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Very brief exposure II: The effects of unreportable stimuli on reducing phobic behavior ☆

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ABSTRACT

This experiment compared the effects of exposure to masked phobic stimuli at a very brief stimulus-onset asynchrony on spider-phobic and non-phobic individuals. Participants were identified through a widely used questionnaire and a Behavioral Avoidance Test (BAT) with a live, caged tarantula to establish baseline levels of avoidance. One week later, they were individually administered one of two continuous series of masked images: spiders or flowers. Preliminary masking experiments showed that independent samples of participants from the same populations failed to recognize these stimuli. Participants in the main experiment reported ratings of subjective distress immediately before and after the exposure manipulation. Then they engaged in the BAT once again. Very brief exposure to images of spiders reduced phobic participants' avoidance of the tarantula. No effects were evidenced on subjective distress, or on non-phobic participants. Theoretical implications for the non-conscious basis of fear are discussed.

1. Introduction

Over the past two decades, basic scientific research on fear has mounted a considerable challenge to the view of consciousness as an agent of cognitive control. Mounting behavioral and neuroscientific studies have shown that fear responses can be activated, conditioned and experientially evoked outside of awareness (Carlsson et al., 2004; Katkin, Wiens, & Ohman, 2001; LeDoux, 1996; Öhman & Soares, 1993, 1994, 1998; Morris, Ohman, & Dolan, 1998, 1999; Phelps, 2005; Ruys & Stapel, 2008). Neuroanatomical studies across mammal species have consistently identified a dual neural architecture of fear, implicating structures that are dissociable in terms of consciousness (Bechara et al., 1995; Fendt & Fanselow, 1999; LaBar, LeDoux, Spencer, & Phelps, 1995; Lang, Davis, & Ohman, 2001). More recently, similar findings have emerged in a variety of neuroimaging studies, which have demonstrated the activation of the human amygdala by non-conscious, fear-relevant stimuli (Etkin et al., 2004; Morris et al., 1998; Phelps, 2005; Whalen et al., 1998, 2004; Williams, Morris, McGlone, Abbott, & Mattingley, 2004). Thus, fear is currently viewed as primarily mediated by non-conscious processes that are relatively impenetrable to conscious, cognitive control: "Rather than presuming that various cognitive factors determine fear responding... they are often effects of such responses" (Öhman & Mineka, 2001, p. 514).

This body of research attesting to the non-conscious basis of fear converges on an intriguing question: if fear can be induced, acquired and experientially evoked outside of awareness, is it possible to reduce it under this same condition? For

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example, is it possible to reduce avoidance of a feared object *without conscious awareness*? The purpose of the current study was to address this question.

Tyrer, Horn, and Lee (1978; Lee, Tyrer, & Horn, 1983) tested what they called a subliminal exposure technique by presenting a brief film related to agoraphobia (e.g., crowded markets; busy roads; public transportation). Both subliminal and supraliminal exposure to the film reduced self-reported phobic symptoms and physiological responses in treatment-resistant agoraphobics. However, this study did not assess effects on avoidance of the feared object. Siegel and Weinberger (2009) developed a technique called *very brief exposure* (VBE) for this purpose. If priming with masked, fear-relevant stimuli generates non-conscious fear responses, it stands to reason that continuous exposure to such stimuli will eventually result in reduction of those responses. That is the logic of VBE. Spider-fearful participants were administered a continuous series of masked images of spiders, each for a brief duration (25-ms). A preliminary experiment found that an independent sample of such participants lacked subjective awareness of these stimuli. The main experiment compared the effects of very brief and clearly visible exposure to these stimuli on approaching a live, caged tarantula. Those administered VBE to spiders approached the tarantula more than those exposed to the same, clearly visible stimuli, and those administered VBE to trees (control stimuli). These differences between the groups were maintained on retesting 1 week later. In a similar vein and an independent laboratory, Weinberger, Siegel, Siefert, Drwal (2011) compared the effects of VBE on spider-fearful and non-fearful participants. VBE to images of spiders promoted approach towards a live tarantula among the former but not the latter group.

