Journal of
Experimental Psychopathology
JEP Volume 6 (2015), Issue 1, 112-125
ISSN 2043-8087 / DOI:10.5127/jep.042014

Active Approach Does not Add to the Effects of *in Vivo* Exposure

Sophie L. van Uijen, Marcel van den Hout, and Iris M. Engelhard

Department of Clinical and Health Psychology, Utrecht University, Utrecht, the Netherlands.

Abstract

In exposure therapy, anxiety patients actively approach feared stimuli to violate their expectations of danger and reduce fear. Prior research has shown that stimulus evaluation and behavior are reciprocally related. This suggests that approach behavior itself may decrease fear. This study tested whether approach behavior adds to the beneficial effects of exposure. Spider fearful women were randomly assigned to one of three groups: repeated exposure to a spider by pulling a cart with a jar containing the spider toward them (Exposure + approach) or by having the experimenter do this (Exposure only), or no exposure. Exposure decreased self-reported and behavioral spider fear, compared to no exposure. The decrease was similar for exposure with and without the approach manipulation. No effects were found on affective priming. Our results did not show an added effect of approach by pulling a feared stimulus toward you to exposure. However, the mere visual impression of approach, and/or the decision to approach may have reduced fear.

Keywords: Approach behavior, Spider phobia, Fear, Exposure and response prevention (ERP), Cognitive behavior therapy (CBT)

Correspondence to: Sophie L. van Uijen, Heidelberglaan 1, 3584 CS Utrecht, the Netherlands. Email address: s.l.vanuijen@uu.nl.

Received 18-Mar-2014; received in revised form 30-Jul-2014; accepted 04-Aug-2014

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Introduction

Cognitive behavior therapy (CBT), in particular, Exposure and Response Prevention (ERP) is a highly effective treatment for anxiety disorders (Gunter & Whittal, 2010; Shafran et al., 2009). The defining element of ERP is repeated confrontation with the feared, but innocuous, stimulus (exposure) without avoidance/escape (response prevention). The beneficial effects can be explained in terms of extinction: Patients learn that an anticipated catastrophe does not occur after exposure to a feared stimulus, e.g., people with spider phobia may learn that a spider will not attack them, and people with agoraphobia may learn that busy places do not result in fainting. Exposure to a feared stimulus is regularly established by the patient actively *approaching* it. There are various reasons to believe that approach behavior may be relevant to the understanding of the beneficial effects of ERP, which is an empirical issue that will be tested in the current experiment.

Several lines of research indicate a reciprocal influence between motor behavior and cognition, stimulus evaluation, and affect (see Neumann, Förster, & Strack, 2003; Strack & Deutsch, 2004). Positive evaluations lead to approach tendencies, and negative evaluations lead to avoidance tendencies (Chen & Bargh, 1999). Conversely, perceived movements away from a stimulus trigger the avoidance system and thereby facilitate the processing of negative affective concepts, whereas perceived movements toward a stimulus trigger the approach system and thereby facilitate the processing of positive affective concepts (Neumann & Strack, 2000). For example, arm flexion or having the impression of moving toward a computer screen led to faster categorization of positive words compared to negative words, whereas arm extension or moving away from the computer screen had the opposite effect (Neumann & Strack, 2000).

This reciprocal influence can be explained by an implicit, or automatic (de Houwer, 2006), bidirectional link between behavior and motivational orientation (Strack & Deutsch, 2004). Motivational orientation is determined by the valence of processed information, affect, and the direction of behavior (i.e., approach or avoidance). When in an approach orientation, the processing of positive information, the experience of positive affect, and the execution of approach behavior are facilitated. In an avoidance mode, the opposite applies (Strack & Deutsch, 2004). These are implicit cognitive processes, which means that they may occur unintentionally or outside conscious awareness, and are difficult to control (Moors & de Houwer, 2006). Approach toward a fearful stimulus may contribute to the fear-decreasing effects of exposure by modifying motivational orientation.

The effect of approach and avoidance behavior on stimulus evaluation has been widely investigated. Firstly, the valence of previously *neutral* stimuli is changed by approach and avoidance behavior. Pushing the palm of one's hand up against the bottom of a table, which activates the flexor muscle of the arm (associated with 'pulling'; i.e., approach), led to positive evaluations of a previously neutral stimulus, whereas pressing the hand against the top of the table, which activates the extensor muscle (associated with 'pushing', i.e., avoidance) led to more negative evaluations (Cacioppo, Priester, & Berntson, 1993). Additionally, a similar manipulation of avoidance behavior decreased palatable food intake, whereas approach increased consumption (Förster, 2003). On the other hand, a study in which approach (manipulated by pulling a joystick) toward pictures of faces with a neutral expression led to a more positive evaluation of these faces, whereas avoidance (pushing the joystick away) induced a negative evaluation (Woud, Becker, & Rinck, 2008), was not replicated (Vandenbosch & de Houwer, 2011).

Secondly, avoidance behavior and behavioral inhibition change the response to, and evaluation of*, positive* stimuli. Avoidance-retraining of an approach bias to alcohol stimuli in people with drinking problems, using a joystick, changed automatic action tendencies to approach alcohol, decreased the amount of alcohol consumed in a subsequent taste test (Wiers, Rinck, Kordts, Houben, & Strack, 2010), and improved treatment outcome one year later (Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011). In a theoretically similar line of studies, behavioral inhibition, i.e., not responding to a positive picture, led to devaluation of the valence of that picture (Veling, Holland, & van Knippenberg, 2008).

However, when it comes to reducing the negative valence of stimuli by approach behavior, matters are somewhat complex. Veling et al. (2008) reasoned that the devaluation effect would not occur for negative stimuli, because negative stimuli can elicit both fight (approach) and flight (avoidance) behavior. Yet an approach training to photographs of black people decreased racial bias to black people on an implicit and a behavioral measure (Kawakami, Phills, Steele, & Dovidio, 2007), suggesting a decrease in negative valence.

