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Combining Attention Training with Internet-Based Cognitive-Behavioural Self-Help for Social Anxiety: A Randomised Controlled Trial

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Abstract. Guided Internet-based cognitive-behavioural self-help (ICBT) has been proven to be effective for social anxiety disorder (SAD) by several independent research groups. However, as the proportion of clinical significant change has room for improvement, new treatments should be developed and investigated. A novel treatment is attention bias modification (ABM). This study aimed at evaluating the combination of ABM and ICBT. We compared two groups, one group receiving ICBT and ABM targeting attentional avoidance and the other group receiving ICBT and control training. ABM and control training tasks were both based on the dot-probe paradigm. A total of 133 participants, diagnosed with SAD, were randomised to these two groups. The attention training group ($N = 66$) received 2 weeks of daily attention training followed by 9 weeks of ICBT. The control group ($N = 67$) received 2 weeks of daily control training, also followed by 9 weeks of ICBT. Social anxiety measures as well as the attention bias were assessed at pre-assessment, at week 2, and at post-treatment. Results showed no significant differences between the attention training group and the control group. Both groups improved substantially on social anxiety symptoms from pre- to post-assessment ($d_{within} = 1.39–1.41$), but showed no change in attention processes ($d_{within} = 0.10–0.17$). In this trial, the attention modification training failed to induce differential change in attention bias. Results demonstrate that the applied ABM procedure with its focus on the reduction of attentional avoidance was ineffective in the Internet-based setting. The results do not suggest that adding ABM targeting attentional avoidance to ICBT results in better outcomes than ICBT alone. *Key words: social anxiety disorder; cognitive bias modification; web; psychotherapy*

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Introduction

Social anxiety disorder (SAD) is one of the most common mental disorders. Life-time prevalence is estimated at 12.1% (Kessler et al., 2005). Untreated SAD often takes a chronic course and is associated with major impairment in a person's professional and personal life (Beard, Moitra, Weisberg, & Keller, 2010; Fehm, Pelissolo, Furmark, & Wittchen, 2005; Keller 2003). However, only about 20–40% of the individuals with SAD seek professional help (Issakidis & Andrews 2002; Wang et al., 2005). This low treatment rate is at least partly due to restricted access to evidence-based treatment. On the other hand, the disorder-specific fear of social situations offers a further explanation of why individuals with SAD take up to 20 years to consult a professional (Keller 2003). Olfson et al. (2000)

found that about 20% of those individuals with SAD who do not seek treatment avoid this because of their fear of what others may think of them.

Internet-based interventions have the potential to address these barriers for treatment seeking. They provide low-cost, easy access and widely available interventions (Andersson 2009). Furthermore, the feared face-to-face confrontation with a clinician can be circumvented as all assessments and interventions are conducted via Internet and telephone (Carlbring & Andersson 2006). In the field of SAD, Internet-based treatments are also based on a solid ground of empirical evidence. Numerous randomised controlled trials support the efficacy of Internet-based cognitive-behavioural self-help (ICBT) programmes for SAD (Berger, Hohl, & Caspar, 2009; Botella et al., 2010; Carlbring et al., 2007; Titov, Andrews, Schwencke, & Drobny, 2008). However, not all participants benefit from Internet-based self-help programmes. Data on clinical significant change suggest that a substantial part (about 40–60%) of the participants do not achieve reliable improvement (Berger et al., 2011; Boettcher, Berger, & Renneberg, 2012a; Tillfors et al., 2008; Titov et al., 2010).

The applied CBT rationales in Internet-based self-help programmes are based on the cognitive model by Clark and Wells (1995). They address safety behaviours, avoidance, negative thoughts and self-focused attention. Cognitive models also emphasise the role of biases in information processing some of which are not addressed in CBT manuals. Biases in interpretation and attention processes are thought to be crucial in the maintenance of SAD (Clark & McManus 2002; Rapee & Heimberg 1997). How socially anxious individuals perceive threatening information in social situations has been subject to many experimental studies. In a review on attention bias in anxiety disorders, Cisler and Koster (2010) differentiated between hypervigilance to threat cues (bias towards threat cues) and attentional avoidance (bias away from threat cues). In SAD, both components of attention bias have received at least some empirical support across different experimental designs. Hypervigilance to threat has been demonstrated in the dot-probe paradigm at presentation times of less than 200 ms (Mueller et al., 2009; Roberts, Hart, & Eastwood, 2010; Vassilopoulos 2005) and at 500 ms (Asmundson & Stein 1994; Helfinstein, White, Bar-Haim, & Fox, 2008; Klumpp & Amir 2009; Mogg & Bradley 2002; Mogg, Philippot, & Bradley, 2004; Musa, Lépine, Clark, Mansell, & Ehlers, 2003). Two eye-tracking studies have also found that socially anxious individuals (initially) show greater attention to social threat cues than to neutral cues (Schofield, Johnson, Inhoff, & Coles, 2012; Wieser, Pauli, Weyers, Alpers, & Mühlberger, 2009). Fewer studies suggest that socially anxious individuals display *attentional avoidance* of social threat cues. Two studies using the dot-probe paradigm revealed attentional avoidance at 500 ms (Chen, Ehlers, Clark, & Mansell, 2002; Vassilopoulos 2005) supported by two eye-tracking studies (Mühlberger, Wieser, & Pauli, 2008; Wieser et al., 2009). Attentional hypervigilance and attentional avoidance are not necessarily mutually exclusive when considered within the hypervigilance-avoidance-framework (Pflugshaupt et al., 2005). The hypervigilance-avoidance theory assumes that anxious individuals initially show quick engagement with threat cues followed by attentional avoidance of these same threat cues. There is yet no consensus in the literature as to specific time periods for hypervigilant and avoidant processing stages (Cisler & Koster 2010).

