



Positive valence reduces susceptibility to return of fear and enhances approach behavior



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ABSTRACT

Background and objectives: Although exposure therapy is highly efficacious for anxiety disorders, many individuals do not respond. Drawing from the science of fear extinction and reinstatement, the current study evaluated whether a training designed to increase valence of the feared stimulus improved the longevity of treatment outcomes.

Methods: Participants were 61 undergraduate students with fear of spiders (>10 on Spider Phobia Questionnaire, $M = 20.45$, $SD = 3.98$) who were randomized to receive positive valence training or control training. Participants completed exposure over two days, with training conditions at the end of the first day. Tests of spontaneous recovery and reinstatement were conducted one week later.

Results: Compared to control, the Positive Valence Training group demonstrated significantly less subjective fear at test of spontaneous recovery and less behavioral avoidance after reinstatement. Change in valence predicted subjective fear at spontaneous recovery and after reinstatement but did not predict behavioral avoidance after reinstatement.

Limitations: Due to the relatively small size and homogeneity of the sample, as well as the limited methods of training (i.e., film clips only) and outcome measurement (i.e., self-report and behavioral measures), current results should be interpreted with caution.

Conclusions: Adjunct positive valence training may enhance the longevity of exposure treatment.

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1. Introduction

Anxiety disorders account for an estimated \$42–47 billion in U.S. costs each year (Dupont et al., 1996; Greenberg et al., 1999) and are the most prevalent mental health disorders in the United States (Kessler et al., 2005). Despite extensive development of evidence-based treatments for anxiety, there is an upper limit on effectiveness. For example, an estimated 50% of individuals with anxiety disorders who receive cognitive behavioral therapy (CBT) are classified as non-responders (Loerinc, Meuret, Twohig, Rosenfield, & Craske, Submitted). Further, return of fear following exposure therapy is common (Craske & Mystkowski, 2006). Therefore, development of strategies that improve response rates and decrease return of fear is paramount. In this paper, we evaluate a strategy termed ‘positive valence training’ that is derived from the science of fear extinction and reinstatement.

Exposure therapy is the clinical proxy of extinction training,

which involves repeated unreinforced presentations of the conditional stimulus (CS). Extinction involves the development of a new inhibitory association between the CS and the unconditional stimulus (US) (CS-noUS) that competes with the original excitatory association (CS-US) (Bouton, 2004; see Craske, Liao, Brown, & Vervliet, 2012 for review), which remains intact following extinction. Therefore, the original excitatory association can be ‘reactivated’ under certain conditions, leading to the return of fear. For example, conditional fear can resurge with the passage of time following extinction despite the absence of the US (i.e., “spontaneous recovery”) (Quirk, 2002). Also, extinction is context dependent such that conditional responding (e.g., physiological arousal) increases when the CS is encountered in a context that is distinctly different from the extinction context (Bouton, 2004). In accord, fear returns following exposure therapy when an individual is tested in a distinctly different context (Culver, Stoyanova, & Craske, 2011; Mystkowski, Craske, & Echiverri, 2002; Mystkowski, Echiverri, Labus, & Craske, 2006). Furthermore, unpaired presentation of the US following extinction can result in return of conditional responding (i.e., “reinstatement”) (e.g., Dirikx, Hermans, Vansteenwegen, Baeyens, & Eelen, 2004). Reinstatement is of

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particular clinical relevance because it is not uncommon for individuals to be exposed to adverse events following completion of exposure therapy, and these events may lead to a return of fear.

CS valence, or the degree of fondness or aversion towards the CS, may contribute to reinstatement (e.g., Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002). In addition to acquiring an expectancy of the US, the CS develops a negative valence during acquisition (e.g., Hermans et al., 2005, 2002). Acquired valence of the CS is a type of evaluative learning (De Houwer, Baeyens, & Field, 2005) and is more resistant to extinction than is expectancy learning (Dirikx et al., 2004; Hermans et al., 2002). Hermans et al. (2005) found a positive relationship between CS negative valence at the end of extinction and degree of subjective fear following unpaired US presentations (i.e., reinstatement). We replicated these findings (Zbozinek, Hermans, Prenoveau, Liao, & Craske, 2015).

Unpaired US presentations following extinction are hypothesized to reignite the arousal. The combination of arousal (which lessens during extinction) (e.g., LeDoux, 2014) and the negative valence factor (which does not extinguish) (e.g., Dirikx et al., 2004) is presumed to account for the resurgence of conditional responding (Hermans et al., 2005; Kerkhof, 2010; Lang, 1995).

