to additional improvement in the active group. On the other hand, the knowledge of group affiliation did not influence the motivation to engage in the self-help programme. There were no group differences regarding modules completed or time spent in the programme. One could therefore also assume that there is a beneficial interaction between attention training and CBT self-help programme. The attention training could produce a long-term impact on attention processes which do not show at post-assessment but which influence the efficacy of the following self-help programme.

Our study has limitations. First of all, the present study does not allow drawing conclusions about the long-term effects of the attention training due to the additional active treatment in the follow-up period. We offered this further treatment out of ethical considerations. A future randomized controlled trial with an intervention-free follow-up

period is clearly needed. To examine potential interaction effects of attention training and CBT self-help, future studies should also combine these two approaches and evaluate their combination systematically. A second limitation is breaking the blind at post-assessment. Future studies should maintain participants' being blind to the assigned condition up to the follow-up assessment to reduce potential expectancy effects. A third limitation lies in the assessment of the attention bias at pre- and post-assessment. In the present study, the attention bias assessment was conducted according to Amir et al. (2009) presenting neutral and social threat stimuli for 600 ms. However, previous dot-probe experiments with presentation times of 500 ms or more produced conflicting results. In a vigilance-avoidance paradigm, 500 ms could be viewed as some sort of "grey area" where some socially anxious individuals still show an attention bias towards threat and others already avoid threat. To measure change in attention bias, future studies should apply shorter presentation times of 200 ms or less. Furthermore, the attention bias should also be assessed at follow-up to examine any long-term change in attention processes.

In conclusion, attention modification programmes present theoretically well-founded, short-term interventions for SAD. Internet-based adaptations of such programmes promise even less time and cost restrictions for both practitioners and patients. Results of the present study do not recommend an Internet-based attention training as stand-alone intervention for SAD. However, the integration of attention training tasks into cognitive-behavioural treatment protocols seems promising and warrants further research.

References

Amir, N., Beard, C., Taylor, C. T., Klumpp, H., Elias, J., & Burns, M. (2009). Attention training in individuals with generalized social phobia: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 77*(5), 961–973. doi:10.1037/a0016685.

Amir, N., Elias, J., Klumpp, H., & Przeworski, A. (2003). Attentional bias to threat in social phobia: Facilitated processing of threat or difficulty disengaging attention from threat? *Behaviour Research and Therapy, 41*(11), 1325–1335. doi:10.1016/S0005-7967(03)00039-1.

Amir, N., Foa, E. B., & Coles, M. E. (1998). Automatic activation and strategic avoidance of threat-relevant information in social phobia. *Journal of Abnormal Psychology, 107*(2), 285–290. doi:10.1037/0021-843X.107.2.285.

Andersson, G., Carlbring, P., Holmström, A., Sparthan, E., Furmark, T., & Nilsson-Ihrfelt, E. (2006). Internet-based self-help with therapist feedback and in vivo group exposure for social phobia: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 74*(4), 677–686. doi:10.1037/0022-006X.74.4.677.

Asmundson, G. J. G., & Stein, M. B. (1994). Selective processing of social threat in patients with generalized social phobia: Evaluation using a dot-probe paradigm. *Journal of Anxiety Disorders, 8*(2), 107–117. doi:10.1016/0887-6185(94)90009-4.

Baker, S. L., Heinrichs, N., Kim, H.-J., & Hofmann, S. G. (2002). The Liebowitz social anxiety scale as a self-report instrument: A preliminary psychometric analysis. *Behaviour Research and Therapy, 40*(6), 701–715. doi:10.1016/S0005-7967(01)00060-2.

Bar-Haim, Y. (2010). Research review: Attention bias modification (ABM): A novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry, 51*(8), 859–870. doi:10.1111/j.1469-7610.2010.02251.x.

Beck, A., Steer, R., & Brown, G. (1996). *Beck Depression Inventory-II (BDI-II)*. San Antonio, TX: Psychological Corporation.