Whether approach behavior can also reduce fear, an issue that is highly relevant for the understanding of ERP effects, is the aim of the current study. Approach to a fearful stimulus inevitably causes exposure, which leads to extinction. Therefore the *additional* effect of approach behavior during exposure was investigated. Spider fearful individuals were randomly assigned to one of three conditions: (1) Exposure + approach, (2) Exposure only, or (3) no exposure (Control). Approach was operationalized as activation of the flexor muscle of the arm (cf. Cacioppo et al., 1993; Förster, 2003; Kawakami et al., 2007; Neumann & Strack, 2000; Wiers et al., 2010; Wiers et al., 2011), by pulling a cart with a jar containing a live spider toward you. This operationalization enabled repeated exposure trials without the participant moving away from the spider (i.e., avoidance). Additionally, it ensured a maximum amount of activation of the arm flexor muscle during each trial for participants in the Exposure + approach group. To prevent the approach manipulation from resulting in more exposure in the Exposure + approach group than in the Exposure only group, the only difference between these conditions was that in the Exposure only group during exposure trials *the experimenter* pulled cart with the spider toward the participant. Effects on spider fear were measured with a self-report, behavioral, and implicit measure. It was expected that exposure would lead to a decrease in spider fear on all measures, compared to no exposure, and that Exposure + approach would lead to more decrease than Exposure only. Perceived control may be increased by the approach manipulation, and was measured at various time points during exposure trials to control for its potential effects on fear. At the end of the experiment, pleasantness of the procedure was assessed to investigate whether this was affected by the approach manipulation.

Method

Participants

Participants were recruited through posters, flyers, online advertisements on the University network, and during lectures. 454 students were screened for spider fearfulness using the Spider Anxiety Screening (SAS; Rinck et al., 2002; see Measures). Of the 206 individuals who scored 11 or higher, all 143 women (cf. Huijding & De Jong, 2006) who indicated willingness to participate were invited to participate, of whom 79 volunteered. Exclusion criteria were past or current psychiatric disorders other than spider phobia, uncorrected visual impairment, and use of medication that might alter attention, reaction time, memory, or concentration (n = 0). If the distance between the participant and spider in an opened jar was less than 50 cm (step 6) in the initial behavioral approach test (BAT), the participant was excluded from further testing to ensure a sufficiently high level of spider fear at the start of the experiment and prevent a floor-effect on the BAT (n = 3). This resulted in a final sample of 76 women (mean age 21.78; SD = 2.95) who participated in exchange for money or course credit after giving written informed consent.

Measures

Spider Anxiety Screening (“Spinnenangst screening”; SAS).

The SAS (Rinck et al., 2002) is a four item (rated on a scale from 0 [does not apply at all] to 6 [completely applies]) self-report measure created and used for screening individuals on fear of spiders. The scale shows good reliability (Cronbach’s α = .91) and validity (Rinck et al., 2002). In this sample, Cronbach’s α = .77.

Fear of spiders questionnaire (FSQ).

The FSQ (Szymanski & O'Donohue, 1995) was used as a dependent variable and to check for pre-test differences in spider fear. It consists of 18 statements measuring self-reported spider fear that are rated on a 0 (completely disagree) to 7 (completely agree) scale (range 0-126). It shows good internal consistency (Cronbach’s α = .92; Szymanski & O'Donohue, 1995; in this sample Cronbach’s α = .90). It differentiates between phobic and non-phobic subjects, is sensitive to therapeutic change, and correlates with other measures of spider fear, such as a BAT (Muris & Merckelbach, 1996).

Disgust scale revised (DS-R).

The DS-R (Haidt, McCauley, & Rozin, 1994; revised by Olatunji et al., 2007) is a 27 item (rated on a 0 [completely disagree/not disgusting at all] to 4 [completely agree/extremely disgusting] scale) self-report measure for individual differences in disgust sensitivity. It shows good internal consistency (Cronbach’s α = .87) and validity (Van Overveld, de Jong, Peters, & Schouten, 2011). In this sample, Cronbach’s α = .71. It was used to check for pretest group differences in disgust sensitivity, because this is an important feature of spider fear (Mulkens, de Jong, & Merckelbach, 1996).

Behavioral approach test (BAT).

As a dependent variable and behavioral measure of spider fear, participants were instructed to pull the cart with the jar with the spider from the starting point (3.17 m from the participant) to a “non- or hardly frightening” distance, where they would tolerate it for 90 sec without feeling much distress (cf. De Jong, Merckelbach, & Arntz, 1991; see also Nelissen, Muris, & Merckelbach, 1995) using the construction described in the Procedure. Before each step, the experimenter asked: “Would you feel fearful if you would perform [description of step]?”. If not, the participant was asked to execute the step (De Jong, Vorage, & van den Hout, 2000). If they indicated that they would feel fearful, no further steps were performed. Fear at that step was rated on a 0 - 100 scale.

The BAT steps consisted of leaving the cart at the starting point (0), pulling the cart to various distances (1-6) and all the way toward the participant (7), touching, lifting, and opening the jar (8-10), touching the spider with a pen

(11), with a finger (12), and taking the spider out of the jar (13). If, during the initial BAT, the participant was able to pull the spider to step 6 (50 cm), the BAT was repeated from the start with the jar opened.

Affective priming task (APT).

