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ORIGINAL ARTICLE

Implicit and Explicit Attitudes Toward Spiders: Sensitivity to Treatment and Predictive Value for Generalization of Treatment Effects

Jorg Huijding · Peter J. de Jong

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Abstract This study tested whether high spider fearful individuals' implicit and explicit attitudes toward spiders are sensitive to exposure treatment, and whether post-treatment implicit and/or explicit attitudes are related to the generalization of treatment effects. Self-reported explicit and implicit attitudes (indexed with a pictorial Extrinsic Affective Simon Task) were assessed in high spider fearful, treatment-seeking individuals ($n = 60$) before and after a one-session exposure in vivo treatment and at 2-month follow-up. A group of non-fearful participants ($n = 30$) completed the same assessments once. Results show that implicit attitudes did not change following treatment over and above test–retest effects. In contrast, explicit attitudes did change favorably following treatment, but negative explicit attitudes at post-treatment were associated with less pronounced overt approach behavior at follow-up. These findings support the idea that residual negative explicit attitudes interfere with the generalization of treatment effects.

Keywords Implicit attitudes · Spider-fear · Phobia · Treatment · Exposure in vivo

J. Huijding (✉) · P. J. de Jong
Department of Clinical and Developmental Psychology, University of Groningen, Grote Kruisstraat 2/1, 9712 TS Groningen, The Netherlands
e-mail: huijding@fsw.eur.nl

Present Address:
J. Huijding
Department of Clinical Psychology, Erasmus University Rotterdam, 1738, 3000 DR Rotterdam, The Netherlands

Introduction

Contemporary classical conditioning models of phobias (e.g., Davey 1997) conceptualize phobic stimuli (CSs) as a predictor of catastrophic events (USs). From this perspective, exposure can be seen as an intensive attempt to break this (dysfunctional) predictive CS–US relationship via extinction. Although exposure is generally a very successful strategy for treating phobias (e.g., Öst 1997), it is a common finding that in a subgroup of individuals, fear may return over time (e.g., Mineka et al. 1999).

One explanation for this phenomenon may be that even though exposure treatment leads to a significant extinction of *predictive* CS–US relationships, the CS remains associated with a negative valence (e.g., Hermans et al. 2002). This suggestion is in line with the clinical observation that even after avoidance behavior has been drastically reduced, spider fearful individuals continue to describe spiders as nasty little animals (Baeyens et al. 1989). In addition, there is considerable evidence that evaluative associations are generally resistant to extinction (see De Houwer et al. 2001 for an overview). Furthermore, two recent laboratory studies provided convincing support for the involvement of negative affective associations in the return of fear (Dirikx et al. 2004; Hermans et al. 2005). Both studies found that participants' evaluative ratings of a negatively conditioned CS^+ immediately after an extensive extinction phase were significantly related to participants' self-reported return of fear of the CS^+ after the reinstatement phase. Following these lab studies, an important next step would be to explore whether evaluative associations are also resistant to change in a clinical context, and whether residual negative associations affect the generalization of treatment effects.

It is important to note here that, evaluative associations, also referred to as 'attitudes', are conceptually distinct from 'beliefs'. Whereas attitudes refer to simple associations between a concept and an evaluative category (e.g., Fazio et al. 1982), beliefs refer to (complex) structures of propositionally qualified associations between multiple concepts (cf. De Houwer 2002). Previous studies that have explored treatment effects on general measures of spider fear or dysfunctional beliefs (e.g., Arntz et al. 1993; Mineka et al. 1999), did not specifically test the specific role of attitudes in treatment effects.

To the best of our knowledge, a study by de Jong et al. (2000) is the only one that focused specifically on self-reported attitudes (SA) toward phobic stimuli. This earlier study showed that a regular one-session exposure in vivo treatment along the lines of Öst (1989) favorably influences spider phobics' attitude toward spiders. Unfortunately, this study did not test the critical issue whether post-treatment valence ratings were predictive of the extent to which treatment effects generalized over time. In addition, attitudes were only assessed using direct measures (i.e., self-reports). This is an important limitation because recent information processing models differentiate between automatically activated (i.e., implicit) and more deliberate (i.e., explicit) attitudes, and assume that they have different functional properties (Fazio and Towles-Schwen 1999; Wilson et al. 2000; Strack and Deutsch 2004; Gawronski and Bodenhausen 2006). Whereas explicit attitudes refer to propositions that have a 'truth' value attached to it, implicit attitudes reflect simple associations in memory (e.g., Strack and Deutsch 2004). Reviewing the available evidence Gawronski et al. (2007) recently argued that, 'the major difference between indirect measures and self-reports is that indirect measures provide a proxy for the activation of associations in memory, whereas self-reports reflect the outcome of validation processes.' (p. 187). Translated to the present context this means that although an individual may consider the proposition 'spiders are negative' to be inaccurate, associations between spiders and negative attributes may nevertheless be activated in memory and influence behavior. Importantly, with respect to *changing* attitudes Gawronski et al. (2007) argued that '[...] inconsistency-related rejections of propositions typically affect only judgments assessed with self-report measures but not the activation of associations assessed with indirect measures.' (p. 187). In line with this, implicit attitudes have been found to be resistant to extinction (Hermans et al. 2002; Diaz et al. 2005). Following this, it would be very important to complement self-report measures of explicit attitudes with indirect measures of implicit attitudes when assessing attitude changes over the course of treatment (cf. Hermans et al. 2002).