Recently, investigators have sought to systematically manipulate biased attentional responding to threat. Amir et al. (2009) and Schmidt, Richey, Buckner, and Timpano (2009) were the first to present encouraging results for a training programme aiming at the reduction of attention bias towards threat in individuals with SAD. Controlled effect sizes at post-assessment ranged between $d = 0.35$ and $d = 1.59$. The authors applied a modified dot-probe task where participants were trained to direct their attention away from threat cues towards neutral cues at presentation times of 500 ms. Subsequent trials mostly replicated the positive results of these first studies (Amir, Taylor, & Donohue, 2011; Amir, Weber, Beard, Bomyea, & Taylor, 2008; Heeren, Reese, McNally, & Philippot, 2012; Klumpp & Amir 2010; Li, Tan, Qian, & Liu, 2008). In remote delivery, changes in attention bias and social anxiety seem harder to achieve. Three studies failed to produce significant effects when applying the training procedures

suggested by Amir et al. (2009) via the Internet (Boettcher, Berger, & Renneberg, 2012b; Carlbring et al., 2012; Neubauer et al., 2013). However, one recent trial successfully evaluated the potential of a training procedure aiming at reducing attentional avoidance in an Internet-based setting (Boettcher et al., in press). In this study, an attention training aiming at reducing the hypervigilance to threat was compared with an attention training aiming at reducing attentional avoidance and to a control condition. Participants, diagnosed with SAD, were asked to train daily for 2 weeks. Both training conditions included presentation times not only of 500 ms but also of 1000 ms, with the goal to train attention at potentially different processing stages. As in former Internet trials, the attention training aiming at reducing hypervigilance was not superior to the control group. The attention training condition aiming at reducing attentional avoidance, on the other hand, achieved large effects in the reduction of social fears and was superior to the control condition. The authors concluded that this new format of attention training towards threat held potential in remote delivery (Boettcher et al., in press).

Targeted attention modification programmes are not the only therapeutic techniques that yield change in attention processes. Several authors have examined the effects of cognitive-behaviour therapy on attention bias change. Mathews, Mogg, Kentish, and Eysenck (1995) and Mogg, Bradley, Millar, and White (1995) were the first to demonstrate that CBT reduced attentional hypervigilance in patients with generalised anxiety disorder. This finding was replicated in SAD by Lundh and Öst (2001) and Pishyar, Harris, and Menzies (2008). Pishyar et al. could also show that change in attention bias was associated with better clinical outcome ($r = 0.35–0.61$). Three recent studies examined the different components of biased processing of threat cues. They found that CBT was more effective in reducing attentional avoidance than in reducing hypervigilance to threat cues (Calamaras, Tone, & Anderson, 2012; Legerstee et al., 2010; Waters, Mogg, & Bradley, 2012). The reduction of attentional avoidance mediated change in anxiety symptoms (Legerstee et al., 2010; Waters et al., 2012). It seems that biased attention processes are susceptible to cognitive-behavioural techniques and that changes in attentional avoidance are associated with clinical outcome.

Biases in attention processes are not only subject to change through CBT, but can also be predictors of treatment outcome. Pre-treatment attentional avoidance predicted lower rates of symptom improvement and was associated with non-response in CBT (Price, Tone, & Anderson, 2011; Waters et al., 2012). This finding that clients who display attentional avoidance prior to CBT benefit less from the treatment supports the notion that a combination of attention modification training aiming at reducing attentional avoidance and CBT might be beneficial in the reduction of social anxiety. The fact that a decrease of attentional avoidance mediates change of social anxiety in CBT further supports the idea of a combined treatment approach. So far, no study has attempted to combine attention training that aims at the reduction of attentional avoidance with a CBT intervention. Amir and Taylor (2012) presented first results of a combination of attention training that aims at reducing hypervigilance to threat with computerised CBT. The authors reported encouraging results of this combination in patients with generalised anxiety disorder. In contrast, Rapee et al. (2013) could not detect any benefit when adding attention training aiming at the reduction of hypervigilance to threat to a cognitive-behavioural group therapy programme for SAD.