E Prime 2.0 software (Schneider, Eschman, & Zuccolotto, 2002) on a laptop (17" screen) was used to present the APT. Participants were asked to categorize 12 different words (targets; six positive [e.g., humor] and six negative [e.g., liar] as used in an APT by Engelhard, Leer, Lange, and Olatunji, 2014) as quickly and accurately as possible by pressing 'p' for a positive word, and 'q' for a negative word (Fazio, Sanbonmatsu, Powell, & Kardes, 1986). Targets were presented 100 ms after offset of a picture (prime), which was shown for 200 ms. Participants were told that the pictures were included to make the task more difficult, and to focus on the word. Primes were four pictures of neutral objects (outlet, iron, key ring, and light bulb) and four pictures of spiders selected from a pilot study[1]. Targets and primes were semi-randomly presented, so that no similar combination of picture type (e.g., spider) and word type (e.g., negative word) was presented on two consecutive trials. Each picture preceded each word once, leading to a total of 96 trials, with a break in the middle. Before the actual APT, the task was practiced with three other negative and positive targets and a neutral prime. Target categorization speed was used as a dependent variable and implicit measure of spider fear (De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009), because it gives an indirect index of the prime's valence. Target categorization is relatively fast after a prime with a congruent valence (Klauer & Musch, 2003). Participants wore a sound-attenuating headphone to prevent distraction due to background noise.

Word and picture evaluation task.

An additional computer task was performed before the pre-test APT to enable a manipulation check of the primes and targets used in the APT. Participants rated target valence on a negative (0) to positive (100) visual analogue scale (VAS). Prime valence and arousal were rated using the 7-point Self-Assessment Manikin (Bradley & Lang, 1994).

[1] More detailed information is available on request from the first author.

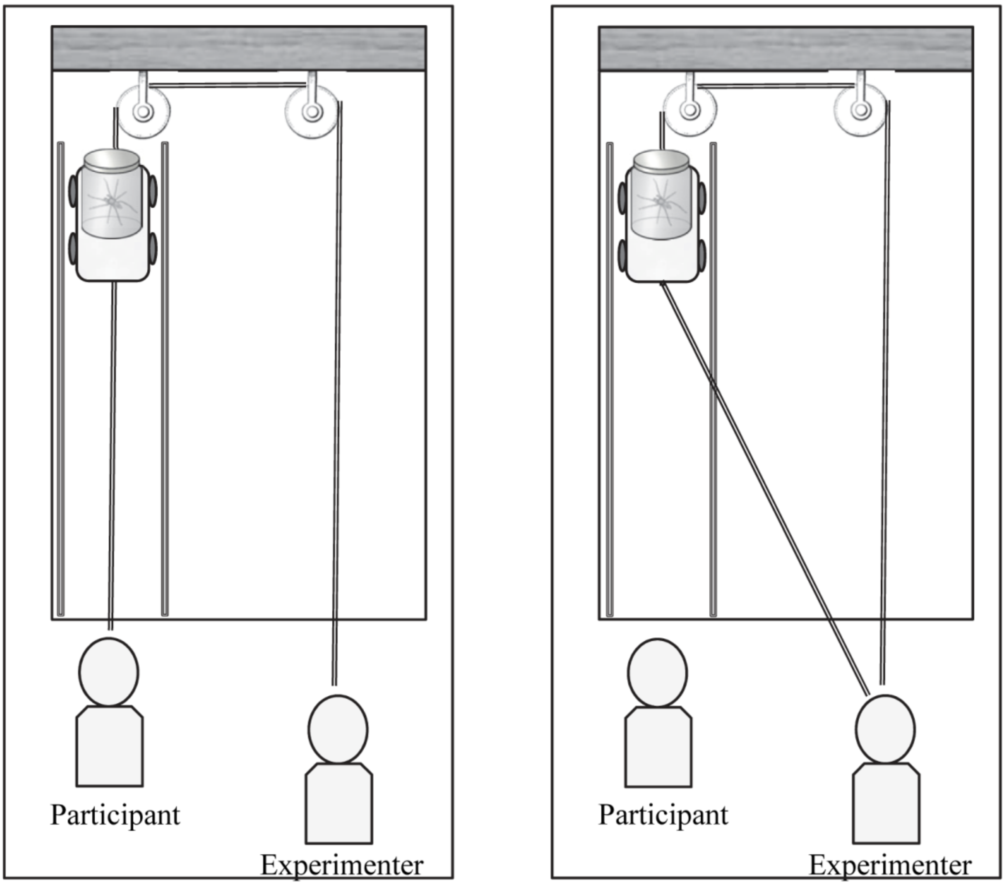

Figure 1: The experimental set-up (not to scale) in the Exposure + approach condition (left) and the Exposure only condition (right).

Perceived control.

To check whether the approach manipulation affected perceived control, participants in both exposure groups were asked to rate perceived control on a 0 (no control) to 100 (total control) scale at exposure trial 1, 5, 10, 15, and 20 (see Procedure).

Procedure

Participants were shown how pulling a rope could drive a cart (at approximately 20 cm/s) in a straight line from one end of two tables set together (length 3.53 m) toward the other end, where the participant was seated. The experimenter could pull the cart back to its starting point while remaining seated next to the participant, by pulling the other end of the rope (see Figure 1).

A closed glass jar containing an average sized house spider (*Tegenaria Atrica*) was then put at 1.77 m from the participant, who rated on a 0 (not at all) to 100 (extremely) scale how scary and how disgusting they thought the spider was. The experimenter put the jar with the spider on the cart at the starting point, and the BAT was performed. The spider was put out of sight, and the FSQ and DS-R were completed, followed by the word- and picture evaluation task, and the APT.