Germane to this issue, Teachman and Woody (2003) assessed implicit associations toward spiders with respect to a range of attribute dimensions (good–bad, afraid–unafraid, disgusting–appealing, danger–safety) before and after exposure treatment, using the Implicit Association Test (IAT: Greenwald et al. 1998). They found that only the disgusting–appealing and the afraid–unafraid IATs showed a significant pre- to post-treatment change in the expected direction. The good–bad IAT showed a marginally significant change in the expected direction, but this change was similar in the phobic and the non-phobic control group.

Although this study thus seems to indicate that exposure treatment can change implicit attitudes, there are at least two reasons why it would be important to further explore the malleability of implicit attitudes. Firstly, inherent to its design, the IAT can only provide estimates of associations with a target concept *relative* to a contrast concept. This poses an important limitation for research focusing on concepts that have no natural contrast, like is the case for spiders. Teachman and Woody (2003) partly tackled this problem by using snakes as the contrast category because snakes and spiders share a comparably negative societal connotation. Nevertheless, there may be strong individual differences in the extent to which participants associate snakes with, for instance, 'bad'. Therefore, this category still provides no unequivocal anchor against which to interpret the IAT-effects. That is, IAT effects of a similar size may be due to a very strong or a rather weak spider-bad association, depending on the strength of the snake-bad association. To more unequivocally assess the strength of implicit attitudes toward spiders, the use of a non-relative measure would be required. Secondly, and perhaps even more importantly, the earlier study of Teachman and Woody (2003) did not include a no-treatment phobic control group. Therefore, it was not possible to determine whether any differences should be attributed to test–retest (e.g., learning) effects, or to actual changes in individuals' implicit attitudes as a result of treatment.

The present study was designed to explore further the influence of exposure in vivo treatment on phobic individuals' implicit and explicit attitudes toward their phobic stimulus, and test whether residual negative implicit and/or explicit attitudes affect the generalization of treatment effects in terms of reduced phobic avoidance behavior. Following previous studies (de Jong et al. 2000; Teachman and Woody 2003) the present study tested these issues in spider-phobic individuals. To assess implicit attitudes, we used a pictorial Extrinsic Affective Simon Task (EAST: Huijding and de Jong 2005a), that was based on the verbal EAST that was originally designed by De Houwer (2003). Like the IAT, the EAST is a reaction time (RT) sorting task that allows for the inference of implicit attitudes toward a target concept on the basis of task performance (see Sect. 'Methods' for details). The important advantage of the EAST over the IAT in the present context is that the EAST is a *non-relative* measure of automatic affective associations that does not require a contrast category. This allows for a more straightforward assessment of implicit attitudes toward spiders. Note that, although a recent series of studies by De Houwer and De Bruycker (2007) suggests that the IAT may perform better than the EAST, the EAST versions that were used in those studies differed from the presently used pictorial EAST with respect to several procedural implementations, which are likely to have limited both the reliability and validity of those EAST versions (cf. De Houwer and De Bruycker 2007). As yet, there are no published studies that make a direct comparison between the IAT and an EAST that is procedurally similar to the one used in the present study. Importantly, however, previous work in analogue groups showed that pictorial EAST-scores based on the accuracy of performance (i.e., error rates) are sensitive to normatively valenced stimuli (Huijding and de Jong 2005b), differentiate between high- and low-fearful individuals with respect to their implicit attitude toward spider pictures, and have independent predictive validity for avoidance behavior next to self-report measures (Huijding and de Jong 2005a). In addition, it has been shown that pictorial EAST effects are independent of age and educational level, indicating that the EAST can be successfully employed in community samples such as tested in the present study (Huijding and de Jong 2005b). Taken together, the accuracy of performance of the pictorial EAST thus seems to be a suited non-relative measure of automatic affective associations in the present context.

To test the malleability of implicit and explicit attitudes and their relation to the generalization of treatment effects, a group of high spider fearful participants were assessed before and after a one-session exposure in vivo treatment and at 2-month follow-up. To control for test–retest effects on the EAST, half of the high-fearful participants completed the EAST twice before treatment. No self-report measures were included at retest because, due to people's tendency to answer consistently, it seems unlikely that retest effects would emerge even if they exist. In addition, several studies have shown that self-reports of spider fear and the Behavioral Approach Test (BAT) remain stable over a waiting period (e.g., Thorpe and Salkovskis 1997; Dewis et al. 2001). Therefore, together with pragmatic considerations concerning time and participant burden, only the EAST was included at retest.