This study aims to combine, for the first time, an attention training that targets the reduction of attentional avoidance with guided cognitive-behavioural self-help. Both treatments were delivered remotely via the Internet. Two groups were compared in a randomised controlled design. The active group received 2 weeks of attention training towards threatening cues prior to 9 weeks of ICBT. The control group received 2 weeks of control training prior to ICBT. Based on the positive results of this form of attention training in one previous Internet study (Boettcher et al., in press) as well as on the association of attentional avoidance and treatment outcome in face-to-face CBT, we hypothesised that participants of the attention training group would show superior reductions in attentional avoidance as well as in social anxiety from pre- to post-assessment

compared with the participants in the control group. We also aimed at exploring the influence of pre-treatment attentional bias on treatment outcome.

Methods

Participants

A more detailed description of the selection of participants, procedure and interventions is provided in the published study protocol (Boettcher, Andersson, & Carlbring, 2013). Participants were recruited via the Internet and advertisement in national newspapers. We applied the following inclusion criteria: (a) being at least 18 years old, (b) meeting diagnostic criteria for a primary diagnosis of SAD, (c) no suicidal ideation, (d) error rate of less than 25% in the first attention bias assessment, (e) not participating in any other psychological treatment for the duration of the study and (f) if on prescribed medication for anxiety/depression, dosage had to be constant for 3 months prior to the start of the treatment.

A total of 133 participants met all inclusion criteria and were randomised to one of the two groups (see flow chart in Figure 1). Six participants (4.5%) did not complete self-report measures at week 2, and seven participants (5.3%) failed to complete the post-assessment. Five participants (3.8%) did not complete the attention bias assessment at week 2, and 28 participants (21.1%) did not complete the attention bias assessment at post-treatment. Drop-out rates did not differ between the two groups (all $\chi^2(1) < 3.05$, all $p > 0.09$). At post-assessment, seven participants (5.3%) indicated that they had initiated psychological or medical treatment during the course of the study and were subsequently excluded from all analyses on mid- and post-data.

Table 1 displays socio-demographic characteristics for the two groups. Participants were, on average, 33.4 years old (SD = 10.39). Pre-treatment scores for primary and secondary outcome measures are depicted in Table 3. There were no significant group differences on any demographic or outcome variable.

Procedure

After pre-assessment, participants were randomly allocated to one of the two groups by an online true random-number service independent of the investigators. After randomisation, participants received access to a website where the respective tasks of the attention training/control training were presented and where the CBT self-help manual was accessible from week 3 to 11. The combined intervention took 11 weeks. During week 1 and 2, participants were asked to carry out the attention training/control training exercises once a day for a total of 14 days. From week 3 to 11, participants in both groups were asked to complete the nine modules of the CBT self-help manual.

Intervention

Attention training and control training. The applied attention training aiming at the reduction of attentional avoidance has previously shown positive results in remote delivery (Boettcher et al., in press). Tasks for the attention training and the control training were both based on the dot-probe paradigm and were identical except for the location of the probe. Tasks are described in more detail in the published study protocol (Boettcher et al., 2013). Each training/control session comprised 192 trials. In the first 96 trials of each session, stimuli were presented for 1000 ms, and in the second 96 trials, stimuli were presented for 500 ms. In each trial, a pair of stimuli appeared, one on top and one at the bottom, either consisting of two words with different emotional valence or of two portrait images expressing two different facial expressions of the same person. During one-third of the trials in each session, stimulus pair members were neutral–negative, in one-third they were positive–negative, and in one-third they were neutral–positive. After either 500 or 1000 ms exposure, the pair of stimuli was replaced with a probe, which appeared in the position of either the upper or the lower previously displayed stimulus. Participants were instructed to respond as quickly and accurately as possible to the probe by pressing the corresponding button on the keyboard.

The attention training and the control conditions only differed in the frequency the probe replaced neutral, positive and negative stimuli. In the attention training condition, the probe always replaced the more negative stimuli establishing a link between the more negative cue and the probe. In the control condition, no contingency between type of