Next, 20 exposure trials were performed. Exposure trials were performed with the jar open if that was how the initial BAT had been performed (Exposure + approach n = 1; Exposure only n = 1). The experimenter put the jar with the spider on the cart at the starting point. In the Exposure + approach condition, participants were asked: “Please pull the spider toward the closest point that would make you feel a little frightened, but of which you are sure you can handle it”. Participants were free to choose any distance. After doing so, they rated their fear (0-100). The experimenter subsequently pulled the cart back to its starting point. If fear was rated 25 or higher, the trial was repeated. If fear was lower than 25, the participant was asked to pull the spider somewhat closer on the next trial to ensure fear was activated at each trial. If the cart had been pulled all the way toward the participant, BAT steps 8 to 13 were suggested. The Exposure only procedure was similar to Exposure + approach, except that the experimenter pulled the spider toward the participant. Participants in the control condition completed a filler task (reading magazines) for 15 minutes, with the spider out of sight.

Next, the APT, FSQ, and final BAT were administered. Finally, participants were asked to rate the pleasantness of the procedure on a 0 (very unpleasant) to 100 (very pleasant) scale, and were debriefed, thanked, and rewarded.

Data Analysis

Due to a technical error, APT data were not collected for one participant. Incorrect responses (2.50%) and reaction times below 200 ms or above 1500 ms (5.12%) were discarded. APT evaluation scores were calculated by subtracting the mean reaction time (ms) of the positive target words from the mean reaction time of the negative targets for each prime type (Engelhard et al., 2014; cf. Kerkhof, Vansteenwegen, Baeyens, & Hermans, 2011). Higher evaluation scores indicate a more positive evaluation of the prime, but the scores should not to be interpreted as absolute values, with zero indicating a neutral evaluation, because reaction times for positive and negative targets may differ overall (Kerkhof et al., 2011).

Outliers were replaced by $M \pm 3SD$. Effects on outcome measures were analyzed using 2 (Time; pre-test and post-test), and, in case of APT analyses, x 2 (Evaluation score; spider or neutral) x 3 (Condition) mixed ANOVAs; pairwise comparisons of pre- to posttest difference scores using Bonferroni correction; and paired t-tests. For all analyses, $\alpha = .05$.

Results

Participant Characteristics and Baseline Differences

Groups did not differ in age, disgust sensitivity (DS-R), and spider fear at screening (SAS) and pretest (FSQ), largest $F(2,73) = 1.14$, $p = .33$, see Table 1. The mean pretest FSQ score of 70.31 ($SD = 19.03$) indicates a subclinical sample, as participants with spider phobia in other studies obtained FSQ scores of 83.74 ($SD = 20.78$), 83.56 (SD = 20.48; Milosevic & Radomsky, 2013), and 89.10 (SD = 19.60; Muris & Merckelbach, 1996), compared to healthy controls with 3.00 ($SD = 7.80$). Groups did not differ in the extent participants thought the spider used in the experiment was scary or disgusting, largest $F(2,73) = 2.27$, $p = .11$. No pretest differences were found on any of the outcomes measures, *F*s < 1.

Table 1: Mean (SD) participant characteristics by condition.

	Condition			
	Exposure + approach (*n* = 26)	**Exposure only (*n* = 25)**	**Control (*n* = 25)**	**Total (*N* = 76)**
Age	21.15 (2.92)	22.40 (3.40)	21.80 (2.43)	21.79 (2.95)
SAS	16.81 (3.39)	16.52 (4.12)	16.24 (3.37)	16.53 (3.60)
DS-R	51.15 (8.65)	51.44 (10.89)	52.44 (11.64)	51.67 (10.33)
Scary	60.31 (23.17)	63.72 (18.60)	51.60 (20.14)	58.57 (21.11)
Disgust	71.69 (21.71)	71.76 (22.63)	61.08 (26.10)	68.22 (26.10)
FSQ	72.23 (19.79)	68.28 (18.42)	70.36 (19.39)	70.32 (19.03)

Note. SAS = Spider Anxiety Screening, DS-R = Disgust Scale Revised, Scary = How scary participants rated the spider, Disgust = How disgusting participants rated the spider, FSQ = Fear of Spiders Questionnaire, pretest.

Outcome Measures

FSQ.

There was a significant effect for Time, $F(1,73) = 64.32$, $p < .001$, $\eta_p^2 = .47$, power = 1.00, and for Time x Condition, $F(2,73) = 5.95$, $p = .004$, $\eta_p^2 = .14$, power = .87, indicating an overall decrease in self-reported spider fear that differed between conditions, see Figure 2 left panel. The pre- to posttest decrease was significant for the Exposure + approach and Exposure only conditions, smallest $t(24) = 5.96$, $p < .001$, $r = .77$, power = 1.00, but not for the Control condition, $t(24) = 1.74$, $p = .10$. Pairwise comparisons showed a larger decrease in FSQ scores for Exposure + approach compared to the Control condition, $p = .004$, power = .76, and a trend for the Exposure only compared to the Control condition, $p = .06$, power = .47. In contrast with the hypothesis that Exposure + approach would outperform Exposure only, these conditions did not differ, $p > .99$.

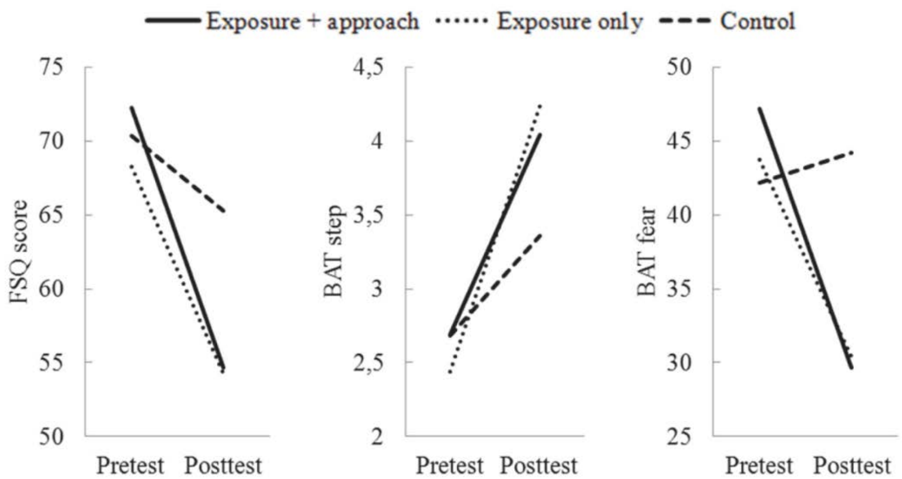

Figure 2: Pre- and posttest Fear of Spiders Questionnaire (FSQ) score (left panel), behavioral approach test (BAT) step (middle panel), and the amount of fear participants experienced at the furthest step of the BAT (BAT fear; right panel) for each condition.