Negative valence has been shown to have a strong positive association with avoidance tendencies (Hans Phaf, Mohr, Rotteveel, & Wicherts, 2014). In a seminal study, individuals were faster at sorting negatively-valenced cards away from their bodies and positively-valenced cards closer to their bodies than the reverse (Solarz, 1960). The same effect has been replicated using other methodologies, including pushing a lever toward or away from one's body (Chen & Bargh, 1999) and increasing or decreasing stimulus size during approach and avoidance movements (e.g., Krieglmeier & Deutsch, 2010; Rinck & Becker, 2007; Roelofs, Minelli, Mars, van Peer, & Toni, 2009). These studies combined demonstrate that implicit action tendencies of approach/avoidance (e.g., pulling/pushing or sorting toward/away from one's body) are associated with valence.

Kerkhof (2010) suggested that CS negative valence may contribute to avoidance following extinction, which prevents strengthening of the CS-noUS association and thereby limits inhibition of the original CS-US association (Kerkhof, 2010). The link between avoidance behavior and CS valence may thus provide another pathway through which negative valence of the CS at the end of extinction contributes to return of fear. Notably, unlike the valence-arousal hypothesis of reinstatement (i.e., the combination of negative valence and arousal following presence of a US results in return of conditional responding), the link between CS valence and avoidance does not rely on a reinstating US to elicit return of fear and could explain spontaneous recovery.

For these reasons, the addition of therapeutic strategies designed to decrease negative valence of the feared stimulus, beyond exposure therapy alone, may improve the longevity of treatment outcomes for individuals with anxiety disorders. The current study aimed to test the following questions: (1) whether a positive valence training paradigm during exposure therapy results in less negative valence toward a phobic stimulus in individuals with elevated fears of spiders, (2) whether positive valence training lessens the return of subjective fear at test of spontaneous recovery and avoidance behavior following a reinstatement experience, and (3) whether change in valence towards spiders explains outcomes at test of spontaneous recovery and after reinstatement.

2. Method

2.1. Participants

Participants were 61 undergraduate students with elevated fear

of spiders. Of the 203 individuals who expressed interest in participating in the study, 67 were scheduled for further screening. Inclusion criteria were 18 years or older and elevations in spider fear (i.e., total score of greater than ten on the Spider Phobia Questionnaire; Klorman, Weerts, Hastings, Melamed, & Lang, 1974). The only exclusion criterion was severe depressive symptoms (i.e., total score of greater than 29 on the Beck Depression Inventory; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). Six of the 67 individuals did not meet inclusion or exclusion criteria. Thus, 61 participants were consented and randomized to one of two groups: Positive Valence Training group ($n = 36$) and Control group ($n = 25$). Participants received course credit or \$10 for completion of the study.

2.2. Questionnaires

2.2.1. Beck Depression Inventory (BDI; Beck et al., 1961)

The BDI is a 21-item questionnaire that is designed to assess symptoms of negative mood. It is a widely used measure that has demonstrated adequate reliability and validity (Beck et al., 1961). The BDI was included for purposes of exclusionary criteria.

2.2.2. Behavioral avoidance task (BAT; Kircanski, Lieberman, & Craske, 2012)

The BAT is a behavioral measure of avoidance. Various versions of this task have been developed. The version described in Kircanski et al. (2012) was utilized in the current study. Participants were asked to stand for 30 s, 5 feet away from a glass terrarium containing a live Chilean Rose Tarantula and rate their subjective levels of fear and valence of spiders. Participants then were asked if they were willing to move to the next step (i.e., six inches closer to the spider) and replicate this procedure. If they were unwilling, the BAT ended and the experimenter recorded how many steps they had taken. If they agreed to move to the next step, the procedure was replicated until they reached the tenth step. At the end of the tenth step, participants were asked if they were willing to touch the spider with a cue-tip. Thus, there were eleven possible steps in each BAT. The dependent variable of avoidance was defined as number of BAT steps and was a primary outcome measure. The BAT was repeated at baseline, after completion of exposure, and after reinstatement.

2.2.3. Subjective ratings of fear and valence

For each step of the BAT, after each exposure trial, and at the start and completion of each exposure session, participants rated their subjective fear of spiders ("Please rate your level of fear of spiders") on a Likert scale from 0 (i.e., "no fear") to 6 (i.e., "intense fear"). They also rated their valence of spiders ("Please rate your level of dislike of spiders") on a Likert scale from -3 (i.e., "extreme dislike") to 3 (i.e., "strong like").

2.3. Procedure

All study procedures were approved by the university's institutional review board. Procedures were administered during three different time points (i.e., T1, T2, T3) across three weeks with one week separating each time point (see Fig. 1). During T1, baseline assessment was comprised of fear and valence ratings and the BAT, which was followed by ten exposure trials. Subjective ratings of fear and valence were obtained after each step of the BAT and each trial of exposure. After completion of the exposure trials, participants received 10 min of positive valence training or control training, after which valence and fear were rated again.

During T2, participants completed another ten trials of exposure, with ratings of fear and valence at the end of each trial. Then

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