Methods

Participants

Participants were 60 high-fearful (82% female) and 30 non-fearful (86% female) individuals that were matched in terms of age, educational level, and sex (see Table 2 for details). As part of a larger ongoing project on spider fear, all participants were recruited through advertisements in regional media. The high-fearful, treatment-seeking individuals responded to advertisements indicating that our department offers free treatment against spider phobia for individuals who are willing to participate in scientific research. The mean score on the Spider Phobia Questionnaire (SPQ: Klorman et al. 1974; Muris and Merckelbach 1996) for the high-fearful participants was 20.6 (SD = 4.5, range = 10–28), which is comparable to that of other exposure treatment studies (e.g., Teachman and Woody 2003, $M = 19.7$).

Measures

Extrinsic Affective Simon Task

Participants' implicit attitudes toward spiders were assessed using a pictorial version of the EAST (Huijding and de Jong 2005a, b). The EAST is a RT-based sorting task in which participants have to sort target and attribute stimuli using a left and a right response key. The task is designed to infer the valence of target stimuli on the basis of participants' task performance. During the present EAST participants were asked to sort *target* and *attribute* pictures as fast as possible using a left and a right response key on an unmarked response box. Attribute pictures were square pictures with a yellow border. Target pictures (e.g., spiders), included no yellow border and were presented half of the time in portrait and half of the time in landscape format. The task consisted of three phases (see Table 1). In the first phase, participants were instructed to sort the attribute stimuli on the basis of their valence. The aim of this phase is to consequently pair each key with either positive or negative pictures eventually resulting in a positive and a negative response key. During the second phase, participants were instructed to sort the target pictures on the basis of their format. This is a practice phase. Then, during the third and critical test phase, participants were instructed to simultaneously (i.e., intermixedly) sort the attribute pictures on the basis of their valence, and the target pictures on the basis of their format. The idea behind this phase is that, although the target stimuli should be sorted on the basis of their format, participants will find it easier to sort these pictures when their valence is congruent with the valence associated with the response key. Note that, because the attribute stimuli are simultaneously sorted, the extrinsic valence of the response keys is continually being reinforced. Because each target picture is equally often presented in portrait and landscape format, the correct response to a particular target is equally often pressing the 'positive' or the 'negative' key. By comparing whether

Table 1 Design of the pictorial EAST

Phase	#, type of Trials	Left hand	Right hand
1	30 attribute	positive	negative
2	18 target	portrait	landscape
3	**90 attribute / 180 target**	**positive / portrait**	**negative / landscape**

Note: The assignment of attribute valence (positive, negative) and target format (portrait, landscape) to the left or the right response key was counterbalanced over participants. The critical test phase is presented in bold face

participants find it easier (i.e., are faster or make fewer errors) to sort a target picture by pressing the 'positive' or the 'negative' response key, the implicit attitude toward the stimulus may be inferred.

Extrinsic Affective Simon Task-scores can be calculated on the basis of response accuracy or response latencies. With respect to the presently used version of the EAST, previous research has shown that meaningful effects are only, or most strongly expressed in the accuracy (ER) data (Huijding and de Jong 2005a). In general it is not unusual for studies using Simon-paradigms to find the expected effects only, or most strongly, in the ER data (e.g., De Houwer 2003; De Houwer and Eelen 1998; Huijding and de Jong 2005b). One explanation for the dissociation between ER and RT data in the present version of the EAST is that the task instructions and the use of a response window (see below) focus participants more on maximizing speed than on accuracy. This, in combination with the fact that the target and attribute stimuli are rather similar, is likely to cause effects to be expressed in terms of response accuracy rather than latency. For this reason we will focus on the accuracy-based EAST-scores.

The present EAST used five positive and five negative yellow-bordered attribute pictures, selected from the International Affective Picture System (IAPS: Lang et al. 1996) on the basis of their valence (see Appendix). There were three categories of target pictures: spiders, maggots, and weapons, each consisting of three exemplars (see Appendix). The primary focus of this study was on implicit and explicit attitudes toward spiders. The weapons and maggots pictures were included for pilot purposes and are not included in any of the analyses. To prevent participants from focusing on one point of the screen while discriminating between portrait and landscape pictures (limiting the processing of the picture content), oblong pictures were presented in five different sizes (cf. Huijding and de Jong 2005b). During phase 1, each square yellow-bordered picture was presented three times (30 trials). In phase 2, each oblong picture was presented once in 'portrait' and once in 'landscape' format (18 trials). During the third phase each square picture was presented nine times (90 trials) and each oblong picture was presented ten times in 'portrait' and ten times in 'landscape' format, with each size appearing equally often in the portrait and landscape exemplars of each category (180 trials). Following a correct response, stimuli were immediately replaced by a fixation dot in the middle of the screen, which was replaced by the next stimulus after 500 ms. Following an incorrect response the Dutch word 'FOUT' [false] appeared briefly above the stimulus. Meanwhile, the stimulus remained on the screen until the correct response was given. To further stimulate individuals to work as fast as possible a 2,500-ms response window was used.