BAT.

There was an overall pre- to posttest increase in BAT-steps, $F(1,73) = 73.15$, $p < .001$, $\eta_p^2 = .50$, power = 1.00, which differed between conditions, $F(2,73) = 4.70$, $p = .01$, $\eta_p^2 = .11$, power = .77, see Figure 2 middle panel. It was significant for all conditions, smallest $t(24) = 3.44$, $p = .002$, $r = .57$, power = .91. The only significant difference between conditions was a larger increase for Exposure only compared to the Control condition, p = .01, power = .74. Exposure + approach did not differ from the Control condition, p = .21, or from Exposure only, p = .65. This was not in line with the hypothesis that Exposure + approach would show greater improvement than Exposure only.

The degree of fear participants reported at the furthest BAT-step decreased from pre- to posttest, $F(1,73) = 19.79$, $p < .001$, $\eta_p^2 = .21$, power = .99, and differed between conditions, $F(2,73) = 7.51$, $p = .001$, $\eta_p^2 = .17$, power = .94, see Figure 2 right panel. There was a significant decrease for the Exposure + approach and Exposure only conditions, smallest $t(24) = 3.10$, $p = .005$, $r = .53$, power = .85, but not for the Control condition, $t < 1$. Compared to the Control condition, the decrease was larger for Exposure + approach, $p = .001$, power = .93, and Exposure only, $p = .02$, power = .58, but again, in contrast with the hypothesis, Exposure + approach did not outperform Exposure only, $p > .99$. It seems that participants in all conditions felt motivated to show more approach to the spider on the post-test BAT compared to the pre-test BAT, but only in the Exposure + approach and Exposure only conditions this was accompanied by a decrease in fear.

APT.

Before the pre-test APT, positive targets were rated more positively ($M = 88.16$, $SD = 8.54$) than negative targets ($M = 10.55$, $SD = 8.64$), $F(1,73) = 1772.39$, $p < .001$, $\eta_p^2 = .96$. Neutral primes were generally rated as neutral (i.e., 4 on SAM), $M = 4.02$, $SD = 0.58$, $t < 1$, and were rated more positively than spider primes ($M = 1.43$, $SD = 0.47$), $F(1,73) = 812.53$, $p < .001$, $\eta_p^2 = .92$. Spider primes were rated as more arousing ($M = 5.73$, $SD = 0.97$) than neutral primes ($M = 1.66$, $SD = 0.98$), $F(1,73) = 647.56$, $p < .001$, $\eta_p^2 = .90$. None of this differed between conditions, all Fs < 1.

There was an APT effect at pretest, indicated by a more negative evaluation score for spider primes ($M = -13.48$, $SD = 64.19$) than for neutral primes ($M = 20.29$, $SD = 63.19$), $F(1,72) = 12.39$, $p = .001$, $\eta_p^2 = .15$, power = .94, which did not differ between conditions, $F(2,72) = 1.44$, $p = .24$. This effect did not change from pre- to posttest, $F < 1$, nor was the crucial Time x Evaluation score x Condition interaction significant, $F(2,72) = 1.25$, $p = .29$. The difference between spider and neutral prime evaluation scores did not change for any of the conditions, which was not in line with the hypothesis that the Exposure conditions would outperform the Control condition, and Exposure + approach would show the largest effect.

Pleasantness.

There were no differences between the conditions in how (un)pleasant the experimental procedure was rated, $F < 1$ ($M = 57.33$, $SD = 19.73$). A more positive evaluation was related to a greater improvement on the BAT, $r = .28$, $p = .02$, and a lower score on the FSQ at posttest, $r = -.25$, $p = .04$.

Exposure Trials: Time Course of Effects and Perceived Control

Figure 3 depicts the time course of the steps performed during the exposure trials, and corresponding fear for Exposure + approach and Exposure only. Trend analysis indicates a linear trend for the steps performed, $F(1,49) = 52.86$, $p < .001$, $\eta_p^2 = .52$, power = 1.00. For fear, the trend had a quadratic shape, $F(1,49) = 7.92$, $p = .007$, $\eta_p^2 = .14$, power = 1.00, with a cubic aspect to it, $F(1,49) = 21.81$, $p < .001$, $\eta_p^2 = .31$, meaning that the line has two inflection points (it changes direction twice). Trends are similar for the two conditions, as neither interactions were significant, both Fs < 1.

Perceived control did not change over time, $F(3.43,168.16) = 1.32$, $p = .27$, and there was no interaction with Condition, $F(3.43,168.16) = 2.06$, $p = .10$. However, there was a trend for Condition, $F(1,49) = 3.31$, $p = .08$, $\eta_p^2 = .06$, power = .43. Participants in the Exposure + approach condition tended to perceive more control ($M = 76.78$, $SD = 15.23$) during exposure trials than participants in Exposure only ($M = 67.06$, $SD = 22.37$).