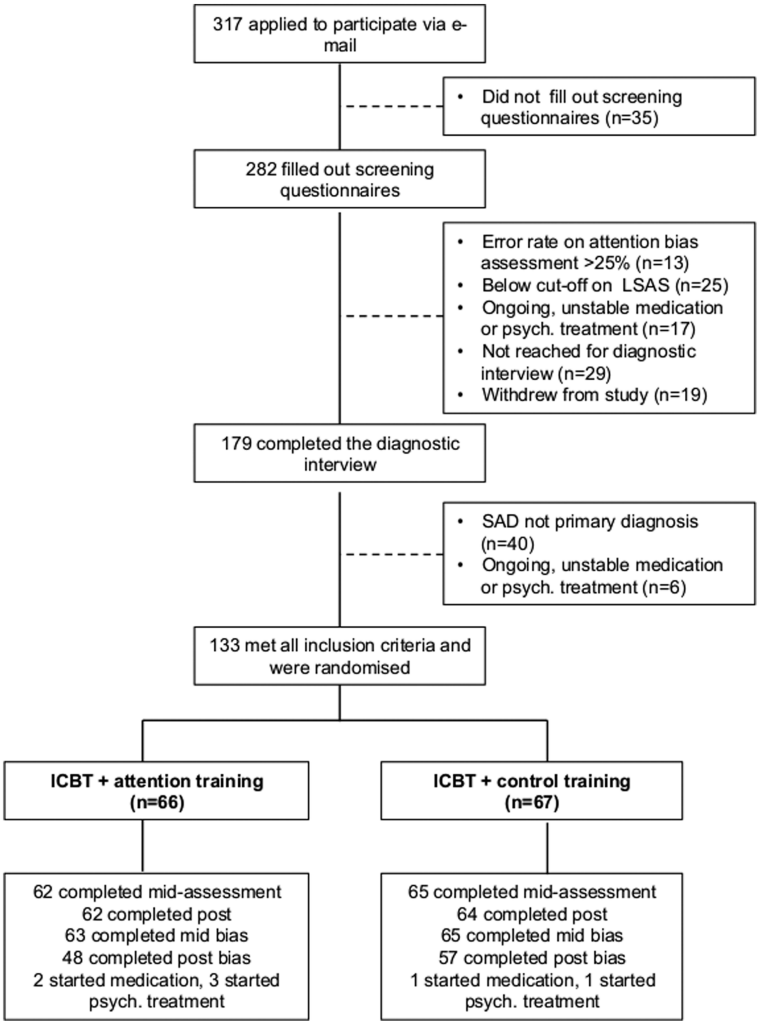

Figure 1. Flowchart of participants.

stimulus and probe was established, and the probe appeared with equal frequency in the location of the more negative and the more positive stimuli.

ICBT. The cognitive-behavioural self-help intervention consisted of our previously evaluated self-help manual for SAD, which comprises 186 pages divided into nine chapters (modules) adapted for use over the Internet (Andersson et al., 2006; Carlbring et al., 2007). The introductory module describes SAD and facts about CBT. Modules 2–4 describe a cognitive model for SAD and introduce cognitive restructuring. Modules 5–7 introduce exposure exercises and exercises on self-focused attention. Modules 8 and 9 mainly concern social skills and relapse prevention. Participants were asked to discuss their homework assignments in weekly email correspondence with their Internet therapist. Internet therapists were 8 MSc clinical psychology students, trained and supervised by a licensed clinical psychologist. On average, therapists were responsible for 16 participants (range 13–19).

Outcome measures

Outcome measures were administered prior to the treatment (pre-assessment), immediately after the attention training/control training at day 15 (mid-assessment), and after the completion of the ICBT programme after week 11 (post-assessment). We administered the

Table 1. *Participants' characteristics at pre-assessment*

	Total ($N = 133$)		Control group ($N = 67$)		Attention training group ($N = 66$)		
	N	%	*N*	%	*N*	%	Test statistics
Male	48	36	27	40	21	32	$\chi^2(1) = 1.04\ p = 0.37$
Female	85	64	40	60	45	68	
Married/in relationship	77	58	35	52	42	64	$\chi^2(2) = 4.94\ p = 0.08$
Single	56	42	32	48	24	36	
Low level of education	4	3	1	1	3	5	$\chi^2(2) = 1.24\ p = 0.56$
Medium level of education	35	26	19	28	16	24	
High level of education	94	71	47	70	47	71	
Former psychotherapy	67	50	31	46	36	55	$\chi^2(1) = 0.91\ p = 0.39$
No (former) medication	80	60	42	63	38	58	$\chi^2(2) = 0.36\ p = 0.85$
Former medication	36	27	17	25	19	29	
On stable medication	17	13	8	12	9	14	

following social anxiety scales as primary outcome measures of the study: the Liebowitz Social Anxiety Scale—self-report version (LSAS-SR, Baker, Heinrichs, Kim, & Hofmann, 2002), the Social Phobia Scale, and the Social Interaction Anxiety Scale (SPS & SIAS, Mattick & Clarke 1998). As secondary outcome measures, we administered the Montgomery Åsberg Depression Rating Scale—self-report version (MADRS-S, Svanborg & Åsberg 1994) to assess depressive symptoms and the Quality of Life Inventory to assess quality of life (QOLI, Frisch, Cornell, Villanueva, & Retzlaff, 1992). The outcome measures used in the trial have been shown to have good psychometric properties when administered via the Internet (Hedman et al., 2010; Lindner et al., in press; Thorndike et al., 2009).

Bias assessment

We assessed the attention bias before the treatment, at mid- and at post-assessment. The attention bias assessment employed the same dot-probe tasks used in the training and presented stimuli for 500 ms. Probes appeared equally often in the locations of negative, neutral and positive stimuli.

Statistical analyses

All analyses on change in attention bias and change in primary and secondary outcome measures were conducted as intention-to-treat analyses using a mixed models approach. We applied autoregressive covariance structures for all analyses to account for the repeated measures design. All analyses were carried out in R Version 2.15 (R Development Core Team 2010), and mixed models were fitted with NLME (Jose, Douglas, Saikat, Deepayan, & R Development Core Team, 2012). In this approach, main and interaction effects are evaluated on the basis of their contribution to an increase of goodness of model fit (Field, Miles, & Field, 2012). The increase of fit is χ^2-distributed.