Self-report Measures

As a measure of SA, participants completed two visual analogue scales (VAS), similar to the evaluative rating scales used in conceptually similar laboratory research (e.g., Hermans et al. 2002; Dirikx et al. 2004). Each VAS consisted of a 10-cm line with the label *not at all* at the start and *very well* at the end. On the first VAS participants were instructed to mark the position that best reflected how well they considered spiders to fit with the attribute category 'positive'. On the second VAS they did the same for the attribute category 'negative' (cf. de Jong et al. 2000).

Self-reported fear of spiders was assessed with the SPQ (Klorman et al. 1974; Muris and Merckelbach 1996). The SPQ is a 31-item true/false endorsement measure (range = 0–31) that describes a range of situations involving interactions with spiders, such as, 'I avoid going into the cellar if there may be spiders about'.

Behavioral Approach Test

The BAT measures how closely participants approach a medium-sized house spider. During the BAT, participants are asked to perform eight steps that range from looking at the spider in a closed jar to guiding the spider over the hand. Each completed step adds one point (range = 0–8).

Procedure

The data presented here are part of a larger study on (implicit) evaluations in spider phobia. Due to space limitations only the measures relevant to the present research questions are addressed here. Note, however, that we also collected data on implicit spider-harm associations and spider-contamination-related associations using two IATs.[1]

[1] As mentioned in the introduction we preferred to use the EAST rather than the IAT for the assessment of implicit attitudes toward spiders because spiders have no meaningful contrast that can be used in a valence-IAT. For the assessment of more specific implicit harm and contamination-related associations, however, we preferred the IAT because the use of prototypically disgust c.q. harm-related contrast

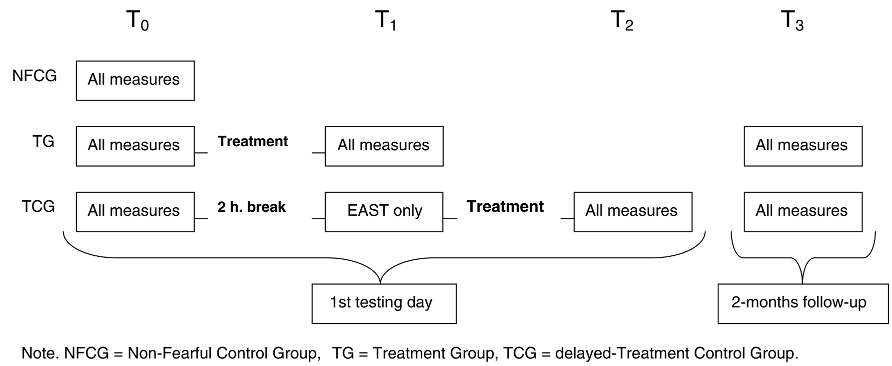

Fig. 1 Schematic overview of the design of the study

These data are described in a separate paper. The design of the present study is shown schematically in Fig. 1. The high-fearful participants were randomly assigned to the treatment group (TG) or the delayed-treatment control group (TCG). However, seven participants were included directly in the TG because the traveling time to and from the lab was too long to be included in the TCG. After a short introduction all participants first completed the EAST, followed by two additional computer tasks (IATs). Following this, participants completed a series of questionnaire measures including the SPQ and the SA. Finally participants completed the BAT. After the first assessment, participants in the TG got a small break and then received the treatment (see below). Participants in the TCG got a 2-h break and then completed the computer tasks, including the EAST, again before also receiving treatment. The treatment was administered by a therapist in a separate room and took about 2.5 h. After the treatment all participants got a short break, returned to the assessment room, and completed the post-treatment assessments. These were identical to the first assessments. At the 2-month follow-up participants again completed the same set of assessments. During all assessments the order of tasks was the same, and participants received the same task version at each assessment. Participants in the non-fearful control group completed all measures once, following the same procedure as the first assessment for the high-fearful participants.