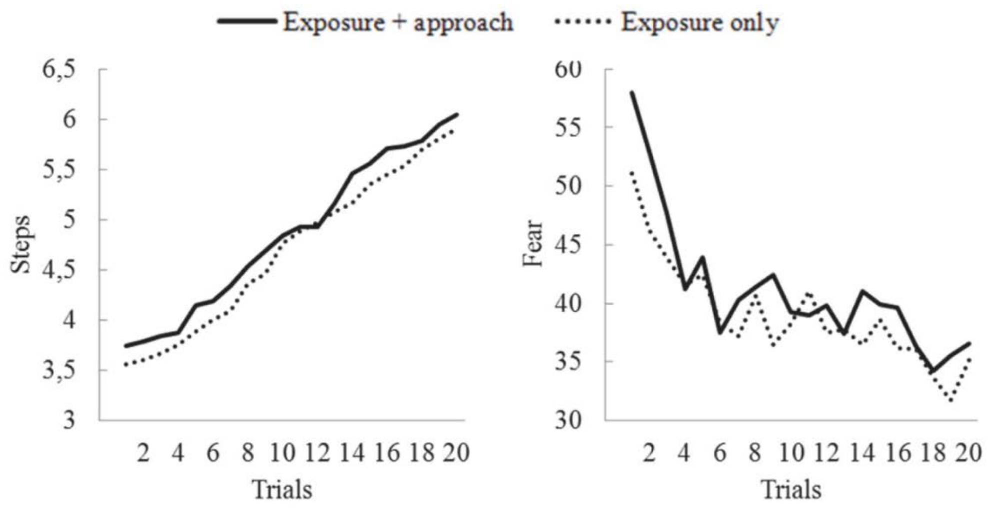

Figure 3: Exposure + approach and Exposure only time course of steps performed (left) and corresponding fear (right) during exposure trials.

Discussion

This study aimed to investigate the role of approach behavior during exposure by testing the effect of pulling a feared stimulus, i.e., a spider, toward you during exposure on spider fear. Compared to a no-exposure control condition and in line with our hypothesis, repeated exposure to a spider led to a decrease in spider fear on a self-report and behavioral measure. However, in contrast to the hypothesis, the approach manipulation did not show an additional effect on any of the spider fear measures: Repeated exposure to the spider by pulling it toward you and by having the experimenter pull it toward you caused similar drops in spider fear. No effects were found on the implicit (affective priming) measure of spider fear. There was a trend for participants who pulled the spider toward them during exposure to report more control than participants who did not. There were no differences between conditions in pleasantness of the procedure.

The pre- to posttest increase in steps performed on the BAT did not differ between the Exposure + approach and the Control group. All groups showed an increase in steps performed on the BAT from pre-test to posttest, which means that all participants pulled the cart with the spider closer toward them at the posttest than at the pre-test. However, this was only associated with a pre- to posttest decrease in self-reported fear at the closest step in the BAT in both Exposure groups, but not in the Control group. Apparently, participants did not adhere to the BAT instructions, namely to pull the cart with the spider to a “non- or hardly frightening” distance, where they would tolerate it for 90 sec without feeling much distress. Even though self-reported spider fear decreased in both Exposure groups, but not in the Control group, there was only a trend for this difference to be larger in the Exposure only group than in the Control group. This may mean that mere exposure and no exposure had similar effects on self-reported spider fear. However, because the effect of exposure is substantial (Gunter & Whittal, 2010; Shafran et al., 2009), it seems more likely that this was due to a lack of power because of the Bonferroni correction that was applied to pairwise comparisons.

Various lines of research indicate a reciprocal influence between motor behavior and cognition and affect (see, for example, Neumann et al., 2003), but this study did not indicate that motor approach behavior, i.e., activation of the flexor muscle of the arm by pulling a fearful stimulus toward you, is relevant to the explanation of the beneficial effects of ERP. Why did the approach manipulation not add to the effects of exposure? First, there may be a theoretical explanation. Veling et al. (2008) suggested that approach behavior does not reduce anxiety for threat stimuli, because threat stimuli may cause both fight (approach) and flight (avoidance) behavior. However, earlier research has shown that spider fearful individuals react to spider pictures more quickly by pushing a joystick away than by pulling it toward them, compared to non-anxious controls and control pictures (Rinck & Becker, 2007). This implies a behavioral avoidance tendency for spider stimuli, and not a “fight” response.

Second, the sense of approach may not have been different for the two exposure conditions: Merely observing the spider moving closer in the Exposure only condition may have induced a sense of approach. Note that, besides actual motor behavior, visual cues are also used as a source of information about one's movement (Neumann & Strack, 2000), and the decrease of spatial distance toward the spider may have been interpreted as approach. Neumann and Strack (2000) showed that the mere impression of moving toward or away from a computer screen led to similar results as *actual* approach or avoidance behavior in a word categorization task. It seems that the effect of approach is not merely due to motor behavior (activation of the flexor muscle of the arm), but also to other cues of movement.

Furthermore, perhaps similar cognitive processes played a role in both exposure conditions. The participants' *decision* to pull the spider toward them or to have the experimenter pull the spider toward them may have been used as a source of information about the safety of the situation (Gangemi, Mancini, & van den Hout, 2012). Gangemi and colleagues showed that fearful individuals derive information about the safety of the situation from both objective danger information and, crucially, from their own avoidance and escape behavior: "I avoid, so there must be danger". Additionally, in a recent experiment, participants who were allowed to use avoidance behavior during presentation of a safety cue (a stimulus that had never been paired with an unpleasant stimulus) subsequently had higher threat beliefs about that safety cue than participants who were not allowed to avoid that cue (Engelhard, van Uijen, van Seters, & Velu, in press). Avoidance behavior thus generated threat beliefs about an objectively safe stimulus. The opposite may have occurred in this study: consenting to be approached by the spider may have decreased threat beliefs about the spider, "I decide to be approached, therefore the spider must not be that dangerous". This would imply that the effect of approach may be due to the *decision* to decrease the distance to the spider.