Berger, T., Caspar, F., Richardson, R., Kneubuhler, B., Sutter, D., & Andersson, G. (2011). Internet-based treatment of social phobia: A randomized controlled trial comparing unguided with two types of guided self-help. *Behaviour Research and Therapy*, (in press). doi:10.1016/j.brat.2010.12.007.

Berger, T., Hohl, E. o., & Caspar, F. (2009). Internet-based treatment for social phobia: A randomized controlled trial. *Journal of Clinical Psychology, 65*(10), 1021–1035. doi:10.1002/jclp.20603.

Bradley, B. P., Mogg, K., & Lee, S. C. (1997). Attentional biases for negative information in induced and naturally occurring dysphoria. *Behaviour Research and Therapy, 35*(10), 911–927. doi:10.1016/S0005-7967(97)00053-3.

Buckner, J. D., Maner, J. K., & Schmidt, N. B. (2010). Difficulty disengaging attention from social threat in social anxiety. *Cognitive Therapy and Research, 34*(1), 99–105. doi:10.1007/s10608-008-9205-y.

Carlbring, P., Furmark, T., Steczkó, J., Ekselius, L., & Andersson, G. (2006). An open study of internet-based bibliotherapy with minimal therapist contact via email for social phobia. *Clinical Psychologist, 10*(1), 30–38. doi:10.1080/13284200500378662.

Carlbring, P., Gunnarsdóttir, M., Hedensjö, L., Andersson, G., Ekselius, L., & Furmark, T. (2007). Treatment of social phobia: Randomised trial of internet-delivered cognitive-behavioural therapy with telephone support. *British Journal of Psychiatry, 190*(2), 123–128. doi:10.1192/bjp.bp.105.020107.

Chen, Y. P., Ehlers, A., Clark, D. M., & Mansell, W. (2002). Patients with generalized social phobia direct their attention away from faces. *Behaviour Research and Therapy, 40*(6), 677–687. doi:10.1016/S0005-7967(01)00086-9.

Clark, D. M., Ehlers, A., Hackmann, A., McManus, F., Fennell, M., & Grey, N. (2006). Cognitive therapy versus exposure and applied relaxation in social phobia: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 74*(3), 568–578. doi:10.1037/0022-006X.74.3.568.

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York, NY, USA: Guilford Press.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale: Lawrence Erlbaum Associates.

Constans, J. I., Penn, D. L., Ihen, G. H., & Hope, D. A. (1999). Interpretive biases for ambiguous stimuli in social anxiety. *Behaviour Research and Therapy, 37*(7), 643–651. doi:10.1016/S0005-7967(98)00180-6.

Derogatis, L. R., & Cleary, P. A. (1977). Confirmation of the dimensional structure of the SCL-90: A study in construct validation. *Journal of Clinical Psychology, 33*(4), 981–989. doi:10.1002/1097-4679(197710)33:4.

Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory: An introductory report. *Psychological Medicine: A Journal of Research in Psychiatry and the Allied Sciences, 13*(3), 595–605. doi:10.1017/S0033291700048017.

Fedoroff, I. C., & Taylor, S. (2001). Psychological and pharmacological treatments of social phobia: A meta-analysis. *Journal of Clinical Psychopharmacology, 21*(3), 311–324. doi:10.1097/00004714-200106000-00011.

Franke, G. (2000). *Brief Symptom Inventory von LR Derogatis; BSI;(kurzform der SCL-90-R); deutsche Version*: Beltz Test.

Fresco, D. M., Coles, M. E., Heimberg, R. G., Leibowitz, M. R., Hami, S., & Stein, M. B. (2001). The Liebowitz Social Anxiety Scale: A comparison of the psychometric properties of self-report and clinician-administered formats. *Psychological Medicine: A Journal of Research in Psychiatry and the Allied Sciences, 31*(6), 1025–1035. doi:10.1017/S0033291701004056.