Treatment

The exposure treatment was given by five students (all women) who had almost finished their Clinical Psychology Master at the University of Groningen, and had successfully passed an elementary training in behavior therapy. They received an additional training concerning the presently used treatment protocol (de Jong and Keijsers 1999). The treatment consisted of a one-session (2.5 h) exposure in vivo treatment along the lines of Öst (1989). After assessing the main dimensions of the patients' fear, and an explanation on how avoidance and escape behavior can maintain the phobic complaints, the therapist explained the rationale for the exposure treatment. It was stressed that the treatment requires a very active role of the patient whereas the therapist would predominantly act as coach, and that nothing would happen against the patient's will. Participants then engaged in exposure exercises of increasing difficulty (from looking at a spider in a jar to prolonged physical contact with several spiders) that were accommodated to each patient's specific fears. Participants were encouraged to design behavioral experiments to get information on questions that arose during the session. The therapist modeled exercises or experiments as it seemed indicated. The authors supervised the therapists throughout the study.

Results

Data Reduction

Following previous research (De Houwer 2003; Huijding and de Jong 2005a), all RTs below 300 ms were recoded to 300 ms and log-transformed (note that the 2,500 ms window effectively eliminated slow responses). Next, we calculated EAST-scores[2] for the error (ER) data of trials

Footnote 1 continued
categories (i.e., weapons and maggots) may facilitate the interpretation of results concerning these specific implicit associations (for a more comprehensive description of the rationale see Huijding and de Jong 2007)

[2] We did run all analyses also with the reaction time-based (RT) EAST-scores. As expected, these analyses showed that the RT-EAST-scores were not sensitive to individual differences in spider fear: At pre-treatment none of the groups differed significantly from each other with respect to their RT EAST-scores [for all $ts(77) < 1.4$, *ns*]. In addition, the RT EAST-scores showed no meaningful relations with any of these measures. With respect to changes over treatment, analysis of the RT EAST-scores showed a significant main effect of Assessment [$F(1, 50) = 5.2$, $p < 0.05$, partial $\eta^2 = 0.09$], that was independent of Group, indicating that, independent of whether participants had received treatment or not, the RT EAST-scores were decreased at the second assessment (test–retest effect). Finally, RT EAST-scores were no significant predictor of participants' post-treatment to follow-up change in BAT performance next to the post-treatment SA and ER EAST-scores ($\beta = -1.14$, $t < 1$).

presenting a spider picture, by subtracting the mean ER on trials where pressing the negative key was required, from trials where pressing the positive key was required. Thus, negative EAST-scores indicate relatively negative implicit attitudes toward spiders (i.e., relatively accurate responses with the negative key), whereas positive EAST-scores indicate relatively positive implicit attitudes toward spiders (i.e., relatively accurate responses with the positive key). The EAST data of one participant in the TG are missing due to an error logging the data. Extreme scores, defined as values more than three standard deviations from the group mean, were excluded from the analyses. In addition, participants who made more than 30% errors on target trials (i.e., pictures in portrait or landscape format) during the test phase of an EAST were excluded from the corresponding analyses. This led to the exclusion of nine individuals at pre-treatment (four from the TG, three from the TCG, and two controls), and two individuals at post-treatment (one from the TG and one from the TCG). Mean number of errors for the rest of the participants were 11.4% (SD = 6.3), 8.1% (SD = 5.5), and 8.9% (SD = 5.5) for the pre, post, and follow-up assessments, respectively. Summary statistics for the direct and indirect measures are shown in Table 2.

Pre-treatment

To assess pre-treatment differences between groups, all measures were subjected to separate one-way ANOVA's with group as the between subject variable, and two a-priori contrasts, the first comparing the high- and low-fearful individuals, and the second comparing both high-fearful groups (i.e., the group that received treatment immediately following the assessment versus the TGC).

Self-report and Behavioral Measures

The high- and low-fearful participants differed significantly in the expected direction in terms of their SPQ-scores [$t(87) = 20.8$, $p < 0.01$, $d = 4.75$], SA positive [$t(87) = -6{,}9$, $p < 0.01$, $d = 1.58$], SA negative [$t(87) = -12.8$, $p < 0.01$, $d = 2.85$], and the number of steps completed during the BAT [$t(87) = -9.3$, $p < 0.01$, $d = 2.33$]. The high-fear groups differed on none of the measures [for all $ts(87) < 1.6$, *ns*].

Extrinsic Affective Simon Task

The analysis of the ER EAST-scores showed that the high-fearful participants had significantly lower EAST-scores than the low-fearful participants [$t(77) = -2.7$, $p < 0.01$, $d = 0.64$], while no difference emerged between both fearful groups [$t(77) < 1$].

Convergent Validity

As can be seen in Table 3, lower ER EAST-scores (i.e., more negative implicit attitudes toward spiders) were moderately but significantly related to higher self-reported fear of spiders (SPQ $r = -0.34$, $p < 0.01$), more negative and less positive SA toward spiders (SA negative $r = -0.28$, $p < 0.05$; SA positive $r = 0.27$, $p < 0.05$), and fewer steps on the BAT ($r = 0.38$, $p < 0.01$).