It remains unclear whether the approach manipulation was effective. Participants in the Exposure + approach condition literally "pulled the strings", but, contrary to what was expected, there was only a trend for perceived control to be higher in this group. Additionally, there were no differences on any measures in the decrease in spider fear between Exposure conditions, not even when looking at the time course effects during exposure trials. Even if the manipulation did work, then any potentially beneficial effects may have been overshadowed by ERP's strong and robust effects (Gunter & Whittal, 2010; Shafran et al., 2009).

Future studies could investigate the effect of a different approach manipulation during exposure, and compare this to a different exposure only condition, in which participants receive no visual information of approach. Additionally, the role of the decision to approach could be investigated, for example by testing whether effects on stimulus evaluation obtained with approach and avoidance motor behavior (e.g., as in Cacioppo et al., 1993; Förster, 2003; Kawakami et al., 2007; Wiers et al., 2010; Wiers et al., 2011) can also be obtained with the mere decision to approach or avoid. This could improve our understanding of the bidirectional link between behavior and cognition and affect, and the relevance of approach to ERP's procedure.

The APT effect did not change from pre- to posttest for any of the conditions, which indicates that the negative valence of the spider primes did not decrease because of exposure or the approach manipulation. This can be explained by the finding that negative stimulus evaluations are resistant to extinction (Engelhard et al., 2014). Negative evaluations remained existent on an affective priming task, even after learning that the evaluated stimulus was no longer followed by an unpleasant stimulus.

This study has several limitations. Participants in the Exposure conditions may have guessed the hypothesis and acted accordingly. However, post-test enquiry about the goal of the experiment did not reveal an expectancy bias. Due to the nature of the procedure, it was impossible for the experimenters to be blind to the experimental condition. All instructions were formulated in detail in an experimental protocol to prevent experimenter's bias. Rejection of our main hypothesis suggests that it is unlikely that this affected our data.

In conclusion, although our results did not show an effect of pulling a feared stimulus toward you compared to having it pulled toward you by the experimenter during exposure, this does not necessarily imply that approach behavior is not relevant to the understanding of the beneficial effects of ERP. The mere visual impression of approach, and/or the decision to approach may be of influence on fear reduction.

Acknowledgements

This study was funded by a Research Talent Grant from the Netherlands Organization for Scientific Research awarded to Sophie van Uijen. We thank C.M.J. van Uijen for building the construction, and I. de Leeuw and T. Schilperoort for data collection.

References

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry, 25*(1), 49-59. http://dx.doi.org/10.1016/0005-7916(94)90063-9

Cacioppo, J. T., Priester, J. R., & Berntson, G. G. (1993). Rudimentary determinants of attitudes. II: Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology, 65*(1), 5-17. http://dx.doi.org/10.1037/0022-3514.65.1.5

Chen, M., & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin, 25*(2), 215-224. http://dx.doi.org/10.1177/0146167299025002007

De Jong, P. J., Merckelbach, H., & Arntz, A. (1991). Eyeblink startle responses in spider phobics before and after treatment: A pilot study. *Journal of Psychopathology and Behavioral Assessment, 13*(3), 213-223. http://dx.doi.org/10.1007/BF00960785

De Jong, P. J., Vorage, I., & van den Hout, M. A. (2000). Counterconditioning in the treatment of spider phobia: Effects on disgust, fear and valence. *Behaviour Research and Therapy, 38*(11), 1055-1069. http://dx.doi.org/10.1016/S0005-7967(99)00135-7

De Houwer, J. (2006). What are implicit measures and why are we using them. In R. W. Wiers, & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction.* (pp. 11-28). CA: SAGE: Thousand Oaks.

De Houwer, J., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin, 135*(3), 347-368. http://dx.doi.org/10.1037/a0014211

Engelhard, I. M., Leer, A., Lange, E., & Olatunji, B. O. (2014). Shaking that icky feeling: Effects of extinction and counterconditioning on learned disgust. *Behavior Therapy, 45,* 708-719. http://dx.doi.org/10.1016/j.beth.2014.04.003

Engelhard, I. M., van Uijen, S. L., van Seters, N., & Velu, N. (in press). The effects of safety behavior directed towards a safety cue on perceptions of threat. *Behavior Therapy*. http://dx.doi.org/10.1016/j.beth.2014.12.006

Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology, 50*, 229-237. http://dx.doi.org/10.1037/0022-3514.50.2.229

Förster, J. (2003). The influence of approach and avoidance motor actions on food intake. *European Journal of Social Psychology, 33*(3), 339-350. http://dx.doi.org/10.1002/ejsp.150

Gangemi, A., Mancini, F., & van den Hout, M. (2012). Behavior as information: "If I avoid, then there must be a danger". *Journal of Behavior Therapy and Experimental Psychiatry, 43*(4), 1032-1038. http://dx.doi.org/10.1016/j.jbtep.2012.04.005

Gunter, R. W., & Whittal, M. L. (2010). Dissemination of cognitive-behavioral treatments for anxiety disorders: Overcoming barriers and improving patient access. *Clinical Psychology Review, 30*(2), 194-202. doi:10.1016/j.cpr.2009.11.001; 10.1016/j.cpr.2009.11.001

Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences, 16*(5), 701-713. http://dx.doi.org/10.1016/0191-8869(94)90212-7

Huijding, J., & De Jong, P. J. (2006). Specific predictive power of automatic spider-related affective associations for controllable and uncontrollable fear responses toward spiders. *Behaviour Research and Therapy, 44*(2), 161-176. http://dx.doi.org/10.1016/j.brat.2005.01.007