To analyse group differences in change of social anxiety from pre- to post-assessment, a social anxiety composite score was entered as dependent variable in the first mixed model analysis. The social anxiety composite score combined the three social anxiety measures. 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 (LSAS-SR, SIAS, SPS) across all the three assessment points (pre-, mid- and post-assessment) to *z*-scores, and then by averaging across the measures. Subsequent to the main analysis, planned contrasts compared differential change in the training conditions from pre- to mid-assessment, capturing the effect of the attention modification programme, and from mid- to post-assessment, reflecting the effect of the ICBT programme.

The attention bias assessment produced reaction times for every participant to the

Table 2. *Primary and secondary outcome measures at pre-, mid-, and post-assessment*

		Attention training group			Control group					
		Mean	SD	d_{within}	Mean	SD	d_{within}	$d_{between}$	Mixed models	
Social anxiety composite score	Pre	0.41	0.72		0.42	0.69			Time	$\chi^2(2) = 244.98.\ p < 0.001$
	Mid	0.25	0.87	0.21	0.19	0.80	0.31	−0.07	Group	$\chi^2(1) = 0.02.\ p = 0.96$
	Post	−0.69	0.84	1.41	−0.63	0.82	1.39	0.07	Time × group	$\chi^2(2) = 0.94.\ p = 0.63$
Attention bias score	Pre	−0.13	24.66		−2.33	22.04			Time	$\chi^2(2) = 1.70.\ p = 0.43$
	Mid	−2.45	23.80	0.10	0.27	16.01	−0.14	0.13	Group	$\chi^2(1) = 0.001.\ p = 0.98$
	Post	2.40	19.72	−0.11	1.69	24.30	−0.17	−0.03	Time × group	$\chi^2(2) = 0.87.\ p = 0.65$
Liebowitz social anxiety scale	Pre	73.80	16.91		73.74	18.23			Time	$\chi^2(2) = 211.80.\ p < 0.001$
	Mid	67.53	21.39	0.33	65.27	20.92	0.43	−0.11	Group	$\chi^2(1) < 0.001.\ p = 0.99$
	Post	45.63	20.54	1.50	48.05	21.36	1.29	0.12	Time × group	$\chi^2(2) = 2.26.\ p = 0.32$
Social phobia scale	Pre	39.38	11.96		39.03	11.96			Time	$\chi^2(2) = 212.61.\ p < 0.001$
	Mid	36.28	13.62	0.24	34.70	13.33	0.34	−0.12	Group	$\chi^2(1) = 0.15.\ p = 0.70$
	Post	22.53	12.64	1.37	23.05	12.74	1.29	0.04	Time × group	$\chi^2(2) = 1.35.\ p = 0.51$
Social interaction anxiety scale	Pre	50.05	15.38		50.78	13.61			Time	$\chi^2(2) = 205.93.\ p < 0.001$
	Mid	49.82	17.41	0.01	50.54	14.49	0.02	0.04	Group	$\chi^2(1) = 0.06.\ p = 0.81$
	Post	34.86	15.82	0.97	35.27	14.76	1.09	0.03	Time × group	$\chi^2(2) = 0.05.\ p = 0.98$
Montgomery Åsberg depression rating scale	Pre	13.56	5.51		14.68	6.78			Time	$\chi^2(2) = 51.77.\ p < 0.001$
	Mid	13.82	6.78	−0.04	12.16	7.07	0.36	−0.24	Group	$\chi^2(1) = 0.56.\ p = 0.45$
	Post	10.77	6.91	0.45	8.81	7.40	0.83	−0.27	Time × group	$\chi^2(2) = 8.46.\ p = 0.02$
Quality of life inventory	Pre	0.78	1.59		0.80	1.67			Time	$\chi^2(2) = 58.41.\ p < 0.001$
	Mid	0.77	1.48	−0.01	1.19	1.78	0.22	−0.26	Group	$\chi^2(1) = 0.78.\ p = 0.38$
	Post	1.40	1.53	0.40	1.79	1.69	0.59	−0.24	Time × group	$\chi^2(2) = 3.26.\ p = 0.20$

Table 3. *Significant clinical change at mid- and post-assessment*

		Control group		Attention training group	
		N	%	*N*	%
Mid-assessment	Deteriorated (RCI)	3	4.8	4	7.0
	No change (RCI)	41	65.1	39	68.4
	Improved (RCI)	19	30.20	14	24.6
	Not recovered (criteria c)	54	85.7	50	87.7
	Recovered (criteria c)	9	14.3	7	12.3
	Improved and recovered	6	9.5	4	7.0
Post-assessment	Deteriorated (RCI)	0	0.0	0	0.0
	No change (RCI)	19	30.6	16	28.1
	Improved (RCI)	43	69.4	41	71.9
	Not recovered (criteria c)	35	56.5	30	52.6
	Recovered (criteria c)	27	43.5	27	47.4
	Improved and recovered	25	40.3	24	42.1

more negative or the more positive cues in three types of trials (32 negative–positive trials, 32 negative–neutral trials, 32 neutral–positive trials). We calculated the mean reaction time for each participant for each type of trial, eliminating response latencies for inaccurate trials (2.2% of all trials), and response latencies less than 200 ms or greater than 2000 ms (1.2% of all trials). We calculated an attention bias score by subtracting mean reaction times to the relatively more negative cue from mean reaction times to the relatively more positive cue (MacLeod & Mathews 1988). A positive attention bias score reflects an attention bias towards threat and away from positive cues. Attention bias scores at pre-, mid- and post-assessment were entered as dependent variable in a mixed model. Subsequent to the main analysis, planned contrasts compared differential change in the training conditions from pre- to mid-assessment and from mid- to post-assessment.