Table 2 Means and standard deviations for the indirect, self-report, and behavioral measures as a function of group

Measures	Pretest			Retest	Posttest		Follow-up	
	NFCG (T_0)	TCG (T_0)	TG (T_0)	TCG (T_1)	TCG (T_2)	TG (T_1)	TCG (T_3)	TG (T_2)
Age	35.2 (13.1)	32.9 (10.2)	35.0 (12.0)					
Education	4.1 (1.2)	3.9 (1.2)	4.0 (1.5)					
Fear								
SPQ	2.4 (3.6)	21.4 (4.5)	20.2 (3.8)	–	14.4 (5.8)	13.6 (6.7)	14.8 (7.2)	13.5 (7.2)
BAT	7.7 (0.9)	3.7 (2.1)	4.0 (2.2)	–	6.9 (1.9)	6.9 (1.8)	6.3 (2.1)	6.4 (1.9)
Valence								
SA-pos	5.5 (2.3)	1.6 (2.5)	1.7 (2.7)	–	4.1 (2.6)	3.6 (2.8)	3.5 (2.4)	3.3 (2.8)
SA-neg	2.6 (2.1)	8.1 (2.3)	8.8 (1.7)	–	4.7 (2.6)	4.5 (3.5)	5.5 (3.0)	6.2 (2.5)
EAST	4.9 (11.5)	−1.7 (11.0)	−3.7 (13.1)	−2.4 (11.4)	0.6 (6.7)	−0.5 (11.7)	2.4 (9.5)	7.1 (17.3)

Note: NFCG = non-fearful control group; TCG = delayed-treatment control group; TG = treatment group; Education could range from 0 (no education completed), to 6 (a masters degree); SPQ = Spider Phobia Questionnaire; BAT = Behavioral Approach Test (higher scores indicating closer approach); SA-pos / SA-neg = Self-reported positive (pos) or negative (neg) Attitudes (higher scores indicate stronger attitudes); EAST = accuracy-based Extrinsic Affective Simon Task scores (higher scores indicating more positive attitudes toward spiders), note that the scores presented here exclude extreme scores and scores of individuals with more than 30% errors on that particular EAST

Table 3 Pre-treatment correlations between the EAST-scores, self-report, and behavioral measures of fear

	SPQ	SA neg	SA pos	BAT
EAST	−.34**	−.28*	.27*	.38**
SPQ	–	.83**	−.68**	−.79**
SA neg		–	−.70**	−.70**
SA pos			–	.62**

Note: * = $p < .05$, ** = $p < .01$. Extreme scores and/or scores of individuals with more than 30% errors on the EAST were excluded from these analyses

Changes on Outcome Measures

To assess pre- to post-treatment changes, all measures except the EAST-scores were subjected to separate 2 Assessment (pre-treatment, post-treatment) × 2 Group (TG, TCG) ANOVA's with repeated measures. To test whether changes in EAST-scores over the course of treatment in the TG were significantly stronger than changes over the course of a 2-h break in the TGC, the EAST-scores were subjected to a 2 Assessment (first, second) × 2 Group (TG, TCG) ANOVA with repeated measures. In this analysis the EAST-scores of T_0 are entered as the first and those of T_1 as the second assessment for both groups (see Fig. 1). Therefore, Assessment effects indicate treatment effects for the TG but test–retest effects for the TCG.

Self-report and Behavioral Measures

The pre- to post-treatment analyses showed significant main effects of Assessment, indicating improvements on all measures; for the SPQ [$F(1, 58) = 99.4$, $p < 0.01$, partial $\eta^2 = 0.63$], the BAT [$F(1, 58) = 153.9$, $p < 0.01$, partial $\eta^2 = 0.73$], the SA positive [$F(1, 58) = 27.9$, $p < 0.01$, partial $\eta^2 = 0.33$], and the SA negative [$F(1, 58) = 94.5$, $p < 0.01$, partial $\eta^2 = 0.62$]. For all measures this effect was independent of group (Fs < 1.6, *ns*).

Extrinsic Affective Simon Task

The analyses of treatment versus test–retest effects for the ER EAST-scores showed no significant main effect of Assessment [$F(1, 49) = 2.4$, $p > 0.05$, partial $\eta^2 = 0.05$]. So, no evidence emerged to suggest that mere test–retest effects played an important role here. In addition, the influence of treatment on implicit attitudes toward spiders was small at best. Although the pattern of results suggests that treatment did influence implicit attitudes, the crucial Assessment by Group interaction was of a small effect size and did not reach the conventional level of significance [$F(1, 49) = 3.4$, $p = 0.07$, partial $\eta^2 = 0.07$].

Predicting Symptom Generalization at Follow-up

Of the 60 high-fearful participants who completed the training, 18 did not return for the 2-month follow-up assessment. The individuals that dropped-out did not differ significantly from the other participants on any of the pre- or post-treatment assessments.

