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Symbolic online exposure for spider fear: Habituation of fear, disgust and physiological arousal and predictors of symptom improvement

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ABSTRACT

Background and objectives: This research compared the effects of real versus hyper-real images on anxiety, disgust, and physiological arousal during internet-delivered exposure in high spider-fearfuls. Hyper-real images were digitally altered to highlight fearful aspects. A further aim was to examine self-reported and behavioural therapeutic outcomes and exposure-related predictors of these outcomes.
Methods: Twenty-eight females were randomised to real (n = 14) or hyper-real (n = 14) treatment groups and nine participants were subsequently allocated to a wait-list control group. Treatment groups viewed an 8-stage exposure hierarchy of real or hyper-real spider images. Subjective anxiety and disgust ratings were taken during each stage (0, 60, 120, 180 s) with heart rate and skin conductance recorded throughout.
Results: Anxiety, disgust and physiological arousal habituated within each exposure stage, with no differential effect of real compared to hyper-real images. Both treatment groups but not controls demonstrated significant reductions in behavioural avoidance and self-reported phobic symptoms from pre-treatment to post-treatment with large effect sizes noted. The change in within-stage habituation of anxiety, disgust and heart rate, between the first and last stage, predicted improvement in behavioural avoidance at post-treatment. This suggests that generalisation of habituation to multiple images is an important predictor of improvement.
Limitations: While findings in relation to therapeutic outcome should be considered preliminary, clear relationships were found between exposure-related variables and outcome among those who undertook treatment.
Conclusions: Findings provide evidence in support of the efficacy of online image-based exposure and have implications for informing further research into the underlying mechanisms of image-based exposure treatment.

1. Introduction

Specific phobia is the most common anxiety disorder with lifetime prevalence estimates ranging from 3 to 12% (Alonso et al., 2004; Kessler et al., 2005; Stinson et al., 2007). Specific phobia can be successfully treated with exposure-based interventions (Öst, 1997; Wolitzky-Taylor, Horowitz, Powers, & Telch, 2008), but many people do not seek treatment (Bebbington et al., 2000; Stinson et al., 2007). Barriers to treatment include unawareness of treatment options, fear of interaction with the phobic stimulus, and factors such as treatment availability, accessibility, labour intensiveness, stigma, and cost (Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009; Wolitzky-Taylor et al., 2008).

Computer-delivered and internet-based treatments have potential to provide cost-effective and convenient treatment to large numbers of people (Carlbring & Andersson, 2006; Ritterband et al., 2003). These treatment approaches include guided relaxation, instructional-based self-exposure (Marks, Kenwright, McDonough, Whittaker, & Mataix-Cols, 2004), vicarious exposure (Gilroy, Kirkby, Daniels, Menzies, & Montgomery, 2003), virtual reality (Krijn, Emmelkamp, Olafsson, & Biemond, 2004) and symbolic exposure via images and videos (Bornas et al., 2002; Matthews, Scanlan, & Kirkby, 2012; Vansteenwegen et al., 2007). A recent meta-analysis concluded that exposure-based interventions were

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more effective than placebo, or alternative psychotherapeutic interventions, and that *in vivo* exposure (involving direct contact with the phobic stimulus) was more effective than 'other' exposure-based interventions (e.g., imaginal, virtual reality) at post-treatment but not at follow-up (Wolitzky-Taylor et al., 2008). This latter finding was attributed to further improvements for 'other' exposure-based treatment rather than return of fear for *in vivo* treatment (Wolitzky-Taylor et al., 2008).

The mechanisms underlying exposure treatment remain a topic of debate in the literature. According to emotional processing theory (EPT) (Foa, Huppert, & Cahill, 2006; Foa & Kozak, 1986; Rachman, 1980), phobic fear is represented in memory by a 'fear structure' which is characterised by pathological associations between the feared stimulus, response representations, and threat-related cognitions (Foa & Kozak, 1986). These associations are maintained by behavioural and cognitive avoidance and cognitive biases at various stages of processing (Foa et al., 2006). For effective exposure treatment, it has been argued that the original 'fear structure' must be sufficiently activated (as indexed by physiological or self-report measures) and followed by reduction or habituation of response (Foa & Kozak, 1986). Secondly, new information is either incorporated into the original fear structure, a process known as corrective learning (Foa & Kozak, 1986), or new associations are formed which either inhibit or compete with the original associations (Foa et al., 2006; Foa & McNally, 1996). The theory that the latter context-dependent inhibitory learning takes place is supported by animal learning research (see Myers & Davis, 2007).