In order to detect differences between participants with an initial attention bias towards threat (pre-bias score >0, $N = 55$) and those with an initial attention bias away from threat (pre-bias score <0, $N = 78$), we entered the initial bias as additional independent factor into two mixed models with the social anxiety composite score and the attention bias score as dependent variables.

Clinically significant change at mid- and post-assessment was determined for the completer sample and based on the LSAS-SR as this scale encompasses both fear and avoidance of performance and interaction situations. In a first step, reliable change according to the Reliable Change Index (Jacobson & Truax 1991) was determined based on psychometric properties reported by Hedman et al. ($SD_1 = 22.48$, $\alpha = 0.94$; 2010). As suggested by Lambert and Ogles (2009), we used internal consistencies rather than re-test-reliabilities to calculate the reliable change index. In a second step, a cut-off score was calculated for the formula 'c' reported by Jacobson and Truax (1991) and based on normative data by Fresco et al. (2001). Based on these assumptions, clinically significant improvement for a given participant was defined as showing a pre- to mid- or a pre- to post-change score of 15.26 or greater and a mid- or post-test score below 43.3 on LSAS-SR.

Results

Participants adhered well to the treatment protocols. They completed, on average, 13.64 (SD = 1.91) out of the 14 attention training/control training exercises during weeks 1 and 2. From week 3 to 11, participants completed on average 6.50 (SD = 2.63) of the nine ICBT modules. Groups did not differ in their adherence (all $t < 1.73$, all $p > .09$). At post-assessment, participants were asked how satisfied they were with the combined treatment on a 4-point Likert scale (1 = very dissatisfied, 4 = very satisfied). On average,

participants were satisfied with the treatment (mean = 3.13, SD = 0.70) with no differences in satisfaction between the groups ($t(117) = 0.44$, $p = 0.66$).

Change in social anxiety

Table 2 displays means, standard deviations as well as within- and between-group effect sizes for all social anxiety measures in the two groups. It also presents the results of the mixed model analyses.

Response to combined treatment: The mixed model analysis using the social anxiety composite score as dependent variable revealed that participants in both groups improved significantly from pre- to post-assessment (time: $\chi^2(2) = 244.98$, $p < 0.001$). Groups did not differ significantly in their level of social anxiety across all three assessment points (group: $\chi^2(1) = 0.002$, $p = 0.96$) nor in the rate of improvement of social fears (group × time: $\chi^2(2) = 0.94$, $p = 0.63$). Within-group effect sizes showed large improvements from pre- to post-assessment ($d = 1.39–1.41$).

Response to ABM: Planned comparisons revealed that there was no differential change of social anxiety in the two groups from pre- to mid-assessment ($t(235) = -0.64$, $p = 0.53$, $d = 0.08$). Participants of both groups showed similar improvements of social anxiety through the attention/control training procedure.

Response to ICBT: Planned comparisons also showed that change in social anxiety from mid- to post-assessment did not differ between the two groups ($t(235) = -0.94$, $p = 0.35$, $d = 0.12$). Participants of the attention training group showed similar change rates through ICBT than participants of the control group.

Initial bias score: The pre-treatment attention bias score did not predict or moderate change in social anxiety. Interaction effects of time × initial bias ($\chi^2(2) = 1.87$, $p = 0.39$) as well as of treatment condition × time × initial bias ($\chi^2(3) = 3.50$, $p = 0.32$) were not significant. Participants with an attention bias towards threat showed similar change rates of social anxiety than did participants with an attention bias away from threat, independent of their group affiliation.

Change in attention bias

Table 2 displays means, standard deviations and effect sizes for the attention bias scores.

Response to combined treatment: The mixed model analysis using the attention bias score as dependent variable revealed no change in attention bias from pre- to post-assessment across the two groups (time: $\chi^2(2) = 1.70$, $p = 0.43$). The attention training group and the control group did not differ in their overall level of attention bias (group: $\chi^2(1) = 0.001$, $p = 0.98$) nor did they differ in their change of attention bias (group × time: $\chi^2(2) = 0.87$, $p = 0.65$).

Response to ABM: Planned comparisons revealed that the two groups did not respond differently to the attention training or control training. Changes in attention bias from pre- to mid-assessment were similar between the two groups ($t(218) = 0.91$, $p = 0.37$, $d = 0.12$).