Fydrich, T., Renneberg, B., Schmitz, B., & Wittchen, H.-U. (1997). *Strukturiertes Klinisches Interview für DSM-IV, Achse II: Persönlichkeitsstörungen*. Göttingen: Hogrefe.

Gotlib, I. H., Krasnoperova, E., Yue, D. N., & Joormann, J. (2004). Attentional biases for negative interpersonal stimuli in clinical depression. *Journal of Abnormal Psychology, 113*(1), 127–135. doi:10.1037/0021-843X.113.1.121.

Gould, R. A., Buckminster, S., Pollack, M. H., Otto, M. W., & Yap, L. (1997). Cognitive-behavioral and pharmacological treatment for social phobia: A meta-analysis. *Clinical Psychology: Science and Practice, 4*(4), 291–306. doi:10.1111/j.1468-2850.1997.tb00123.x.

Hakamata, Y., Lissek, S., Bar-Haim, Y., Britton, J. C., Fox, N. A., & Leibenluft, E. (2010). Attention bias modification treatment: A meta-analysis toward the establishment of novel treatment for anxiety. *Biological Psychiatry, 68*(11), 982–990. doi:10.1016/j.biopsych.2010.07.021.

Hautzinger, M., Keller, F., & Kühner, C. (2006). *Das beck depressions-inventar II. Revision*. Frankfurt/Main: Harcourt Test Services.

Heimberg, R. G., Liebowitz, M. R., Hope, D. A., Schneier, F. R., Holt, C. S., & Welkowitz, L. A. (1998). Cognitive behavioral group therapy vs. phenelzine therapy for social phobia: 12-week outcome. *Archives of General Psychiatry, 55*(12), 1133–1141. doi:10.1001/archpsyc.55.12.1133.

Helfinstein, S. M., White, L. K., Bar-Haim, Y., & Fox, N. A. (2008). Affective primes suppress attention bias to threat in socially anxious individuals. *Behaviour Research and Therapy, 46*(7), 799–810. doi:10.1016/j.brat.2008.03.011.

Holländare, F., Askerlund, A.-M., Nieminen, A., & Engström, I. (2008). Can BDI-II and MADRS-S be transferred to online use without affecting their psychometric properties? *E-Journal of Applied Psychology, 4*(2), 63–65.

Hope, D. A., Rapee, R. M., Heimberg, R. G., & Dombeck, M. J. (1990). Representations of the self in social phobia: Vulnerability to social threat. *Cognitive Therapy and Research, 14*(2), 177–189. doi:10.1007/BF01176208.

Horenstein, M., & Segui, J. (1997). Chronometrics of attentional processes in anxiety disorders. *Psychopathology, 30*(1), 25–35.

Issakidis, C., & Andrews, G. (2002). Service utilisation for anxiety in an Australian community sample. *Social Psychiatry and Psychiatric Epidemiology, 37*(4), 153–163.

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59*(1), 12–19. doi:10.1037/0022-006X.59.1.12.

Joels, M., Pu, Z., Wiegert, O., Oitzl, M. S., & Krugers, H. J. (2006). Learning under stress: How does it work? *Trends in Cognitive Sciences, 10*(4), 152–158. doi:10.1016/j.tics.2006.02.002.

Keller, M. B. (2003). The lifelong course of social anxiety disorder: A clinical perspective. *Acta Psychiatrica Scandinavica, 108*(Supplement 417), 85–94. doi:10.1034/j.1600-0447.108.s417.6.x.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*(6), 593–602. doi:10.1001/archpsyc.62.6.593.

Kühner, C., Bürger, C., Keller, F., & Hautzinger, M. (2007). Reliabilität und Validität des revidierten Beck-Depressionsinventars (BDI-II). Befunde aus deutschsprachigen Stichproben. *Der Nervenarzt, 78*(6), 651–656. doi:10.1007/s00115-006-2098-7.