These initial experiments tested whether VBE influences approach towards a feared object – not if it reduces avoidance of that object from a baseline. Siegel and Weinberger (2009) reported such an effect based on a small sample. The purpose of the current study was to replicate this finding with a larger sample, and to build on it in two additional respects. First, it compares the effect of VBE on reducing avoidance of phobic versus non-phobic participants. This builds directly on Weinberger et al. (2011) as participants' self-reported fear of spiders or lack thereof was confirmed by a baseline assessment of avoidance of a live tarantula. We compared effects on phobic versus non- phobic samples because fear is a basic emotion. Thus, VBE may reduce phobic behavior in general. This would be theoretically intriguing, but less potentially valuable.

Second, the current study investigated the effects of VBE on conscious distress as well as phobic avoidance. A comparison of these effects has significant implications for the relationship between conscious cognition and emotion. It's one thing to suggest the primacy of unconscious processes over conscious cognition in the elicitation of fear. As noted above, relevant unconscious phenomena are robust. The prevailing theoretical paradigm of emotional automaticity explains these phenomena convincingly (LeDoux, 1996; Öhman & Mineka, 2001). It's quite another thing, however, to suggest that fear can be reduced in the absence of cognitive control. Models of fear reduction heavily emphasize the regulatory role of conscious cognition. For example, disconfirmation of catastrophic beliefs theory holds that fear is reduced when a person realizes that her fear of an object/situation is unwarranted. Supporting this view, phobics overestimate the danger of phobic objects (Cavanagh & Davey, 2004; Thorpe & Salkovskis, 1997). Accordingly, this theory holds that one must directly confront feared objects or situations with full conscious awareness – or undergo *exposure* (Anton & Swinson, 2000; Emmelkamp, 2004) – in order to reduce fear. Similarly, new learning theory holds that when fear is reduced as a result of exposure to a feared object, old beliefs are not merely disconfirmed: new beliefs are formed (Bouton, Mineka, & Barlow, 2001; Foa, 1997; Schiller et al., 2010). When a phobic person encounters his feared object and "nothing bad happens", a new learning experience occurs that is independent of the learning that resulted in fear of the object in the first place. Supporting this model, people who previously feared an object form new beliefs when they overcome their fear. At the same time, their fears tend to return during times of stress, showing that the old learning never went away (Barlow, 2002). In this theory, awareness of the new learning experience is also necessary.

There are also practical and humane implications to the effect of VBE on subjective distress. Exposure is an infamously unpleasant experience. People experience much distress when they confront what they fear. This is a considerable obstacle in bringing those who suffer from phobias to treatment (Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996). There is a likely relationship between awareness of exposure and the experience of distress: lack of awareness may diminish distress, and thereby make exposure less aversive. Therefore, prior to proceeding to the main experiment, we conducted preliminary masking experiments to assess awareness of the exposure stimuli.

2. Preliminary experiments: masking the stimuli

A backwards masking procedure was used to present the stimuli (Holender, 1986; Öhman & Soares, 1994). A target stimulus is flashed and immediately followed by a masking stimulus. With suitable stimulus-onset asynchrony (SOA) between the two stimuli, an effective mask prevents recognition of the target. Öhman and Soares (1993, 1994) found that when the SOA between pictures of spiders and an effective mask was 30-ms or less, both fearful and non-fearful participants identified them no better than chance in forced-choice discrimination tasks. We replicated this finding for the stimuli used in the current study with a sample of 12 spider-fearful participants (identified as described below) using an SOA of 25-ms.[1] The masking stimulus was an array of capital letters (ABCD) that was shown to be effective in prior studies (Siegel & Weinberger, 2009). It

[1] The SOA is primarily a function of the refresh rate of the monitor, or how quickly it regenerates stimuli on the screen. SuperLab has an option wherein the target stimulus is erased before the masking stimulus is presented on the next refresh cycle. This keeps the target stimulus on the screen for approximately one-half a refresh cycle, or 8-ms, making the SOA approximately 25-ms (personal communication, SuperLab).