Response to ICBT: Attention bias did not change differently in the two groups through ICBT. Planned comparisons showed similar change rates from mid- to post-assessment ($t(218) = 0.60$, $p = 0.55$, $d = 0.08$).

Initial bias score: The pre-treatment bias score qualified as a significant predictor of change in attention bias (time × initial bias: $\chi^2(2) = 70.02$, $p < 0.001$). Planned contrasts revealed that this difference in attention bias change was based on different change rates from pre- to mid-assessment ($t(216) = 2.60$, $p < 0.001$, $d = 0.35$). Participants who showed an initial bias towards threat reduced their attention bias score, whereas participants who showed initial attentional avoidance increased their attention bias score from week 0 to 2 (Away: $M(SD)_{\text{pre}} = -16.64(12.5)$, $M(SD)_{mid} = -1.68(17.4)$, Towards: $M(SD)_{\text{pre}} = 19.91(17.2)$, $M(SD)_{mid} = -0.15(23.4)$). Pre-treatment attention bias scores did not affect attention bias change differently in the treatment conditions. The interaction effect of time × treatment condition × initial bias was not significant ($\chi^2(3) = 2.80$, $p = 0.42$).

Change on secondary outcomes

Depression: Change in depression scores was analysed in a mixed model approach entering group affiliation as fixed factor and the MADRS-S score as dependent variable. Means, standard deviations and effect sizes are summarised in Table 2. Results showed a

significant main effect of time ($\chi^2(2) = 51.77$, $p < 0.001$), which was qualified by a significant interaction effect of time × group ($\chi^2(2) = 8.46$, $p = 0.02$). Participants in the control group showed a larger decrease of depressive symptoms from pre- to post-assessment compared with participants in the attention training group. Planned comparisons revealed that this difference in change rates was based on the differential response from pre- to mid-assessment ($t(235) = -2.32$, $p = 0.02$, $d = 0.30$). Between-group effect sizes were small at mid-assessment ($d = 0.24$) and at post-assessment ($d = 0.27$).

Quality of life: Potential improvements in the participants' quality of life were examined in a mixed model using the quality of life score as dependent variable and group affiliation as fixed factor. Results indicated that participants of both groups improved their quality of life from pre- to post-assessment (main effect of time: $\chi^2(2) = 57.41$, $p < 0.001$). There was no significant interaction effect of time × group ($\chi^2(2) = 3.26$, $p = 0.20$).

Clinical change

Table 3 shows the rates of improvement and recovery for the completer sample. At mid-assessment, four (7%) participants in the attention training group and six (10%) participants in the control group were classified as improved and recovered according to the criteria suggested by Jacobson and Truax (1991, see Statistical Analyses). At post-assessment, 24 (42%) participants in the attention training group and 25 (40%) participants in the control group showed significant clinical change. There were no significant group differences at mid-assessment ($\chi^2(1) = 0.25$, $p = 0.75$) or at post-assessment ($\chi^2(1) = 0.04$, $p = 0.85$).

Discussion

The current trial aimed at evaluating the efficacy of a sequential combined treatment approach of attention training and guided ICBT. The combination of attention training aiming at reducing attentional avoidance and ICBT was compared with the combination of control training and ICBT. We hypothesised that participants of the attention training group would show larger reductions in attentional avoidance and in social anxiety compared with participants of the control group. Results indicated that the addition of the attention training did not yield more change in social anxiety or attentional selectivity than did the addition of a control training. As this study applied an attention training procedure aiming at the reduction of attentional avoidance, the comparability with previous attention bias modification (ABM) trials that mostly applied procedures aiming at the reduction of hypervigilance is limited. One previous trial applied the same attention training as this study (Boettcher et al., in press). In contrast to this study, it showed significant effects for this form of attention training and thus inspired the inclusion of the attentional avoidance training in the current trial. Apart from adding 60 more faces (Samuelsson, Jarnvik, Henningsson, Andersson, & Carlbring, 2012) in the stimulus set in order to maximise the generalisability, no salient differences in procedures, adherence or patient characteristics can explain the differences in findings between the effects of the attention training in this former trial and in this study. Moreover, there were no substantial differences in pre-training attention bias scores. In the current trial, 58% of all participants showed attentional avoidance prior to the training, whereas 46% of the participants in the previous trial displayed attentional avoidance. This indicates that participants of this study did not less frequently show attentional avoidance than participants of previous trials. Indeed, the proportion of participants showing attentional avoidance was comparable to former studies reporting rates of 40–60% (Price et al., 2011; Waters et al., 2012). Thus, participants of this study were not in any way unsuited to complete a training procedure targeting attentional avoidance.