As a first step, we assessed whether there was any evidence of systematic changes in symptoms from post-treatment to follow-up on the SPQ and BAT. A 2 Group (TG, TCG) × 2 Time (post-treatment, follow-up) ANOVA did not show an overall return of self-reported fear [$F(1, 40) < 1$]. Neither the main effect for Group, nor the Group × Time interaction were significant [for both $F(1, 40) < 1$]. For the BAT a 2 Group (TG, TCG) × 2 Time (post-treatment, follow-up) ANOVA showed that overall there was a significant return of avoidance behavior [$F(1, 39) = 13.8$, $p < 0.01$, partial $\eta^2 = 0.26$]. Neither the main effect for Group, nor the Group × Time interaction were significant [for both $F(1, 39) < 1$].

Next, to assess whether residual negative implicit and/or explicit attitudes are related to the generalization of treatment effects, we assessed whether these attitudes predicted participants' post-treatment to follow-up change in BAT performance in a linear regression analysis. Because of the unreliability of simple change scores we used post to follow-up residual gain scores of the BAT as the dependent variable. The independent variables were participants' post-treatment SA and ER EAST-scores. To simplify the analyses we calculated a SA-index combining the scores on the positive and negative SA so that higher scores indicate more positive and less negative explicit attitudes toward spiders.

The analysis showed that the overall model was marginally significant [$F(2, 37) = 3.2$, $p = 0.05$, $R^2 = 0.16$]. The post-treatment SA-index was the only significant independent predictor of change on the BAT, such that a more negative explicit attitude toward spiders at post-treatment predicted a relatively strong increase in avoidance behavior at follow-up; for the SA-index, $\beta = 0.36$, $t = 2.3$, $p < 0.05$, for the ER EAST, $\beta = -0.18$, $t = 1.2$, $p > 0.05$.

Discussion

The results of this study can be summarized as follows: (1) Before treatment, high-fearful individuals displayed more negative implicit as well as explicit attitudes toward spiders than did non-fearful individuals; (2) Post-treatment explicit attitudes toward spiders were less negative than pre-treatment attitudes; (3) No convincing evidence emerged to indicate that implicit attitudes toward spiders changed over the course of treatment; and (4) Residual self-reported, but not implicit, attitudes predicted post-treatment to follow-up changes in avoidance behavior during the BAT.

In line with previous research in treatment-seeking (Teachman and Woody 2003) and analogue samples (e.g., Teachman et al. 2001; Huijding and de Jong 2005a; Ellwart et al. 2006), spider fearful individuals showed a more negative implicit attitude toward spiders than non- (spider) fearful individuals. Consistent with previous research (e.g., de Jong et al. 2000) the high-fearful participants also explicitly reported more negative and less positive attitudes toward spiders than did the low-fearful participants.

The first major goal of this study was to test whether these relatively negative implicit and/or explicit attitudes toward spiders would change in a favorable direction following a one-session exposure in vivo treatment. In line with the previous findings of de Jong et al. (2000), SA were found to be significantly less negative following treatment, although there was still room for improvement (i.e., explicit attitudes toward spiders remained more negative and less positive than those of the non-fearful participants). The finding that SA seem affected by one session of exposure in vivo treatment supports the conclusion drawn by de Jong et al. (2000) that, '[...] in contrast to the prediction of Baeyens et al. (1989), the regular exposure treatment appeared already quite effective in altering the affective valence of spiders.' (p. 1066). One explanation for this finding may be that the treatment procedure is not restricted to merely experiencing the non-occurrence of a US when being presented with the CS. Particularly reinforcement and praise by the therapist may be conceptualized as a form of counterconditioning that could neutralize the negative evaluation of the phobic stimulus.

No convincing evidence emerged indicating that implicit attitudes were also affected by a one-session exposure in vivo treatment. Although the data tentatively suggest that participants' implicit attitudes toward spiders were somewhat favorably changed after treatment this change was small at best, and it remains to be seen whether this modest change reflects a replicable phenomenon. This finding seems at odds with previous findings of Teachman and Woody (2003), who found IAT-effects to change favorably over the course of an exposure treatment. Meanwhile, this earlier study did not include a TCG. It is, therefore, not possible to determine whether the changes in IAT-effects in that study indeed reflect treatment effects or should be attributed to test–retest (e.g., learning) effects. Pertinent to this issue, IAT-data from the present sample (testing spider-harm and spider-contamination associations) suggest that the IAT is highly sensitive to test–retest effects, whereas no changes were evident on the IATs over and above these test–retest effects (see Huijding and de Jong 2007). The present ER EAST-scores appeared relatively insensitive to such undesirable test–retest effects. This suggests that the EAST may provide a more reliable indication of treatment effects than the IAT.