Kawakami, K., Phills, C. E., Steele, J. R., & Dovidio, J. F. (2007). (Close) distance makes the heart grow fonder: Improving implicit racial attitudes and interracial interactions through approach behaviors. *Journal of Personality and Social Psychology, 92*(6), 957-971. http://dx.doi.org/10.1037/0022-3514.92.6.957

Kerkhof, I., Vansteenwegen, D., Baeyens, F., & Hermans, D. (2011). Counterconditioning: An effective technique for changing conditioned preferences. *Experimental Psychology, 58*(1), 31-38. doi:10.1027/1618-3169/a000063; 10.1027/1618-3169/a000063

Klauer, K. C., & Musch, J. (2003). Affective priming; findings and theories. In J. Musch, & K. C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion.* (pp. 7-49) Mahwah, NJ: Erlbaum.

Milosevic, I., & Radomsky, A. S. (2013). Keep your eye on the target: Safety behavior reduces targeted threat beliefs following a behavioral experiment. *Cognitive Therapy and Research, 37*(3), 557-571. http://dx.doi.org/10.1007/s10608-012-9483-2

Moors, A., & de Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin, 132*(2), 297-326. http://dx.doi.org/10.1037/0033-2909.132.2.297

Mulkens, S. A. N., de Jong, P. J., & Merckelbach, H. (1996). Disgust and spider phobia. *Journal of Abnormal Psychology, 105*(3), 464. http://dx.doi.org/10.1037/0021-843X.105.3.464

Muris, P., & Merckelbach, H. (1996). A comparison of two spider fear questionnaires. *Journal of Behavior Therapy and Experimental Psychiatry, 27*(3), 241-244. http://dx.doi.org/10.1016/S0005-7916(96)00022-5

Nelissen, I., Muris, P., & Merckelbach, H. (1995). Computerized exposure and in vivo exposure treatments of spider fear in children: Two case reports. *Journal of Behavior Therapy and Experimental Psychiatry, 26*(2), 153-156. http://dx.doi.org/10.1016/0005-7916(95)00002-H

Neumann, R., Förster, J., & Strack, F. (2003). Motor combatibility: The bidirectional link between behavior and evaluation. In J. Musch, & K. C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion.* (pp. 371-391) Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Neumann, R., & Strack, F. (2000). Approach and avoidance: The influence of proprioceptive and exteroceptive cues on encoding of affective information. *Journal of Personality and Social Psychology, 79*(1), 39-48. http://dx.doi.org/10.1037/0022-3514.79.1.39

Olatunji, B. O., Williams, N. L., Tolin, D. F., Sawchuk, C. N., Abramowitz, J. S., Lohr, J. M., & Elwood, L. (2007). The disgust scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment, 19*(3), 281-297. http://dx.doi.org/10.1037/1040-3590.19.3.281

Rinck, M., & Becker, E. S. (2007). Approach and avoidance in fear of spiders. *Journal of Behavior Therapy and Experimental Psychiatry, 38*(2), 105. http://dx.doi.org/10.1016/j.jbtep.2006.10.001

Rinck, M., Bundschuh, S., Engler, S., Müller, A., Wissmann, J., Ellwart, T., & Becker, E. S. (2002). Reliabilität und validität dreier instrumente zur messung von angst vor spinnen. *Diagnostica, 48*(3), 141-149. http://dx.doi.org/10.1026//0012-1924.48.3.141

Schneider, W., Eschman, A., & Zuccolotto, A. (2002). *E-prime user's guide.* Pittsburg: Psychology Software Tools, Inc.

Shafran, R., Clark, D. M., Fairburn, C. G., Arntz, A., Barlow, D. H., Ehlers, A., . . . Wilson, G. T. (2009). Mind the gap: Improving the dissemination of CBT. *Behaviour Research and Therapy, 47*(11), 902-909. doi:10.1016/j.brat.2009.07.003; 10.1016/j.brat.2009.07.003

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*(3), 220-247. http://dx.doi.org/10.1207/s15327957pspr0803_1

Szymanski, J., & O'Donohue, W. (1995). Fear of spiders questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry, 26*(1), 31-34. http://dx.doi.org/10.1016/0005-7916(94)00072-T

Van Overveld, M., de Jong, P. J., Peters, M. L., & Schouten, E. (2011). The disgust scale-R: A valid and reliable index to investigate separate disgust domains? *Personality and Individual Differences, 51*(3), 325-330. http://dx.doi.org/10.1016/j.paid.2011.03.023

Vandenbosch, K., & de Houwer, J. (2011). Failures to induce implicit evaluations by means of approach–avoid training. *Cognition & Emotion, 25*(7), 1311-1330. http://dx.doi.org/10.1080/02699931.2011.596819

Veling, H., Holland, R. W., & van Knippenberg, A. (2008). When approach motivation and behavioral inhibition collide: Behavior regulation through stimulus devaluation. *Journal of Experimental Social Psychology, 44*(4), 1013-1019. http://dx.doi.org/10.1016/j.jesp.2008.03.004

Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science, 22*(4), 490-497. doi:10.1177/0956797611400615; 10.1177/0956797611400615

Wiers, R. W., Rinck, M., Kordts, R., Houben, K., & Strack, F. (2010). Retraining automatic action-tendencies to approach alcohol in hazardous drinkers. *Addiction (Abingdon, England), 105*(2), 279-287. doi:10.1111/j.1360-0443.2009.02775.x; 10.1111/j.1360-0443.2009.02775.x

Woud, M. L., Becker, E. S., & Rinck, M. (2008). Implicit evaluation bias induced by approach and avoidance. *Cognition & Emotion, 22*(6), 1187-1197. http://dx.doi.org/10.1080/02699930801906843