The most salient difference between the current and the previous trial on Internet-based attentional avoidance training was that the former trial delivered the attention training as stand-alone treatment. Higher outcome expectations in regard to a stand-alone intervention compared with expectations to one of several treatment elements could explain the differences in effect sizes. In the current trial, participants of both groups showed only small social anxiety improvements during the dot-probe procedure from week 0 to 2. At the same time, differences in expectations towards stand-alone versus combined interventions

cannot explain why there were no significant differences between the active and the control group in the current trial. In fact, the only significant difference between the two treatment conditions in this study was found in depressive symptoms. In the first two weeks of the treatment, participants in the control group showed a decrease of depressive symptoms, whereas participants of the attention training group did not. This lack of change in the attention training group might be explained by the prolonged attentional exposure to negative stimuli in this condition, and the effect of this might have had on biases in information processing associated with depressive symptoms. Depression was found to be associated with a difficulty to disengage attention from negatively valenced stimuli as well as with attentional avoidance of positive stimuli (Bradley et al., 1997; Gotlib, Yue, & Joormann, 2005; Hallion & Ruscio 2011). As two-thirds of the trials in the attention training condition induced not only a heightened focus on negative cues but also a reduced focus on positive cues (the positive–negative and the positive–neutral trials), this could have led to a reinforcement of biased attention processes and to the maintenance of depressive symptoms in the first 2 weeks of the intervention. However, as the attention training applied in this study did not lead to any significant changes in attention processes in either direction, the difference in depression scores could also be attributed to the effect the prolonged attentional exposure to negative stimuli had on participants' mood.

The failure to significantly modify attention processes somewhat compromises conclusions regarding the efficacy of combined psychological treatment approaches for SAD. Clearly, the applied attention training was ineffective and did not change attentional avoidance. At the same time, the applied ICBT programme was effective in reducing social anxiety symptoms but still did not lead to changes in attention bias. This contrasts the previous findings where CBT was associated with a decrease of attentional avoidance (Legerstee et al., 2010; Waters et al., 2012). Also in contrast to previous trials on face-to-face CBT, pre-treatment attentional avoidance did not predict poorer response to the CBT intervention (Price et al., 2011; Waters et al., 2012). In this study, initial attention bias did not predict change in social anxiety. It did, however, predict change in attention bias. Still, as the attention subgroups were defined on the basis of their pre-score, the opposite change in subsequent scores is best interpreted as regression to the mean (Nielsen, Karpatschof, & Kreiner, 2007).

Limitations and future research

This study has a number of limitations. First of all, the lack of an 'ICBT only' control group constricts the informative value on the benefit of adding *any* dot-probe procedure to the ICBT protocol. Pre–post effect sizes of the current trial were higher than those reported in previous trials examining the same ICBT programme. When applying the identical formula of Cohen's d for the same measure (LSAS-SR), pre–post within effect sizes in five previous trials average $d = 1.04$ (range 0.98–1.14) (Andersson et al., 2006; Andersson, Carlbring, & Furmark, 2012; Carlbring et al., 2007; Furmark et al., 2009; Tillfors et al., 2008). In the current trial, the mean pre-post within effect size for the LSAS-SR was $d = 1.39$ across both treatment conditions. Even though results on attention processes clearly show that the ABM procedure did not activate the assumed mechanism of work, the elevated effect sizes for the combined treatment approach point in the direction that there was some additional benefit. In contrast to previous ICBT studies, the current treatment protocol included 11 instead of 9 weeks/modules. Dose–response research in psychotherapy has shown that more psychotherapy sessions lead to more change in symptoms (Harnett, O'Donovan, & Lambert, 2010; Lambert 2007). Internet-based treatment protocols have so far always been time-limited, asking participants to complete self-help guides in 8–15 weeks. Future research should evaluate longer treatment protocols and investigate whether more exposure to treatment leads to greater proportions of improved and recovered participants.

A second limitation of this study presents the unknown reliability of the Internet-based attention bias assessment. In direct face-to-face delivery, the reliability of the applied attention bias assessment has been found to be poor in several trials (Dear, Sharpe, Nicholas, & Refshauge, 2011; Schmukle 2005; Staugaard

2009). The unknown reliability of the attention bias assessment when delivered via the Internet is problematic as it compromises the interpretation of the non-existing changes in attention processes in this study. It could be argued that the failure to change attentional avoidance through attention training and through ICBT merely reflects a failure to reliably assess these changes. Future studies should therefore examine the reliability of the dot-probe task when delivered via the Internet and compare it to other attention assessment paradigms.

A third limitation of the present design constitutes the sample size. It was calculated to detect moderate differences between the attention training and the control group (see study protocol: Boettcher et al., 2013). If differences between the two groups were only small, these would not necessarily be detected in the current design. At the same time, the clinical importance of small differences is limited. Thus, one can conclude that this study does not support the beneficial impact of adding attentional avoidance training to ICBT. Still, future studies should continue to examine this combination but deliver attention training tasks instead in the laboratory to ensure the effective modification and assessment of attention processes. Furthermore, future research should investigate the incorporation of training programmes for other biases in information processing in SAD. First promising results on the efficacy of interpretation modification programmes encourage their combination with cognitive-behavioural interventions (Lang, Blackwell, Harmer, Davison, & Holmes, 2012; Mathews, Ridgeway, Cook, & Yiend, 2007). The systematic training of benign interpretations promises to complement and enhance the effects of CBT interventions. The unbiased allocation of attention to positive, neutral and social threat information still holds the same potential even though this study could not empirically support the benefit of adding attentional avoidance training to CBT.

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