Lincoln, T. M., Rief, W., Hahlweg, K., Frank, M., von Witzleben, I., & Schroeder, B. (2003). Effectiveness of an empirically supported treatment for social phobia in the field. *Behaviour Research and Therapy, 41*(11), 1251–1269. doi:10.1016/S0005-7967(03)00038-X.

Lundh, L.-G., & Öst, L.-G. (1996). Stroop interference, self-focus and perfectionism in social phobics. *Personality and Individual Differences, 20*(6), 725–731. doi:10.1016/0191-8869(96)00008-6.

Maidenberg, E., Chen, E., Craske, M., & Bohn, P. (1996). Specificity of attentional bias in panic disorder and social phobia. *Journal of Anxiety Disorders, 10*(6), 529–541. doi:10.1016/S0887-6185(96)00028-X.

Mattia, J. I., Heimberg, R. G., & Hope, D. A. (1993). The revised Stroop color-naming task in social phobics. *Behaviour Research and Therapy, 31*(3), 305–313. doi:10.1016/0005-7967(93)90029-T.

Mattick, R. P., & Clarke, J. C. (1989). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Unpublished manuscript*.

Mogg, K., & Bradley, B. P. (2002). Selective orienting of attention to masked threat faces in social anxiety. *Behaviour Research and Therapy, 40*(12), 1403–1414. doi:10.1016/S0005-7967(02)00017-7.

Mogg, K., Philippot, P., & Bradley, B. P. (2004). Selective attention to angry faces in clinical social phobia. *Journal of Abnormal Psychology, 113*(1), 160–165. doi:10.1037/0021-843X.113.1.160.

Mühlberger, A., Wieser, M. J., & Pauli, P. (2008). Visual attention during virtual social situations depends on social anxiety. *Cyber Psychology & Behavior, 11*(4), 425–430. doi:10.1089/cpb.2007.0084.

Musa, C., Lepine, J. P., Clark, D. M., Mansell, W., & Ehlers, A. (2003). Selective attention in social phobia and the moderating effect of a concurrent depressive disorder. *Behaviour Research and Therapy, 41*(9), 1043–1054. doi:10.1016/S0005-7967(02)00212-7.

Olfson, M., Guardino, M., Struening, E., Schneier, F. R., Hellman, F., & Klein, D. F. (2000). Barriers to the treatment of social anxiety. *The American Journal of Psychiatry, 157*(4), 521–527. doi:10.1176/appi.ajp.157.4.521.

Pineles, S. L., & Mineka, S. (2005). Attentional biases to internal and external sources of potential threat in social anxiety. *Journal of Abnormal Psychology, 114*(2), 314–318. doi:10.1037/0021-843X.114.2.314.

Pishyar, R., Harris, L. M., & Menzies, R. G. (2004). Attentional bias for words and faces in social anxiety. *Anxiety, Stress & Coping: An International Journal, 17*(1), 23–36. doi:10.1080/10615800310001601458.

Posner, M. I. (1980). Orienting of attention. *The Quarterly Journal of Experimental Psychology, 32*(1), 3–25. doi:10.1080/00335558008248231.

Powers, M. B., Sigmarsson, S. R., & Emmelkamp, P. M. G. (2008). A meta-analytic review of psychological treatments for social anxiety disorder. *International Journal of Cognitive Therapy, 1*(2), 94–113. doi:10.1521/ijct.2008.1.2.94.

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35*(8), 741–756. doi:10.1016/S0005-7967(97)00022-3.

Renneberg, B., Theobald, E., Nobs, M., & Weisbrod, M. (2005). Autobiographical memory in borderline personality disorder and

depression. *Cognitive Therapy and Research, 29*(3), 343–358. doi:10.1007/s10608-005-4267-4.

Roberts, K. E., Hart, T. A., & Eastwood, J. D. (2010). Attentional biases to social and health threat words in individuals with and without high social anxiety or depression. *Cognitive Therapy and Research, 34*(4), 388–399. doi:10.1007/s10608-009-9245-y.