Within the context of EPT, initial fear activation (IFA), within-session habituation (WSH) and between-session habituation (BSH) have been identified as potential predictors of therapeutic improvement (see Craske et al., 2008; Foa & Kozak, 1986). IFA refers to the peak fear response during an exposure trial (minus baseline) and WSH is the difference between IFA and the end response during an exposure trial. BSH is the difference between the peak response in the first and last exposure trials and typically represents long-term learning across several sessions of exposure. The relationship between these variables and therapeutic outcome has often been examined in anxiety disorders other than specific phobia and has generally yielded equivocal findings (for a review see Craske et al., 2008). However, there is some evidence that between rather than within session habituation may be a more reliable predictor of treatment outcome (Craske et al., 2008; Foa et al., 2006).

The experience of disgust is particularly important in the development and maintenance of spider phobia (Cisler, Olatunji, & Lohr, 2009; Olatunji, Cisler, McKay, & Phillips, 2010). For example, during exposure, self-reported disgust was found to be a better predictor of avoidance than self-reported fear (Woody, McLean, & Klassen, 2005) and high disgust sensitivity is associated with heightened resistance to extinction, suggesting that it may contribute to relapse following treatment (Mason & Richardson, 2010). There is evidence that self-reported disgust habituates or reduces over time during *in vivo* exposure (Smits, Telch, & Randall, 2002) and during exposure to videos of spiders (Edwards & Salkovskis, 2006; Olatunji et al., 2009), and also evidence that habituation of disgust occurs at a slower rate than fear (Cisler et al., 2009; Olatunji et al., 2009). However, there has been little research examining the relationship between the activation and habituation of disgust and therapeutic outcome, with one study showing that both fear and disgust explain unique variance in symptom improvement following exposure-based treatment (Olatunji, Huijding, de Jong, & Smits, 2011).

Treatments based on exposure to images and videos have been shown to produce activation and habituation of anxiety (as measured by self-report, behavioural and physiological measures) in studies of dental phobia, spider phobia, and fear of flying (Coldwell et al., 1998; Nelissen, Muris, & Merckelbach, 1995; Vansteenwegen et al., 2007; Veltman et al., 2004). A computer platform for the delivery of image-based exposure (Feardrop) has recently been developed for the treatment of spider fear (Matthews, Scanlan, & Kirkby, 2010; Matthews et al., 2012; Matthews, Wong, Scanlan, & Kirkby, 2011). In this program, participants view spider images (moving or stationary) and rate their anxiety at several time points. A hierarchy of stages is completed with progression based on the level of subjective anxiety at the end of the previous stage. Research in both the laboratory and online environment has shown that high spider fearful participants show habituation across stages and generalisation between stages of the program. Furthermore, in a preceding study comprising laboratory-based then home-based exposure tasks (Matthews et al., 2011), participants showed significant reductions in self-reported spider phobia symptoms at 30-day follow-up, suggesting that the exposure treatment reduced phobic fear.

The aim of the present study was to conduct a laboratory evaluation of the program, using self-report, behavioural, and physiological outcome measures. Given the importance of disgust in spider phobia, self-reported disgust was also measured during exposure. Participants were allocated to receive exposure to either real or hyper-real images. Hyper-real images were real images altered to portray extra features such as enlarged fangs. The hyper-real condition was included in an attempt to increase initial fear and disgust activation in order to test hypotheses derived from EPT. For example, early conceptualisations of EPT would predict that greater activation of fear would result in better therapeutic outcome (Foa & Kozak, 1986). However, more recently it has been argued that while adequate fear activation is necessary, over activation may actually impede emotional processing due to its impact on attentional processing (Foa et al., 2006).

It was hypothesised that both treatment groups (hyper-real and real) would experience a reduction in self-reported anxiety and disgust, and physiological arousal (heart rate and skin conductance) within each stage of the program (within-stage habituation). An interaction was also predicted such that exposure to hyper-real compared to real images would result in higher self-reported anxiety and disgust and greater physiological arousal. It was also hypothesised that there would be a reduction in spider phobia symptoms (self-reported and behavioural) from pre-treatment to one-week and one-month post-treatment for the two treatment groups, but not for the wait-list control group. Within the context of EPT, a further aim was to examine the relationship between treatment outcome and both self-reported and physiological measures of fear activation and habituation (within-stage and between-stage) during exposure.

2. Method

2.1. Participants

Thirty-seven females (Mean age = 26.5, *SD* = 8.9 years) volunteered to participate. Fourteen participants were recruited by screening undergraduate Psychology students (n = 177) with the Spider Phobia Questionnaire (SPQ) (Watts & Sharrock, 1984), receiving course credit for participation. The remainder were recruited from the local community via media and flyer distribution and received no reimbursement.

Eligibility criteria was high spider fear, defined as a score of 55 or above on the Fear of Spiders Questionnaire (FSQ) (Szymanski & O'Donohue, 1995). Exclusion criteria included current pregnancy,