The finding that a 2.5-h exposure in vivo training did not have a strong effect on participants' implicit attitudes toward spiders but did change their explicit attitudes is consistent with the idea that falsification of propositions in the short term primarily affects self-reports but not indirect measures of implicit attitudes (Gawronski et al. 2007). Gawronski and Bodenhausen argued that explicit attitudes are readily changed when faced with information that is inconsistent with the existing propositions. Implicit attitudes on the other hand may change only when new associations are formed through evaluative conditioning or when new propositions ingrain into new associations. Importantly, Gawronski and Bodenhausen argue that a simple negation of existing propositions will not result in changes in evaluative associations (see Gawronski and Bodenhausen 2006 for a detailed description of how implicit and explicit attitudes may change). A single session exposure treatment may provide too little opportunity for evaluative conditioning processes to change implicit attitudes toward spiders. In addition, changes in implicit attitudes that are mediated by changes in participants' propositional reasoning (i.e., more positive propositions) may only become apparent after these propositions have had the time to become sufficiently ingrained. In line with this, a post-hoc analysis showed that while participants' self-reported positive associations with spiders remained stable from post-treatment to follow-up, participants showed significantly more positive implicit attitudes toward spiders at follow-up than at post-treatment.[3]

Nevertheless, an important implication of the finding that participants improved on all outcome measures except the EAST is that, apparently, a change of implicit attitudes is not a necessary prerequisite for immediate symptom alleviation.

The second major goal of this study was to test whether relatively negative implicit and/or explicit attitudes toward spiders immediately after treatment are predictive of the generalization of treatments effects at 2-month follow-up. Although several recent analogue lab experiments provided support for the involvement of residual self-reported negative attitudes in the return of fear (Hermans et al. 2005;

[3] A 2 Group (TG, TCG) × 2 Time (post-treatment, follow-up) ANOVA with the ER EAST-scores as dependent variable showed a significant main effect of Assessment [$F(1, 38) = 4.7$, $p < 0.05$, partial $\eta^2 = 0.11$], indicating that participants showed more positive implicit attitudes toward spiders at follow-up than at post-treatment. Neither the main effect of Group nor the Assessment × Group interaction was significant [for both $F(1, 38) < 1$]. A 2 Group (TG, TCG) × 2 Time (post-treatment, follow-up) ANOVA with the SA positive as dependent variable showed no significant effects [for all $F(1, 38) < 1$, *ns*.]

Dirikx et al. 2004), these predictions had thus far never been formally tested in a clinical context. The present findings provide clinical support for the idea that explicit negative attitudes may indeed interfere with the generalization of treatment effects. That is, relatively strong residual self-reported negative attitudes toward spiders after treatment predicted a relatively strong increase of avoidance behavior during the BAT at follow-up (over and above post-treatment BAT-scores). The implication of this finding is that it may be worthwhile to seek for ways to improve the impact of treatment on attitudes, for instance by including counterconditioning elements (e.g., de Jong et al. 2000).

In contrast, participants' post-treatment (negative) implicit attitudes showed no predictive power for the extent to which treatment effects were generalized at follow-up. This might perhaps not be very surprising since implicit attitudes seem relatively unaffected by a single session 2.5 h exposure treatment. So, at least in the relatively short run, residual negative implicit attitudes seem not to interfere with the positive effects of treatment. An important issue for future research, however, is to test how the course of implicit attitudes on the longer-term is associated with symptom severity. Based on the way implicit attitudes are conceptualized (e.g., Strack and Deutsch 2004; Gawronski and Bodenhausen 2006), it can be hypothesized that if newly acquired positive explicit attitudes do not become fully ingrained (i.e., result in positive implicit attitudes), for instance due to insufficient treatment or practice, they may fade and subsequently fail to counteract residual negative implicit attitudes. As a result the original treatment effects may not consolidate and symptoms may return.

In sum, the present data suggest that a one-session exposure in vivo treatment favorably affects explicit attitudes. In addition, supporting the notion that residual negative attitudes may impede the generalization of treatment effects, relatively negative SA immediately after treatment predicted an increase in avoidance behavior at follow-up. Conversely, no convincing evidence emerged to suggest that implicit attitudes were sensitive to a one-session exposure treatment, and post-treatment implicit attitudes were not predictive of the generalization of treatment effects at 2-month follow-up. Apparently, residual negative implicit associations after treatment do not interfere with short-term symptom alleviation. However, future research should test the relation between negative implicit attitudes and the generalization of treatment effects over a longer period of time. The present findings underline the importance of seeking ways to improve the impact of treatment on (explicit) attitudes toward phobic stimuli, for instance by including counterconditioning elements (e.g., de Jong et al. 2000).

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Appendix: Specific IAPS Pictures used in the EAST

Category	IAPS numbers
Positive square	1750, 2150, 2550, 5910, 8501
Negative square	3063, 3080, 3130, 3500, 6313
Weapons oblong	6230, 6250, 6260

Note: The spider and maggot target pictures were not selected from the IAPS but made by the authors or found on the internet. These pictures can be obtained from the corresponding author

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