Rodebaugh, T. L., Holaway, R. M., & Heimberg, R. G. (2004). The treatment of social anxiety disorder. *Clinical Psychology Review, 24*(7), 883–908. doi:10.1016/j.cpr.2004.07.007.

Rosnow, R. L., & Rosenthal, R. (1991). If you're looking at the cell means, you're not looking at only the interaction (unless all main effects are zero). *Psychological Bulletin, 110*(3), 574–576. doi:10.1037/0033-2909.110.3.574.

Saile, H., Weiland-Heil, K., & Schwenkmezger, P. (2000). Lassen sich in klinischen Erstgesprächen valide Diagnosen stellen? Vergleich von klinischem Erstgespräch, strukturiertem Interview und Symptom-Checkliste. *Zeitschrift für Klinische Psychologie und Psychotherapie: Forschung und Praxis, 29*(3), 214–220. doi:10.1026//0084-5345.29.3.214.

Schiller, A. (2004). *Effekte einer Alkoholgabe auf die Informationsverarbeitung bei sozial phobischen Frauen.* Dissertation, Münster University Münster.

Schmidt, N. B., Richey, J. A., Buckner, J. D., & Timpano, K. R. (2009). Attention training for generalized social anxiety disorder. *Journal of Abnormal Psychology, 118*(1), 5–14. doi:10.1037/a0013643.

Stangier, U., & Heidenreich, T. (2003). Die Liebowitz Soziale Angst-Skala (LSAS). In P. Scalarum (Ed.), *Internationale Skalen für Psychiatrie*. Göttingen: Hogrefe.

Stangier, U., Heidenreich, T., Berardi, A., Golbs, U., & Hoyer, J. r. (1999). Die Erfassung sozialer Phobie durch Social Interaction Anxiety Scale (SIAS) und die Social Phobia Scale (SPS). *Zeitschrift für Klinische Psychologie, 28*(1), 28–36. doi:10.1026//0084-5345.28.1.28.

Stopa, L., & Clark, D. M. (2000). Social phobia and interpretation of social events. *Behaviour Research and Therapy, 38*(3), 273–283. doi:10.1016/S0005-7967(99)00043-1.

Titov, N., Andrews, G., & Schwencke, G. (2008a). Shyness 2: Treating social phobia online: Replication and extension. *Australian and New Zealand Journal of Psychiatry, 42*(7), 595–605. doi:10.1080/00048670802119820.

Titov, N., Andrews, G., Schwencke, G., Drobny, J., & Einstein, D. (2008b). Shyness 1: Distance treatment of social phobia over the internet. *Australian and New Zealand Journal of Psychiatry, 42*(7), 585–594. doi:10.1080/00048670802119762.

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., & Hare, T. A. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research, 168*(3), 242–249. doi:10.1016/j.psychres.2008.05.006.

Vassilopoulos, S. P. (2005). Social Anxiety and the Vigilance-Avoidance Pattern of Attentional Processing. *Behavioural and Cognitive Psychotherapy, 33*(1), 13–24. doi:10.1017/S1352465804001730.

Wang, P. S., Berglund, P., Olfson, M., Pincus, H. A., Wells, K. B., & Kessler, R. C. (2005). Failure and Delay in Initial Treatment Contact After First Onset of Mental Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*(6), 603–613. doi:10.1001/archpsyc.62.6.603.

Wittchen, H.-U., Wunderlich, U., Gruschwitz, S., & Zaudig, M. (1997). *Strukturiertes klinisches Interview für DSM-IV*. Göttingen: Hogrefe.

Wittchen, H.-U., Zaudig, M., Spengler, P., Mombour, W., Hiller, W., & Essau, C. A. (1991). Wie zuverlässig ist operationalisierte Diagnostik? Die Test-Retest-Reliabilität des Strukturierten Klinischen Interviews für DSM-III-R. *Zeitschrift für Klinische Psychologie, 20*(2), 136–153.